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U.S. Department of the Interior
Bureau of Land Management

Casper District Office | October 1995

FINAL
Environmental Assessment for the Antelope Coal Lease Application
as applied for by Antelope Coal Company (Federal Coal Lease Application WYW128322)

The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; a combination of uses that take into account the long term needs of future generations for renewable and nonrenewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness and natural, scenic, scientific and cultural values.

BLM/WY/PL-96/001+1300

WY-062-94-102

Final
Environmental Assessment
for the
Antelope Coal Lease Application
as applied for by Antelope Coal Company
(Federal Coal Lease Application WYW128322)

EA # WY-062-94-102

Prepared by

Western Water Consultants, Inc.
Sheridan, Wyoming

and

Casper District
Bureau of Land Management

Cooperating Agencies:
U.S. Office of Surface Mining Reclamation and Enforcement
U.S. Forest Service

October, 1995

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SUMMARY

Antelope Coal Company (ACC) has applied to the BLM for a lease for federal coal adjacent to ACC's existing Antelope Mine. The tract proposed for leasing is called the Antelope Lease-By-Application (LBA) tract.

This environmental assessment characterizes and quantifies the environmental impacts that would likely result from leasing the Antelope LBA tract. It considers the existing coal mining in the basin and the pending and previously issued LBAs in evaluating the cumulative impacts of leasing this tract of coal.

In preparation of this environmental assessment, six alternatives were considered as follows:

Alternative 1	Lease the tract as applied for as a maintenance tract for an existing mine. This alternative assumes that the applicant is the successful bidder.
Alternative 2	Expand the lease tract to square up the existing leases. Lease the modified tract as a maintenance tract for an existing mine. This alternative also assumes that the applicant is the successful bidder.
Alternative 3	Reduce the size of the lease tract to enlarge the opening between existing leases and the LBA tract. Lease the modified tract as a maintenance tract for an existing mine. This alternative also assumes that the applicant is the successful bidder.
Alternative 4	The no action alternative. This alternative assumes that the coal would not be leased.
Alternative 5	Lease the coal for a new mine start. This alternative assumes that the coal is acquired by someone other than the applicant. This alternative was not analyzed in detail because the amount of coal under consideration in any of the first three alternatives would not include sufficient reserves on which to base a new mine.
Alternative 6	Postpone the lease sale to wait for higher coal prices. This alternative was not analyzed in detail because the environmental impacts would be similar to Alternative 1, 2, or 3 if ACC acquired the lease; or similar to Alternative 4 if the sale was held after the time ACC could logically mine the coal.

Under alternatives 1, 2 and 3, the tract would be offered for lease at a competitive sale, with the coal rights going to the company or individual submitting the highest qualified bonus bid that meets or exceeds the Fair Market Value for the property as determined by the BLM. Table S-1 compares the area that would be impacted under the existing mine plan and the three alternate tract configurations.

Table S-1. Comparison of Impacts of Alternative LBA Tracts on Existing Mine Disturbance Area

Mine Configuration	Additional area to be mined (acres)	Additional coal to be mined (1) (million tons)	Total area to be mined (acres)	Percent increase in area to be mined	Total area to be disturbed (acres) (2)	Percent increase in area to be disturbed
Existing Mine Permit	--	--	4,301	--	4,896	
Alternative 1	462	57	4,763	11	5,358	9.4
Alternative 2	668	82	4,969	16	5,564	13.6
Alternative 3	300	37	4,601	7	5,196	6.1

Notes: (1) These values are based on a coal recovery efficiency of 95%, which WDEQ/LQD documents indicate is a typical value for Powder River Basin mines.

(2) Areas disturbed by activities other than mining include the mine facilities area, haulroads and access roads, the mine railroad loop, stockpiles, and miscellaneous other areas.

Under Alternative 1, the proposed action, the tract as applied for by ACC would be offered for lease. This is the preferred alternative of the BLM. This alternative assumes that ACC acquires the tract, which is located between the existing Antelope coal leases and the Burlington Northern/ Chicago Northwestern Gillette-Orin main railroad line, as a maintenance lease. Coal would be recovered from beneath about 462 acres of land within the tract as applied for. The tract contains approximately 60 million tons of minable coal. Assuming that 95% of the estimated coal reserves are recoverable (57 million tons), the reserves requested in the application for the Antelope LBA tract would increase the time that coal could be recovered at the currently permitted maximum rate of 12 million tons per year. If the coal in this tract is not included in the Antelope Mine, it would potentially be permanently bypassed because of its location between the existing mine and the railroad line.

The environmental impacts of Alternative 1 would not significantly increase the impacts that would result from the mining of the current Antelope Mine leases. Most of the LBA area is already within the approved mining permit boundary issued by the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD). The area of disturbance would increase by about 9.4% over the currently permitted disturbance area. Water level drawdowns in the overburden have not been considered significant at the Antelope Mine because there are few water-bearing sandstone units in the overburden in this area, and this would not change with the addition of the LBA tract. Water-level drawdowns in the coal aquifer would be extended approximately

1,300 feet further northward than without the LBA. This is approximately the incremental distance over which mining would occur in this direction. Water-level drawdowns due to mining of the LBA area have been considered in the mining permit application submitted to WDEQ/LQD. Soils and vegetation are similar to those on the existing Antelope Mine, where reclamation has begun. They have been studied as a part of the baseline investigations because the tract is already included in the Antelope Mine permit area. Wildlife has also been monitored in the LBA area because it is within the current permit area. Addition of the LBA would increase the area of mining impacts to wildlife. Currently approved plans for mitigating impacts to wildlife, including raptors and the mountain plover, would have to be revised if ACC acquires the LBA. There are no cultural resources eligible for the National Register of Historic Places located on the tract, and no significant paleontologic resources have been identified on the tract. Visual impacts would not be different from those under the current mine plan at Antelope Mine. Air quality would be affected to approximately the same degree with or without mining of the LBA tract. Economic benefits would be realized from the bonus bid, from royalty payments, taxes and fees on the additional coal reserves, and from an extended period of maximum employment for the mine.

Alternative 2 would add approximately 206 acres to the LBA tract to provide for recovery of approximately 25 million additional tons of federal coal located west of the tract as applied for. Much of this area is not within the current Antelope Mine permit area. Under Alternative 2, the area of disturbance would be increased 13.6% over what is currently permitted. This coal could logically be mined as an extension of the Antelope LBA tract, and the coal added under this alternative, like the LBA tract as applied for, could potentially be bypassed if not mined as part of the Antelope Mine. According to the currently approved mining plan, this coal would probably not be mined until late in the life of the mine, which would potentially reduce its fair market value if it is leased at this time. This alternative was not selected because of the potentially low present value of the coal to the mine, and because the coal could be added to the Antelope Mine in the future to avoid a bypass.

The environmental impacts of Alternative 2 are similar to those for Alternative 1. Additional surface would be disturbed by mining, but as long as reclamation continues to keep pace with mining and the currently permitted production rate does not change there would not be a significant change in the magnitude of the impacts. Economic benefits would increase proportionately due to the additional 25 million tons of coal to be mined under this alternative.

Alternative 3 would reduce the size of the LBA tract by about 162 acres and remove about 20 million tons less coal. This alternative assumes that development of unleased coal resources north of the Antelope Mine would be economically feasible in the future. The area that would be removed from the LBA under Alternative 3 would provide a potential low overburden entry point for development of higher overburden coal to the north. If the coal to the north is not leased in the future, the coal removed from the LBA tract as applied for could be bypassed. Although this tract would be smaller than the tract that was applied for, the environmental impacts

might not be proportionately smaller due to complications associated with mining and reclaiming the Horse Creek drainage. Economic benefits would be decreased in proportion to the amount of coal removed from the LBA tract. This alternative was not selected because it would be more efficient to mine and reclaim this coal with the rest of the LBA.

Alternative 4, the No Action Alternative, would leave the Antelope LBA tract essentially as it now exists. A portion of the south edge of the tract would be disturbed by overstripping along the existing lease boundary according to the current Antelope mine plan. Economic and employment benefits associated with the mining of the LBA tract would be foregone.

Alternative 5 assumes that someone other than the applicant acquires the lease for the purpose of starting a new mine when the competitive lease sale is held. This alternative was not analyzed in detail because there are insufficient coal resources in the LBA tract to justify building a new mine, and the unleased coal resources north and northwest of the Antelope Mine are not currently economically attractive because of increasing overburden in that direction.

Alternative 6, postponement of the lease sale, would delay leasing on the premise that if the price of coal in the region increases, the government could receive a larger bonus from the lease sale. The LBA tract could potentially be applied for as an emergency bypass lease if the LBA lease sale is postponed. This alternative was not analyzed in detail because the impacts of issuing the lease at a later date could be the same as or slightly greater than the impacts for alternatives 1, 2, 3 or 4. If leasing is not delayed beyond the time when the tract could be mined with the existing Antelope leases, the impacts would be similar to Alternatives 1, 2 or 3. There might be a slight increase in environmental impacts if the sale is postponed because there would be less time to design and implement an efficient coal recovery plan. The impacts of delaying the lease sale could be the same as Alternative 4, the No Action Alternative, if the delay extends beyond the time that ACC can reasonably incorporate the LBA tract into the Antelope mine plan. In that case, the coal could be permanently bypassed because of its location.

ENVIRONMENTAL ASSESSMENT
of the
ANTELOPE LEASE APPLICATION
AS APPLIED FOR BY ANTELOPE COAL COMPANY
(Federal Coal Lease Application WYW128322)
October 1995

1.0 INTRODUCTION

1.1 Purpose and Need

On December 29, 1992, Antelope Coal Company (ACC) filed an application for a coal lease on federal coal reserves located north of and adjacent to the Antelope Mine. The mine is operated by ACC, a subsidiary of Nerco Coal Corp. Nerco is a subsidiary of Kennecott Energy and Coal Company. The coal lease application was filed with the Bureau of Land Management (BLM), the administrative agency responsible for leasing federal coal. The purpose of this environmental assessment is to evaluate the environmental impacts of mining the coal reserves that were applied for by ACC.

The lands applied for are located in Converse County, Wyoming, approximately 55 miles north of Douglas, Wyoming and 60 miles south of Gillette, Wyoming. Figure 1 is a map showing the location of the area. The proposed lease contains approximately 617.2 acres of federal coal in Converse County, Wyoming, but due to the presence of the Burlington Northern/Chicago and Northwestern (BN/C&NW) Railroad Gillette-Orin main line and County Road 37, coal is considered recoverable under only about 462.2 acres. Figure 2 is a map showing the location of the proposed LBA tract as applied for, relative to the adjacent federal and state leases held by ACC (i.e., the existing Antelope Mine). The surface of the proposed lease area is owned by the federal government [part of the Thunder Basin National Grassland administered by the U.S. Forest Service (USFS)] and ACC, with rights-of-way owned by BN/C&NW for the Gillette-Orin main line, by Converse County for County Road 37, and by US West Communications for a telephone line. As applied for, the proposed lease would be mined as part of the existing operations at the Antelope Mine. After mining, the land would be reclaimed for livestock grazing and wildlife use as is the current practice at the Antelope Mine.

The Antelope coal lease application was reviewed by the BLM in the agency's Wyoming State Office in Cheyenne, Wyoming. It was determined that the application and the lands involved meet the requirements of regulations governing coal leasing on application [43 Code of Federal Regulations (CFR) 3425].

The proposed Antelope lease lies within the decertified Powder River Federal Coal Production Region. The Antelope coal lease application was reviewed and approved for processing as a lease-by-application (LBA) by the Powder River Regional Coal

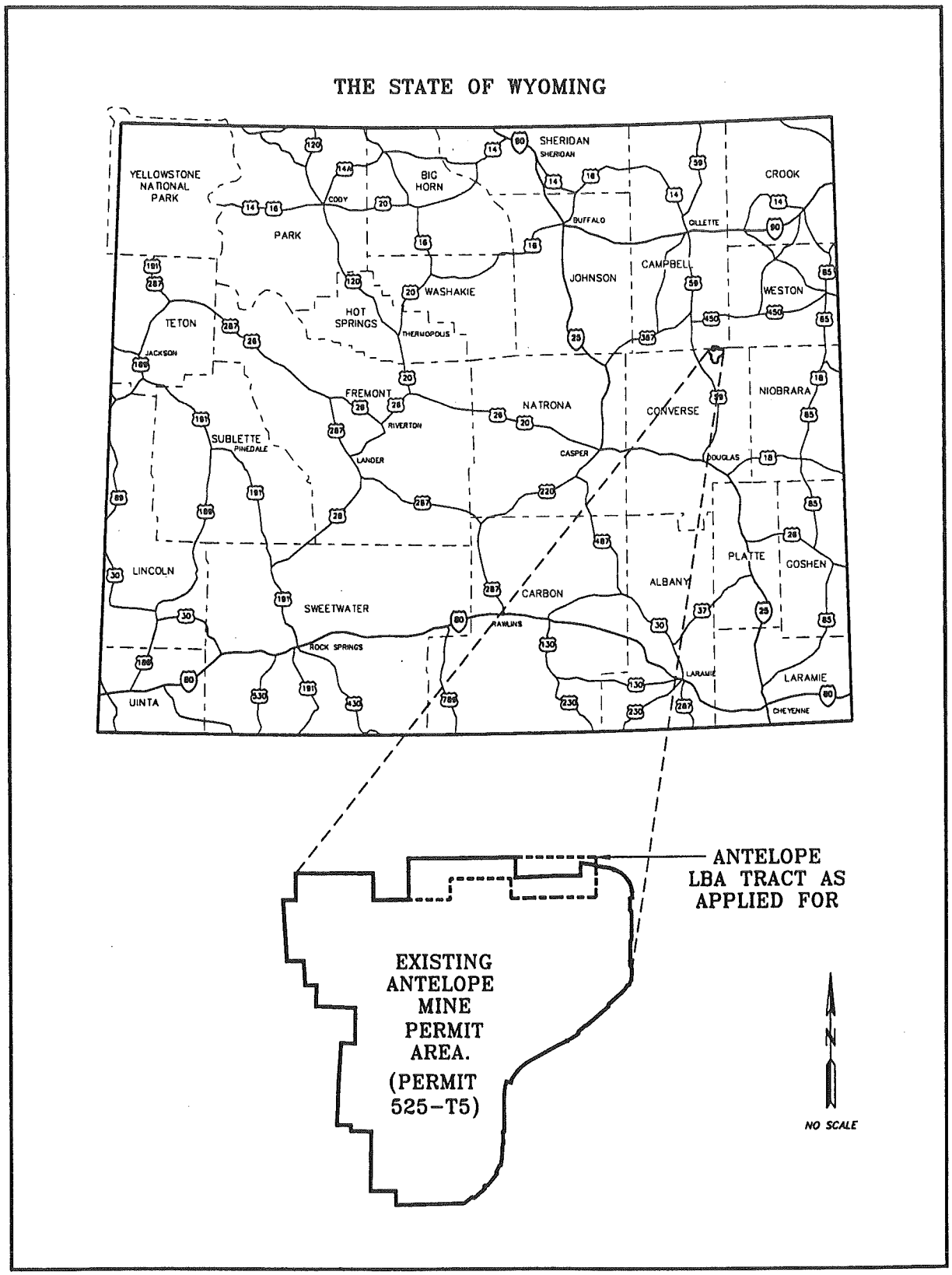


Figure 1. General Location Map of Antelope LBA Tract

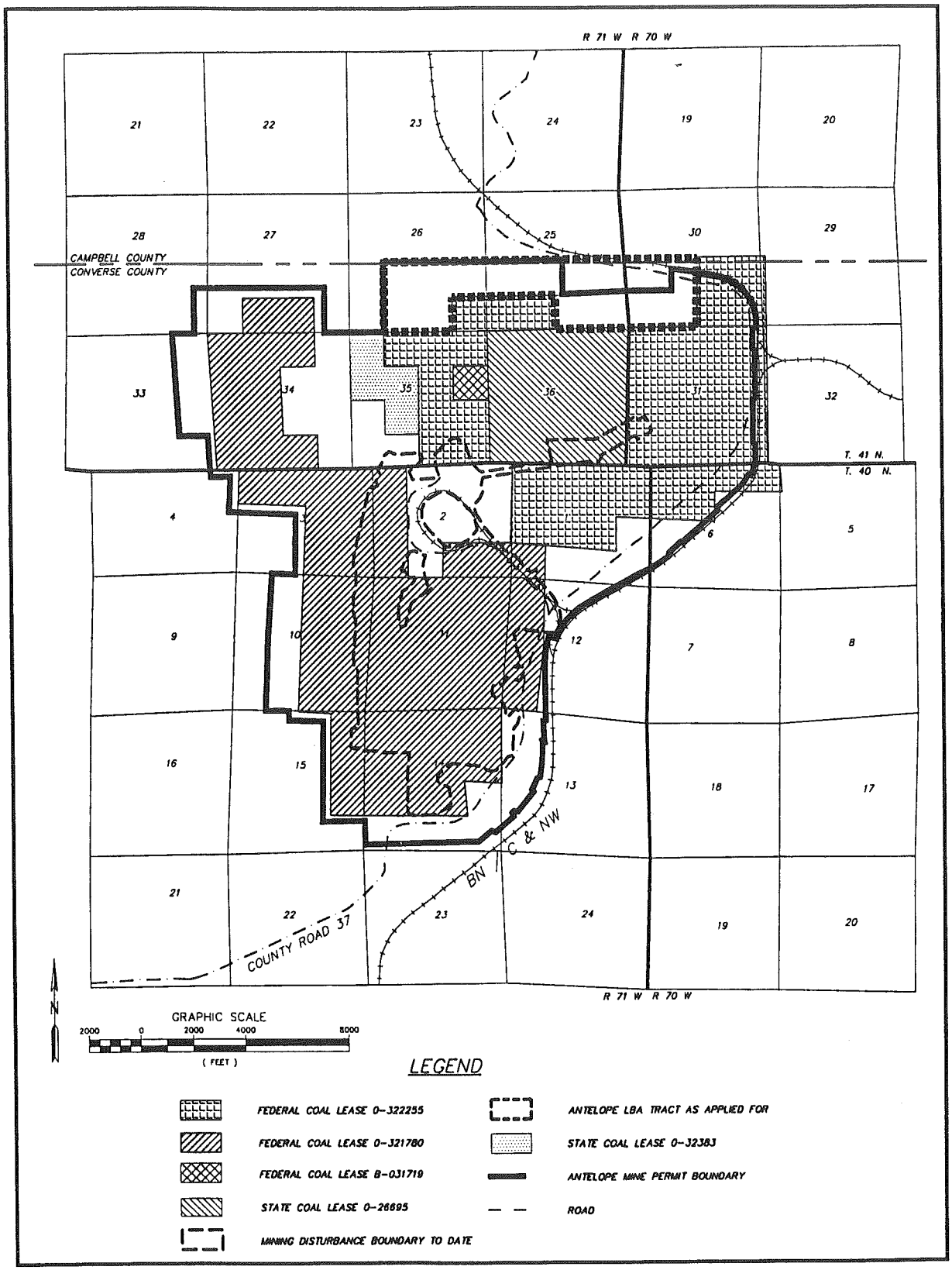


Figure 2. Antelope Coal Leases and LBA Boundary As Applied For

Team at the June 16, 1993 meeting in Billings, Montana. Although the Powder River Federal Coal Production Region was decertified as a federal coal production region in January 1990, the Regional Coal Team has remained active and has reviewed proposed coal leasing in the region on a regular basis since decertification. The most recent Powder River Regional Coal Team meeting was the one held in Billings, Montana, on June 16, 1993.

Five LBAs have been issued in the Wyoming portion of the Powder River Federal Coal Region since the region was decertified. Within the Powder River Federal Coal Region, there are currently four pending LBA tracts in Wyoming, including the Antelope application. One coal lease sale has been held, and one application is pending in Montana. Table 1 lists the LBAs issued to date in Wyoming, and the pending Wyoming LBAs.

The BLM must complete three actions for an LBA to be processed: a planning and environmental review, a geologic and mine plan review, and an economic review of the proposed lease area. Leasing by application is a competitive process, and a public hearing is required for each LBA.

This environmental assessment (EA) satisfies the planning and environmental review portion of the LBA process. It has been prepared to assist both the BLM and the USFS in making a decision on the proposed lease, to provide a basis for public review, and to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA).

1.2 Conformance With Land Use Plan

The BLM's principal authority to manage public lands is established by the Federal Land Policy and Management Act (FLPMA) of 1976. Through this authority, the BLM is responsible for managing resources on public lands in a manner that maintains or improves them. The Solid Minerals division of the Casper BLM office, which administers federal coal leases in the Wyoming Powder River Basin, has adopted as its mission the provision of "timely services to our customers to ensure responsible mineral development." The BLM planning regulations are set forth in 43 CFR 1600. The Platte River Resource Area Resource Management Plan and its associated environmental impact statement (EIS) is the plan which governs the management of BLM-administered lands and minerals in Converse County (BLM, 1985). The Platte River Resource Area consists of Natrona, Converse, Platte and Goshen counties. The proposed action conforms with the current Platte River Resource Area Resource Management Plan, although this plan does not directly address the area covered by the LBA.

A major portion of the lands in the application area are on the Thunder Basin National Grassland, for which the USFS is the surface management agency. The Thunder Basin National Grassland is administered by the district USFS office in Douglas, Wyoming. This district office is, in turn, under the USFS forest supervisor's

Table 1. WYOMING POWDER RIVER BASIN COAL LEASING SUMMARY

LEASE BY APPLICATIONS (LBAs): SALE HELD

LBA LEASE NO. APPLICANT	APPLI-CATION DATE	AS APPLIED FOR ESTIMATED LEASE SIZE & COAL TONNAGE	STATUS	AS OFFERED LEASE SIZE & EST. TONS OF MINEABLE*** COAL	SALE INFORMATION***	AVERAGE COAL QUALITY DATA FROM LEASE SALE NOTICE
JACOBS RANCH I Jacobs Ranch Mine WYW117924 Kerr-McGee	10/10/89	1465.16 Acres 123 MM Tons	Sale Held: 9/26/91; EA unsuccessfuly appealed by PRBRC*, WOC*, and Sierra Club; Lease Effective: 10/1/92; Motion by PRBRC* for IBLA reconsideration denied	1708.62 Acres 147,423,560 Tons	1 bid received: $20,114,930.00 $11,772.62/acre; 13.6 cents/ton Bid Accepted	Btu/lb=8540 Ash=5.4%, Sulfur 0.47% Strip Ratio=2.46 BCY**/ton
WEST BLACK THUNDER WYW118907 Black Thunder Mine Thunder Basin Coal Co.	12/22/89	3225 Acres 400 MM Tons	Sale held: 8/12/92, Bid Accepted Lease Effective: 10/1/92	3492.495 Acres 429,048,216 Tons	1 bid received: $71,909,282.69 $20,589.66/acre, 16.8 cents/ton Bid Accepted	Btu/lb=8839 Ash=4.40%, Sulfur=0.25% Strip Ratio=2.72 BCY**/ton
NORTH ANTELOPE/ ROCHELLE I WYW119554 N.Ant & Rochelle Mines Powder River Coal Co.	3/2/90 two applications	N. Antelope 954 Acres, 120 MM Tons; Rochelle 1196 Acres, 150 MM Tons	Sale Held: 9/28/92, Bid Accepted Lease Effective: 10/1/92	Offered as One Tract: 3064.04 Acres 403,500,000 Tons	1 bid received, $86,987,765.00 $28,389.89/acre, 21.6 cents/ton Bid Accepted	Btu/lb= 8804, 8700 Ash = 4.28%, 4.31% Sulfur=0.35%, 0.13% Ratio = 2.29, 2.16 BCY**/ton
WEST ROCKY BUTTE WYW122586 Proposed Rocky Butte Mine Northwestern Resources Co.	12/4/90	390 Acres 50 MM tons	Sale Held: 12/3/92, Bid Rejected; Sale Held 1/7/93, Bid Accepted; Sale Procedure Appealed, Sale upheld by IBLA; Lease Effective 1/1/93; Reconsideration Requested by PRBRC*; Logical Mining Unit Approved	463.205 Acres 56,700,000 Tons	12/3/92, 1 bid received, $14,200,000 $30,603.45/acre, 25.8 cents/ton Bid Rejected 1/7/92, 1 bid received, $16,500,000 $35,621.38/acre, 29.1 cents/ton Bid Accepted	Upper Coal(98% of coal) Btu/lb=8354 Ash=4.30%, Sulfur=0.27% Average Overall Strip Ratio=3.75BCY**/ton
EAGLE BUTTE WYW124783 Eagle Butte Mine AMAX Land Co.	7/25/91	915 Acres 150 MM Tons	Sale Held: 4/5/95, Bid Accepted Lease Effective 8/1/95	1059.175 acres 166,400,000 Tons	1 bid received, $18,470,400 $17,438.48/acre; 11.1 cents/ton Bid Accepted	Upper Coal: Btu/lb=8434 Ash=4.95%, Sulfur=0.54% Lower Coal: Btu/lb=8431 Ash=4.23%, Sulfur=0.22% Strip Ratio=1.99BCY**/ton

TOTAL BONUS: $213,982,377.69; ESTIMATED TONS OF MINEABLE COAL LEASED: 1,203,071,776; TOTAL ACRES: 9,787.535

LEASE BY APPLICATIONS (LBA'S): PENDING

ANTELOPE WYW128322 Antelope Mine Antelope Coal Co.	12/29/92	617.2 Acres 60 MM Tons	Scoping Meeting held 2/17/94 in Douglas; Second scoping period through 5/16/94; Draft EA released 3/95 Hearing Held 4/26/95 in Douglas
NORTH ROCHELLE WYW127221 North Rochelle Mine Zeigler Coal Co/SMC Mining	7/22/92	1439 Acres 140 MM tons	Regional Coal Team recommended processing on 6/16/93; EIS in preparation Scoping not currently scheduled
NORTH ANTELOPE/ ROCHELLE II N.Ant & Rochelle Mines WYW136142 Powder River Coal Co.	3/23/95	4020 Acres 550 MM Tons	Waiting on RCT review
JACOBS RANCH II WYW136458 Jacobs Ranch Mine Kerr-McGee	4/14/95	4000 Acres 432 MM Tons	Waiting on RCT Review

TOTAL PENDING: 1.18 BILLION TONS OF COAL UNDER 10,076 ACRES

*PRBRC=Powder River Basin Resource Council, WOC=Wyoming Outdoor Council

**BCY = Bank Cubic Yards

***ESTIMATED MINEABLE TONS OF COAL, AS REPORTED ON THE SALE NOTICE. MINEABLE TONS OF COAL ARE ASSUMED TO BE THE SAME AS IN PLACE TONS OF COAL UNLESS REPORTED DIFFERENTLY IN THE SALE NOTICE. BONUS RECEIVED PER TON IS CALCULATED USING MINEABLE TONS OF COAL.

office in Laramie, Wyoming, which also has jurisdiction over the Medicine Bow National Forest. Therefore, the Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan (USFS, 1985) is the land use management plan that more directly pertains to the Antelope coal lease application. The proposed action is in conformance with this USFS land use plan.

The unsuitability criteria for coal mining listed in the Federal Coal Management Regulations (43 CFR 3461) have been applied to the lease application area. Table 2 summarizes the unsuitability criteria (column 1), describes the findings for the entire area of the Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan (column 2), and validates these findings for the Antelope LBA tract, including the lands under alternatives 1, 2, and 3 (column 3). As indicated in the table, the lands within the BN/C&NW right-of-way are unsuitable for mining under Unsuitability Criterion Number 2. These lands are included in the lease tract to allow recovery of all of the minable coal outside of the railroad right-of-way and to comply with coal leasing regulations which do not allow leasing of less than 10-acre aliquot parts. A stipulation stating that the portion of the lease within the BN/C&NW right-of-way is excluded from mining will be added to the lease when it is issued (see Section 2.1.1.6 of this EA). The exclusion of the coal underlying the railroad right-of-way from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion Number 2 for the BN/C&NW right-of-way.

1.3 Relationship To Statutes, Regulations, Or Other Plans

The Antelope coal lease application was submitted and will be processed and evaluated under the following authorities: Mineral Leasing Act of 1920 as amended; Multiple-Use Sustained Yield Act of 1960; NEPA; Federal Coal Leasing Amendments Act of 1976; FLPMA; and, the Surface Mining Control and Reclamation Act of 1977 (SMCRA).

The leasing of federal coal is the responsibility of the BLM under the Mineral Leasing Act of 1920. This environmental assessment has been prepared to evaluate the potential impacts which could occur if the proposed lease is issued and mined.

After a coal lease is issued, SMCRA gives the Office of Surface Mining Reclamation and Enforcement (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 Wyoming Department of Environmental Quality (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 non-federal 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.

Table 2. Validation of Mining Unsuitability Criteria for Antelope LBA Tract

UNSUITABILITY CRITERIA	FINDINGS FOR THUNDER BASIN NATIONAL GRASSLAND (TBNG) STUDY AREA (USFS, 1985)	VALIDATION FOR 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.	TBNG is not part of a national forest and none of the other listed federal lands categories is present within the study area.	None of the listed federal lands are present on the Antelope LBA tract, and the tract is therefore not unsuitable for mining.
2. Rights-Of-Way and Easements. Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial or other public purposes, on federally owned surface, are unsuitable for mining.	TBNG contains two rights-of-way that meet the intent of this criterion: BN railroad and the Tri-County 230 KV transmission line.	The BN/C&NW right-of-way is on a portion of the Antelope LBA tract. This right-of-way was designated unsuitable for mining in the TBNG Land and Resource Management Plan. The lease will be stipulated to exclude mining within the railroad right-of-way.
3. Dwellings, Roads, Cemeteries, and Public Buildings. Federal lands within 100 feet of a right-of-way of a public road or a cemetery; or within 300 feet of any public building, school, church, community or institutional building or public park; or within 300 feet of an occupied dwelling are unsuitable for mining.	Within TBNG, a school at Wilkinson Ranch headquarters, Wyoming State Highway 59, and 5 ranch headquarters were found to meet the intent of this criterion	None of the listed rights-of-way or buildings are on the Antelope LBA tract, and the tract is therefore not unsuitable for mining.
4. Wilderness Study Areas. Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands within TBNG review area are within a wilderness study area.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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 on TBNG meet the scenic criteria as outlined.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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.	No lands in the TBNG review area are under permit except small enclosures being used to gage reclamation success on existing mines.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
7. Historic Lands and Sites. All publicly or privately owned places which are included in or are eligible for inclusion in the National Register of Historic Places and an appropriate buffer zone are unsuitable.	On the basis of the consultation with the State Historic Preservation Office, there were no unsuitable findings under this criterion in the TBNG review area.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
8. Natural Areas. Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the TBNG are designated as natural areas or as National Natural Landmarks.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
9. Critical Habitat for Threatened or Endangered Plant and Animal Species. Federally designated critical habitat for T or E plant and animal species, and scientifically documented essential habitat for T or E species are unsuitable.	There is no habitat meeting federally designated criterion for T or E plant or animal species within the TBNG review area.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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 T or E shall be considered unsuitable.	Wyoming does not maintain a state list of T or E species of plants or animals. Therefore, this criterion does not apply.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.

UNSUITABILITY CRITERIA	FINDINGS FOR THUNDER BASIN NATIONAL GRASSLAND (TBNG) STUDY AREA (USFS, 1985)	VALIDATION FOR 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.	The USFS found numerous eagle nests, and buffer zones were established, and determined that coal leasing can occur within the buffer zone if the nests are protected with stipulations and site mitigation plans. There were no unsuitable findings under this criterion, but lands involved in buffer zones are subject to special lease stipulations.	Active eagle nests are found near the tract (on the tract under Alternative 2). Federally approved buffer zones are in place to assure protection and mitigation. There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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.	No golden eagle roost or concentration areas occur on the TBNG review area. Mining planned in the review area is not likely to jeopardize the continued existence of the bald eagle. Coal leasing can occur and adequate protection can be provided. There were no unsuitable findings in the TBNG review area.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
13. 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.	After consultation with the U.S. Fish and Wildlife Service (USFWS), it was determined that this criterion does not apply in TBNG.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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.	After consultation with the USFWS, it was determined that this criterion does not apply in TBNG.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining. The LBA tract includes a mountain plover use area. A mitigation plan will be developed prior to mining, and USFWS will be consulted prior to mitigation plan approval.
15. Fish and Wildlife Habitat for Resident Species. Federal lands which the surface management agency and state jointly agree are fish and wildlife habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable.	Sage grouse leks were found on and near the TBNG review area. However, methods of mining can be developed which will not have a significant long-term impact on the grouse or their habitat. Therefore, the areas involved in leks and buffer zones are not unsuitable.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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.	After consultation with the U.S. Geological Survey, it was determined that floodplains can be mined with site specific stipulations and resource protection safeguards to be developed during mining and reclamation planning. Therefore, all lands within the TBNG review area are not unsuitable for mining.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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 municipal watersheds in the TBNG review area.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
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 natural resource waters within the TBNG review area.	There are no unsuitable findings, and the Antelope tract is not unsuitable for mining.
19. Alluvial Valley Floors. All 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.	Lands along prominent drainages were considered potential AVFs pending a final determination by the state. These lands are placed in an "available pending further study" category and are not considered unsuitable.	The state has made a final determination on Antelope Creek and Horse Creek in the Antelope Permit area, which includes most of the Antelope tract. The AVF was found not to be significant to farming. Thus the area is not unsuitable for mining.
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.	The state has no applicable criteria and there is no Indian tribe located in or near the planning area. Therefore there is no unsuitability finding.	Various tribal entities were notified by the USFS archeologist during scoping process. None expressed concerns. Thus the Antelope tract is not unsuitable for mining.

Pursuant to the cooperative agreement, a federal coal lease holder in Wyoming must submit a permit application package to OSM and WDEQ/Land Quality Division (LQD) for any proposed coal mining and reclamation operations on federal lands in the state. WDEQ/LQD reviews the permit application package to ensure that the permit application complies with the permitting requirements and that the coal mining operation will meet the performance standards of the approved Wyoming program. OSM, BLM, USFS, and other federal agencies review the permit application package to ensure that it complies with the terms of the coal lease, the Mineral Leasing Act of 1920, 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 mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the mining plan can be approved, the BLM and the USFS must concur with this recommendation.

If the proposed Antelope LBA tract is leased, the lessee would be 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 must be developed showing how the lands in the new lease area would be mined and reclaimed. Specific impacts which would occur during the mining and reclamation of the tract will be addressed in that proposed mining and reclamation plan and specific mitigation for any anticipated impacts will be proposed.

WDEQ enforces the performance standards and permit requirements for reclamation during the mine's operation and has primary authority in environmental emergencies. OSM retains oversight responsibility for this enforcement. BLM has authority in those emergency situations where WDEQ or OSM cannot act before significant environmental harm or damage occurs.

A significant amount of permitting is required in addition to the coal mining permit before mining can commence. Table 3 lists the state and federal regulatory agencies which must be consulted prior to mining and the additional permits that may be needed.

1.4 Public Participation

The Antelope lease application was reviewed by the Powder River Regional Coal Team at their meeting in Billings, Montana on June 16, 1993. At that meeting, ACC presented information about the Antelope Mine and the lease application to the regional coal team and the public in attendance.

Preliminary scoping for developing the draft EA was based upon the issues considered in the previously prepared environmental analyses and detailed mine permits in the Powder River Coal Region. In February 1994, more than 200 notices of a scheduled scoping meeting were mailed to federal and state agencies, local governments, conservation groups, commodity groups, and individuals who may be impacted by this lease application. The mailing list for the scoping notice was

Table 3: Federal and State Permitting Requirements and Agencies

AGENCY	LEASE/PERMIT/ACTION
FEDERAL	
Bureau of Land Management	Coal Lease Resource Recovery and Protection Plan Scoria Sales Contract Exploration Drilling Permit
Forest Service	Special Use Permits Contract for Sale of Mineral Materials
Office of Surface Mining	Mining Plan Approval SMCRA Oversight
Mine Safety and Health Administration	Safety Permit and Legal I.D.
Bureau of Alcohol, Tobacco and Firearms	Explosives Manufacturer's License Explosives Use and Storage Permit
Federal Communication Commission	Radio Permit: Ambulance Mobile Relay System Radio License
Nuclear Regulatory Commission	Radioactive Byproducts Material License
Army Core of Engineers	Authorization of Impacts to Wetlands & Other Waters of the U.S.
Environmental Protection Agency	Hazardous Waste I.D. Number
Department of Transportation	Hazardous Waste Shipment Notification
Federal Aviation Administration	Radio Tower Permit
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; and 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 & Sewage Treatment System
Department of Environmental Quality-Solid Waste Management	Solid Waste Disposal Permit-Permanent and Construction
State Engineer's Office	Appropriation of Surface Water Permits Appropriation of Groundwater Permits
Industrial Siting Council	Industrial Siting Certificate of Non-Jurisdiction
Department of Health	Radioactive Material Certificate of Registration

jointly developed by the BLM, the USFS, and ACC. A scoping meeting was held in Douglas, Wyoming on February 17, 1994. Four written comments were received on the Antelope lease application, and one oral comment was made at the scoping meeting. Additional scoping comments were requested during April and May on three potential tract configurations. Seven additional written comments were received during this period. Concerns expressed during the public scoping process have been addressed in this draft EA and include:

- the need for additional on-site surveys and inventories for endangered species and migratory birds of high federal interest,
- the cumulative impacts of current and proposed mining operations and all other human activities on wildlife carrying capacities,
- impacts to utility and pipeline facilities,
- impacts to wetlands and waters of the U.S., and
- impacts to cultural resources and traditional cultural properties.

Additional review and coordination with state and federal agencies was also done. Specifically, letters were written to appropriate agencies advising of the pending lease application and requesting their concerns. Results are discussed below in the sections dealing with the respective environmental disciplines.

The draft EA for the Antelope Coal Lease Application was issued in late March, 1995, and a formal public hearing was held on April 26, 1995, at the Holiday Inn in Douglas, Wyoming. There were two oral comments during the public hearing. A copy of the hearing transcript is available at the BLM Casper District Office. The comment period on the draft EA ended on May 30, 1995. Eight written comments were received on the draft EA. These comment letters and responses are included as Appendix A of this final EA.

2.0 PROPOSED ACTION AND ALTERNATIVES

Three alternative LBA tract configurations are shown on Figure 3. The tract as applied for by ACC constitutes Alternative 1, and two modified tract configurations that are being considered by BLM are shown as Alternative 2 and Alternative 3.

2.1 Alternative 1: Competitive Sale of Tract As Applied For To Be Mined With Existing Mining Operation (Proposed Action)

Under this alternative, the Antelope tract, as applied for by ACC (see Figure 3), would be offered for lease at a competitive sale, subject to standard and special lease stipulations. The boundaries of the tract would be consistent with the tract configuration proposed in the Antelope lease application (see figures 2 and 3). This alternative assumes that the applicant (ACC) is the successful bidder on the tract if it is offered for sale. Alternative 1 is the preferred alternative of the BLM.

The legal description of the proposed coal lease lands as applied for by ACC under Alternative 1 is as follows:

T. 41 N., R. 71 W., 6th P.M. Converse County, Wyoming	
Section 25: Lots 5-8, 13, & 14	253.67 acres
Section 26: Lots 9-11, 14 & 15	201.78 acres
T. 41 N., R. 70 W., 6th P.M., Converse County, Wyoming	
Section 30: Lots 15-18	161.75 acres
TOTAL (applied for)	617.2 acres more or less

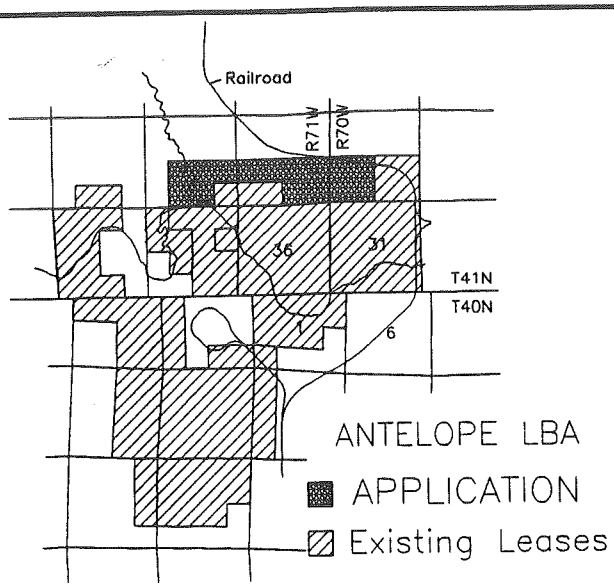
This legal description and acreage are based on approved U.S. Department of the Interior, Bureau of Land Management plats filed in Cheyenne, Wyoming.

Approximately 155 acres within the above-described lands are unsuitable for mining due to the presence of the BN/C&NW railroad right-of-way (see discussion in Section 1.2). Although these lands would not be mined, they are included in the tract to allow recovery of all the minable coal outside of the right-of-way and to comply with the coal leasing regulations which do not allow leasing of less than 10 acre aliquot parts. ACC currently does not have agreements with all of the surface owners along the north boundary of the LBA tract. Such agreements would be necessary to allow recovery of all the coal up to the lease boundaries. ACC's approved mining plan avoids disturbing the Antelope Creek valley, so the coal resources within the above-described lands that are beneath Antelope Creek would not be recovered.

The recoverable coal resources for the tract are preliminarily estimated at 57 million tons underlying approximately 462 acres, after the areas beneath the railroad and right-of-way and Antelope Creek are eliminated. This is based on 95% recovery of the preliminarily estimated 60 million tons of minable coal reserves on the tract.

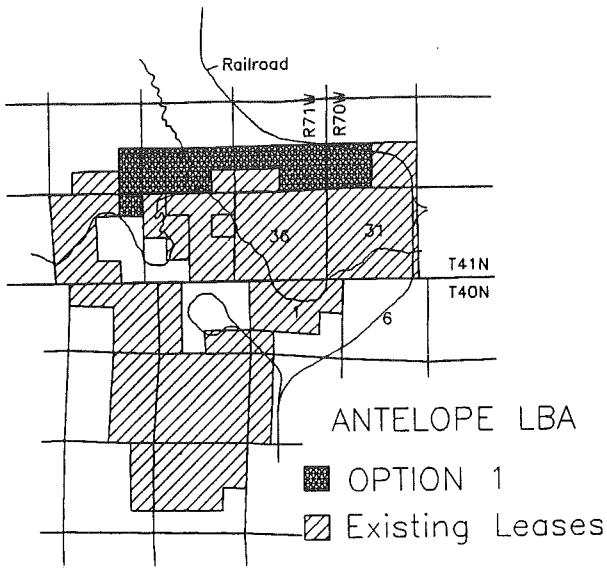
Alternative 1

Tract as Applied For



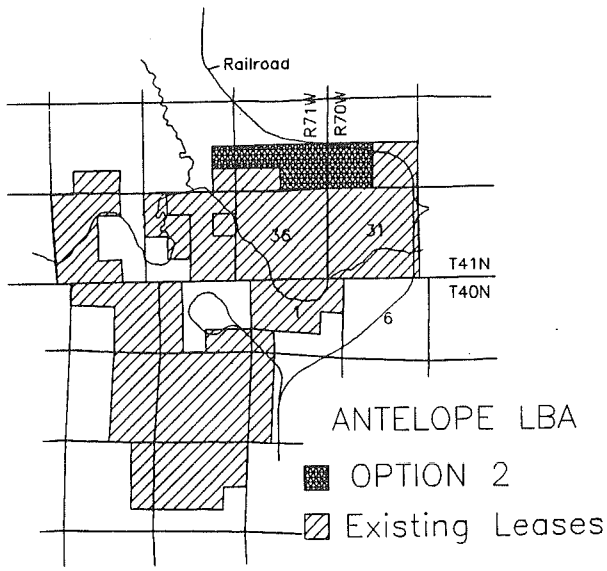
Alternative 2

Tract as Expanded by BLM



Alternative 3

Tract as Reduced by BLM



File: d:\drawings\antscope.dwg

Figure 3: Tract Configurations for Alternatives 1,2 and 3

This estimate of coal resources is used for the EA because it is based on publicly available information. A more accurate estimate of recoverable reserves based on the geologic and engineering evaluation of the tract will be included in the sale notice when the tract is offered for sale.

The ACC application for the coal in the Antelope LBA tract was based on the fact that it is a logical northern extension of the Antelope Mine operation. The tract is bounded by the existing ACC leases to the south and by Converse County Road 37 and the BN/C&NW Gillette-Orin main line on the north and east. No other existing operator is in a position to recover the coal reserves in this area. If another mine opens in the future on currently unleased federal coal resources to the north and northwest of the LBA, it would potentially be in a position to recover some of the coal included in the LBA. Due to the physical constraints of the railroad right-of-way and the existing Antelope leases, however, some of the coal in the eastern part of the LBA might not be recoverable unless it is mined in conjunction with the existing Antelope Mine. Increasing overburden depths to the north and northwest and the existence of eighteen competing mines in the Wyoming portion of the Powder River Basin make a new mine start on these currently unleased federal coal resources economically unattractive in the foreseeable future.

The Antelope Mine is a surface coal mine, owned and operated by ACC. Overburden removal is accomplished with a dragline assisted by a mobile stripping fleet consisting of scrapers, trucks, and loaders. Coal production occurs from two coal seams (Anderson and Canyon) and 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. Existing facilities at the mine include crushing, conveying, storage, loading, administrative, and equipment maintenance facilities. Railroad access is provided for unit trains via the Gillette-Orin main line of the joint BN/C&NW Railroad which runs adjacent to the east edge of the permit area.

The initial 525-T1 mine permit for Antelope Mine was issued on March 11, 1982. OSM concurrence was enacted shortly thereafter on April 1, 1982. Construction of the Antelope Mine facilities began in 1982. The first coal was shipped on November 8, 1985. Current production is about 8 million tons per year. The mine is permitted to produce up to 12 million tons per year through the year 2016. The currently permitted mining plan is to produce 12 million tons per year from 1999 through 2004, and decrease annual production from year 2005 through year 2016. However, if markets exist and necessary permit revisions are approved, the mine could produce at the 12 million ton per year level beyond the year 2004 and exhaust the existing reserves prior to 2016.

With the LBA tract, and assuming an available market, the mine could produce coal at 12 million tons per year through the year 2015, and then decline in 2016, the last year of production. The addition of the LBA tract would extend the period that coal could be produced at the maximum level, but would not extend the life of the

mine beyond 2016, which is the estimated mine life under the currently permitted mining plan. Employment is not predicted to increase if the LBA tract is acquired, although employment levels would remain at their peak for a longer time due to the increased duration of peak coal production.

If ACC leases the tract, it would be mined as part of the existing Antelope mining operation. A new mining and reclamation plan, showing a detailed mining sequence into the newly leased area, would be developed and approved before any disturbance took place on the new lease. Addition of the lease would result in an increase of approximately 462 acres to the area to be affected by mining and mining-related activities at Antelope Mine. Based on the location and movement of the existing pit, it is estimated that coal removal within the LBA tract would begin in approximately 2000. Topsoil removal would begin prior to that. Most of the LBA tract is already within the currently approved mine permit area.

2.1.1 Special Lease Stipulations

The special lease stipulations required would be as follows:

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 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.

2.1.1.1 Cultural Resources

- 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 office 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., archaeologist, 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 the 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 lease lands. The lessee shall not commence the surface disturbing activities until permission to proceed is given by the Assistant Director or Authorized Officer.

- 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 plan or exploration plan.

- The cost of conducting the inventory, preparing reports, and carrying out mitigation measures shall be borne by the lessee.

- 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 lessee unless otherwise specified by the authorized officer of the BLM or of the surface managing agency, if different.

- All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

2.1.1.2 Paleontological Resources

- If paleontological resources, either large and conspicuous, and/or of significant scientific value are discovered during mining operations, the find will be reported to the Authorized Officer immediately. Mining operations will be suspended within 250 feet of said find. An evaluation of the paleontological discovery will be made by a BLM or surface management agency 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 a 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 interest discovered during the mining operations.

2.1.1.3 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. Lessor reserves the right in accordance with applicable coal regulations administered by Lessor to require the Operator/Lessee to modify the Resource Recovery and Protection Plan (R2P2) to minimize conflicts with other resources and to maximize recovery of all resources.

2.1.1.4 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.

2.1.1.5 Resource Recovery and Protection

- Any bypass of Federal coal determined to be economically recoverable must have the written approval of the Authorized Officer of the BLM in the form of an approved modification to the Resource Recovery and Protection Plan (R2P2) prior to the Federal coal being bypassed. (43 CFR 3482.2(c)(2)) Failure to comply with this requirement shall result in the issuance of a Notice of Noncompliance by the Authorized Officer. The Notice of Noncompliance will include the amount of damages to be assessed for the unauthorized bypass of Federal coal as determined by the Authorized Officer. Lessee shall pay royalty for all coal not recovered which was available for mining and was economically recoverable by mining operations under an R2P2 approved by the Authorized Officer. The royalty shall be determined in accordance with Section 2.(a). PRODUCTION ROYALTIES, of this lease, and the value of the coal shall be determined as set forth in the applicable coal regulations administered by the Lessor. Federal coal not recovered, but which was available for recovery, will be volumetrically determined by the Authorized Officer using standard industry practices.

2.1.1.6 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 Public Lands of the United States". The survey will be recorded in the appropriate county records, with a copy sent to the authorized officer.

2.1.1.7 Coal Resources Within the Burlington Northern/Chicago Northwestern Gillette-Orin Mainline Right-of-Way

- No mining activity of any kind may be conducted within the Burlington Northern/Chicago Northwestern Gillette-Orin Main Line 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.

2.2 Alternative 2: Competitive Sale of Tract as Expanded by BLM to be Mined with Existing Mining Operation

To further prevent potential bypass of coal in the future, the BLM is considering adding lands to the tract (see Figure 3). The legal description of the coal lease lands that would be added to the Antelope LBA tract by the BLM under Alternative 2 is as follows:

T. 40 N., R. 71 W., 6th P.M., Wyoming	
Section 34: Lot 1	40.84 acres
T. 41 N., R. 71 W., 6th P.M., Wyoming	
Section 26: Lots 12 and 13	81.27 acres
Section 27: Lots 13 and 16	83.52 acres
TOTAL ADDED TO LEASE:	205.63 acres more or less
TOTAL APPLIED FOR:	617.2 acres more or less
TOTAL UNDER ALTERNATIVE 2:	822.83 acres more or less

This legal description and acreage are based on approved U.S. Department of the Interior, BLM plats filed in Cheyenne, Wyoming.

Under this alternative, the Antelope LBA tract with amended boundaries would be offered for competitive leasing subject to the standard lease stipulations and to the special lease stipulations listed in Section 2.1.1 above. Alternative 2 would add approximately 206 acres to the tract to provide for recovery of federal coal located west of and adjacent to the Antelope LBA tract as applied for. Alternative 2 also assumes that the applicant is the successful bidder on the tract if it is offered for sale.

Alternative 2 allows for recovery of about 25 million additional tons of coal (about 82 million tons total). The coal added under this alternative could logically be

mined as an extension of the Antelope LBA, and this coal could be bypassed if it is not mined with the Antelope leases and the new LBA tract. The area added under this alternative would square up the existing leases and avoid a potential bypass situation in the future.

There are some drawbacks to Alternative 2. The federal and state governments could potentially realize more financial benefits by waiting to lease the coal added by this alternative. The coal added under Alternative 2 would not be mined until near the end of the mine life, according to the current mine plan. This coal could have a higher fair market value if it is leased closer to the time that it would be mined. Most of the area added under this alternative is not within the current permit area. Including it in the tract would increase the costs to the company, and increase the permitting time. This could further decrease the fair market value of the tract.

Although this coal could possibly be bypassed if it is not mined as part of the Antelope Mine, several mechanisms exist for adding it to the mine closer to the time when it would be mined. It could be leased in the future under the lease-by-application process; it could be leased as an emergency bypass lease; or ACC could apply to modify several of its existing leases to include this acreage. This alternative was not selected as the preferred alternative because of the potential financial loss to the public at this time, and because there are mechanisms to avoid bypass of this coal in the future.

2.3 Alternative 3: Competitive Sale of Tract as Reduced by BLM to be Mined with Existing Mining Operation

To preserve some unleased coal with relatively low overburden thickness for future leasing, the BLM is considering reducing the LBA tract size (see Figure 3). The legal description of the lands to be subtracted from the Antelope LBA tract is as follows:

T. 41 N., R. 71 W., 6th P.M., Wyoming Section 26: Lots 10, 11, 14 and 15	161.77 acres
TOTAL SUBTRACTED FROM LEASE:	161.77 acres more or less
TOTAL APPLIED FOR:	617.2 acres more or less
TOTAL UNDER ALTERNATIVE 3:	455.43 acres more or less

This legal description and acreage are based on approved U.S. Department of the Interior, BLM plats filed in Cheyenne, Wyoming.

Under this alternative, the Antelope LBA tract with amended boundaries would be offered for competitive leasing subject to the standard lease stipulations and to the special lease stipulations listed in Section 2.1.1 above. Alternative 3 would subtract approximately 162 acres and 20 million tons of coal from the LBA tract as applied for

by ACC, leaving the tract with approximately 37 million tons of recoverable coal. The tract configuration under Alternative 3 avoids the area in the Antelope Creek Valley where some coal would not be recovered under alternatives 1 or 2. Alternative 3 also assumes that the applicant is the successful bidder on the tract if it is offered for sale.

Alternative 3 assumes that development of unleased coal resources north of the Antelope Mine would be economically feasible in the future. There is unleased federal coal north of the existing Antelope lease and west of the main railroad line that was included in the Ridgerunner tract in 1983 (BLM, April, 1983). It was evaluated as a potential tract for leasing in the proposed 1984 Powder River regional coal lease sale that was cancelled. The overburden in the western half of the 1983 Ridgerunner tract is very thick, making that coal unattractive economically relative to the coal that is currently being mined in the basin. If the Ridgerunner tract is leased in the future, the area that is proposed for removal from the Antelope tract under Alternative 3 would be a potential entry point for development of the coal in the Ridgerunner tract because of its relatively low overburden thickness.

There are also some potential drawbacks to this alternative. The coal removed under Alternative 3 is logically mined with the existing Antelope Mine, and the Ridgerunner tract may not be leased in the foreseeable future. Removal of this coal from the Antelope LBA could potentially result in its being permanently bypassed, which is not responsible management of public resources. Also, a portion of the Horse Creek drainage is excluded under Alternative 3. This drainage would be most efficiently mined and reclaimed with the rest of the LBA tract. Although the coal which would be excluded under this alternative could potentially be mined in the future, that could result in less efficient coal recovery and more significant environmental impacts following reclamation. Therefore, this alternative was not selected as the preferred alternative.

2.4 Alternative 4: No Action Alternative

Under this alternative, the BLM would reject the coal lease application, the tract would not be offered for sale, and the coal would not be mined. If this coal is not mined with Antelope's current operation, a portion would remain as a finger of coal between the mined and reclaimed Antelope lease on the south and the railroad right-of-way to the north and east (see Figure 3). This narrow band of coal might not be economically recoverable by another operator in the future. As a result, all or part of the 57 million tons of recoverable coal on the tract as proposed could potentially be permanently bypassed. If this were the case, the environmental impacts associated with mining the LBA tract would be avoided. The potential income from the bonus bid, future royalties and taxes on 57 millions tons of coal would be foregone, as well as the income from additional years of peak coal production at the mine. A portion of the surface of the proposed lease area (approximately 95 acres) would be disturbed due to overstripping to allow coal to be recovered from the existing contiguous ACC coal leases.

2.5 Alternatives Considered But Not Analyzed In Detail

Alternative 5: Proposed Lease Sale for a New Stand-Alone Mine

The lease-by-application process is an open, public competitive leasing process, as required by law and regulation. The LBA coal tracts are nominated for leasing by companies with an interest in acquiring them, but the sale of the coal is a competitive bidding process which is not restricted to the company nominating the lease.

Under this alternative, the Antelope LBA tract would be offered for competitive leasing subject to standard and special lease stipulations, but it is assumed that ACC would not be the successful bidder. The same special lease stipulations would be required as for Alternative 1 (see section 2.1.1 of this EA). The boundaries of the tract would be consistent with one of the tract configurations designated in alternatives 1, 2, or 3 (see Figure 3).

In that event, the successful bidder would be required to produce one percent of the estimated coal reserves within 10 years or lose the lease due to the diligence requirements of the Federal Coal Leasing Amendments Act of 1976. There are no other existing mines in a position to recover this coal, so a new mine would have to be permitted and constructed to mine this coal within that 10-year period. Development of a stand-alone mine would require the construction of new surface facilities including offices, shop facilities, warehouses, coal processing facilities, coal loadout, and railroad spur. This alternative is not considered feasible for several reasons:

- There may not be an appropriate location for such surface facilities within or adjacent to this LBA tract. The LBA tract is physically constrained on the south by the existing Antelope coal leases and on the north and east by the BN/C&NW railroad (see Figure 2). Facilities could potentially be located on the tract or northwest of the tract, on currently unleased coal. This would be prohibitively expensive in either case, because either the coal beneath the facilities would not be mined, reducing the amount of recoverable coal for any new mine, or the facilities would have to be moved at some point during the life of the mine.

- In order to avoid leased or leasable coal reserves, the railroad spur line would be long and expensive. It takes considerable land with suitable topography to construct a railroad loop capable of loading mile-long trains without obstructing the main line. As above, the only locations available would be on the tract itself or northwest of the tract on unleased federal coal. If it were placed on the tract, the coal underlying the loop would be unavailable for mining. Placing it on unleased federal coal to the northwest would prevent that coal from being mined, and the topography in that area is significantly higher than on the LBA tract, making it less suitable for a railroad loop.

- The Antelope tract as applied for contains about 57 million tons of recoverable coal reserves, assuming that the facilities and railroad are located off-lease and that all of the coal in the tract would be recoverable after the existing Antelope leases to the south are mined and reclaimed. That is not enough coal to justify the estimated cost of building the facilities, which could exceed $100 million. There is unleased federal coal north of the existing Antelope lease that was included in two tracts that were considered for leasing in the proposed 1984 Powder River regional coal lease sale that was cancelled. The Ridgerunner tract was located west of the main railroad line and the Rochelle Hills tract was located east of the main railroad line. The coal in the Rochelle Hills tract is not logistically minable with the Antelope Mine operations or with the Ridgerunner tract because it is separated from both by the main railroad line right-of-way, which is unsuitable for mining. Most of the coal in the Antelope tract could potentially be mined with the Ridgerunner tract, but the thick overburden in the western part of the Ridgerunner Tract would make it difficult for a new mine with those reserves to compete with the existing mines in the basin.

As discussed above, the Antelope LBA does not contain enough coal reserves to economically justify a new mine start. Additional coal reserves are accessible to the north and west, but they are not economically minable at this time. Consequently, the probability of this tract being purchased by another company is very low, and Alternative 5 was not analyzed in detail. The environmental impacts of mining the LBA under Alternative 5 would be greater than for alternatives 1, 2, or 3 because of the need for new facilities, a new rail line, new employment, and the creation of additional sources of dust and blasting.

Alternative 6: Postpone Lease Sale

Under this alternative, the sale of the Antelope tract would be postponed until coal prices increase in the basin on the assumption that the fair market value of the unleased coal would increase if coal prices increase. If the fair market value increases, the government would receive a larger bonus bid at the time the coal is leased.

The average price per ton of Wyoming coal has been declining since about 1983 (Wyoming State Geological Survey; May, 1994, Figure 8). In the early 1980s, most of the coal in the Powder River Basin was sold under long-term contracts at guaranteed prices. As more mines opened, the supply of coal increased, and utilities started to buy more coal on the spot market at lower prices, rather than negotiating longer-term contracts at higher prices. The percentage of sales of lower-cost spot coal has been increasing as the long-term contracts have been expiring. Spot prices have decreased in recent years as well, and in 1993 they were at an all-time low.

An increase in demand for Powder River Basin coal has been predicted for several years by some as a result of incentives favoring low-sulfur coal in the Clean Air Act of 1990. An increase in demand could result in an increase in spot prices, as well as an increase in longer-term contracts for coal sales. Production of Powder

River Basin coal did increase significantly in 1993 and 1994, after a decline in production in 1992. Spot prices for Powder River Basin coal rose in 1994 as a result of cold weather, rail disruptions and other market factors. These conditions no longer exist and spot pricing has returned to pre-1994 levels.

The main source of revenue to federal and state governments from leasing and mining federal coal is the 12.5% royalty that is collected on all federal coal at the time it is sold. Since the 12.5% royalty is collected when the coal is sold, the mechanism is already in place for government revenues to increase if coal prices rise. Postponement of a lease sale until coal prices rise could result in an increase in the bonus bid to the government, but that increase could be offset by a reduction in royalty benefits if the price rise cannot be fully taken advantage of. The duration of any price increase cannot be predicted, and there is a time lag of several years between the time prices escalate and the time the coal can be brought to market due to the time necessary for evaluating environmental impacts, leasing, baseline data collection, and permitting a logical mining plan. Also, postponement could result in lower royalty revenues to the government if the operator must sell the coal on the cheaper spot market, because he does not have the reserves to negotiate higher priced, long-term contracts when the opportunity is there to do so.

The Antelope lease sale is currently tentatively scheduled for early 1996. In 1997, ACC estimates that it will be within three years of mining in the area of the proposed lease. At that point, ACC could apply for the coal in the LBA tract as an emergency lease (under 43 CFR 3425, the same regulations which apply to LBAs). A comparison of emergency and LBA leasing requirements is included in Table 4. There are no particular administrative advantages or disadvantages to be gained by processing the tract as an LBA or as an emergency lease. In either case, the environmental impacts of issuing a lease must be analyzed, the fair market value must be determined, and a competitive lease sale must be held. If the BLM decided to postpone processing the LBA tract until prices increase in the basin, Antelope could re-apply for the same tract as an emergency lease. There is a potential environmental advantage to not delaying the sale. If ACC is able to acquire the new lease earlier, they can begin to develop long pits that are designed to mine through the current leases and the LBA tract concurrently, and the total highwall length (and consequent disturbed area and associated environmental effects) could potentially be reduced slightly.

The environmental impacts of postponing the lease sale could be the same or slightly greater than the environmental impacts of alternatives 1, 2, or 3, or they could be the same as for Alternative 4. The plan being developed for mining the Antelope LBA tract along with the current Antelope Mine coal leases shows coal removal beginning in 2000, with topsoil removal approximately one year in advance. If coal sales increase, these dates could be earlier. If the tract could be leased and permitted before that time, the impacts of mining the LBA tract would be similar to or slightly greater than for Alternatives 1, 2 or 3 (depending on the tract configuration).

Table 4. Comparison of Emergency and LBA Leasing Requirements

EMERGENCY LEASE APPLICATION	LBA
The proposed lease may be located inside or outside a federal coal production region.	The proposed lease is located outside a federal coal production region. The decertification of the Powder River Basin as a Federal coal production region allowed BLM to accept and consider lease by applications.
Before an emergency lease sale may be held, an environmental analysis (EA or EIS) of the proposed lease area must be completed.	Before an LBA sale may be held, an environmental analysis (EA or EIS) of the proposed lease area must be completed.
A public hearing must be held on each proposed emergency coal lease application.	A public hearing must be held on each proposed LBA
Emergency leases are issued by competitive sale, and bids that are less than the fair market value determined by the BLM will not be accepted.	LBAs are issued by competitive sale, and bids that are less than the fair market value determined by the BLM will not be accepted.
The proposed lease must be mined as part of an operation that is producing coal on the date of the application.	
The applicant must demonstrate an emergency need for the coal. (**See definition below)	
The applicant must demonstrate that the need for the coal resulted from circumstances beyond his control or could not have been reasonably foreseen and planned for in time to allow for consideration under the regional leasing process.	
The lease cannot include more than 8 years of recoverable coal reserves at the rate of production at the time of the application.	

** In the regulations, an emergency need is defined as:

a. The federal coal is needed within three years to maintain an existing mining operation at its current average annual level of production on the date of application; or

b. If the coal deposits are not leased, they would be bypassed in the reasonably foreseeable future, and if leased, some portion of the tract applied for would be used within three years.

If the sale is postponed beyond the time the LBA tract could be mined in logical sequence with the Antelope Mine (i.e., after the adjoining acreage on the existing lease was mined and reclaimed), it would not be feasible for ACC to mine the tract. The tract is not economical for a stand-alone mine as discussed under Alternative 5, and it is not likely that another operator would lease the Antelope LBA tract. In this case, postponing the lease sale would have the same impacts as Alternative 4 (the No Action Alternative), with the resulting avoidance of environmental impacts associated with mining the coal in the LBA, potential bypass of the coal in the LBA, and loss of potential income from the bonus bid, future royalties and an extended maximum mine production period. Since the environmental impacts of this alternative would not be significantly different from alternatives 1, 2, 3, or 4, this alternative is not analyzed in detail.

3.0 AFFECTED ENVIRONMENT

3.1 General Setting

The proposed LBA tract is within a region which has been evaluated by several federal environmental analyses which describe the existing and affected environment in the area of the recently issued and currently proposed lease-by-applications. These documents contain analyses of the impacts to be expected as a result of surface coal mining and other mineral development activity in this area. They are available for viewing at the Casper District Office of the BLM. The relevant publications are as follows:

- *Part 1: Regional Analysis, Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming, Volumes I and II,* BLM, October 1974.
- *Final Environmental Statement, Eastern Powder River Coal,* BLM, March 1979.
- *Final Environmental Impact Statement, Federal Coal Management Program,* BLM, April 1979.
- *Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area Management Framework Plan: Gillette Review Area,* BLM, Wyoming, 1980.
- *Final Environmental Impact Statement, Powder River Coal Region,* BLM, December 1981.
- *Proposed Mining and Reclamation Plan, North Antelope Mine, Campbell County, Wyoming,* Final Environmental Impact Statement OSM-EIS-6, February 1982.
- *Powder River Coal Regional Tract Summaries,* Cheyenne, Wyoming, 1983.
- *Draft Environmental Impact Statement, Round II Coal Lease Sale, Powder River Region,* BLM, January 1984.
- *Platte River Resource Area, Resource Management Plan and Final Environmental Impact Statement,* BLM, July, 1985.
- *Buffalo Resource Area, Resource Management Plan and Final Environmental Impact Statement,* BLM, October 5, 1985.
- *Final Environmental Impact Statement Supplement, Federal Coal Management Program,* BLM, October 1985.

- *Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan,* USFS, November 20, 1985.

- *Coal Bed Methane Environmental Assessment, Eastern Campbell County and Western Johnson County, Wyoming WY-061-0-EA064,* BLM, Wyoming, March 1990.

- *Jacobs Ranch Federal Coal Lease Application Environmental Assessment,* BLM, Wyoming, June 1991.

- *Final Environmental Assessment for the West Black Thunder Coal Lease Application,* BLM, Wyoming, March 1992.

- *Final Environmental Assessment for the North Antelope and Rochelle Coal Lease Applications for Powder River Coal Company,* BLM, Wyoming, May 1992.

- *Final West Rocky Butte Coal Lease Application Environmental Impact Statement,* BLM, Wyoming, June 1992.

- *Exxon Pistol Point Coal Bed Methane Project Environmental Assessment,* BLM, Wyoming, September 1992.

- *American Oil and Gas Marquiss Field Coal Bed Methane Project Environmental Assessment,* BLM, Wyoming, October 1992.

- *Final Environmental Assessment of the Eagle Butte Coal Lease Application,* BLM, Wyoming, July 1994.

- *Lighthouse Coal Bed Methane Project Environmental Assessment,* BLM, Wyoming, March 1995.

The Antelope Mine has been specifically evaluated in several federal and state environmental analyses. These documents contain analyses of the impacts to be expected as a result of surface coal mining at the Antelope Mine. They are available for viewing at the Casper District Office of the BLM. The relevant publications are as follows:

- *Proposed Mining and Reclamation Plan, Antelope Mine, Converse County, Wyoming,* Final Environmental Impact Statement OSM-EIS-5, February 1982.

- *Technical Environmental Analysis, Antelope Mine,* WDEQ, Permit 525-T4, November 1, 1988, included in Mining Plan Approval Document for the Antelope Mine, Antelope Coal Company.

The affected environment is also described in detail in the Antelope Mine's 525-T5 Permit Application, which was approved on October 28, 1993 by the WDEQ/LQD. A major revision to this permit was approved by WDEQ/LQD on May 18, 1994. This document is on file and available for public review at the WDEQ/LQD offices in Cheyenne, Wyoming. The detailed environmental baseline information for the current permit area, which has been gathered by ACC and various consultants to comply with the WDEQ/LQD requirements for a mine plan submittal, covers the entire LBA area. This information includes land use, climatology, geology, soils, vegetation, groundwater hydrology, surface water hydrology, archaeology, history, air quality, and wildlife.

These studies have revealed that the following elements of the human environment are either not present in the proposed lease area or would not be affected: areas of critical environmental concern, sole source drinking water, prime or unique farmlands, floodplains unsuitable for mining, riparian areas, wild or scenic rivers, or wilderness.

The LBA tract is substantially similar to the adjacent Antelope Mine, for which detailed site-specific environmental data have been collected and environmental analyses have been prepared by ACC to secure the necessary mining permits. These permits and assessments have been previously reviewed in detail and approved by BLM as providing an adequate environmental impact assessment and employing appropriate environmental stipulations and reclamation measures.

The proposed LBA tract is located north of and adjacent to the existing Antelope Mine as shown on figures 1 and 2. The mine is about 55 miles north of Douglas, Wyoming (see Figure 1). Access to the mine is provided by Wyoming Highway 59 and Converse County Road No. 37. Figure 4 is a detailed map showing features of interest that are located within and near the Antelope LBA tract.

The Antelope Mine and LBA tract are situated in the Powder River structural and topographic basin of northeastern Wyoming. The mine and LBA tract are characterized by rolling hills and uplands which have been dissected by stream activity. Elevations on the tract generally range from 4,600 to 4,700 feet above mean sea level. The climate of the region is semi-arid. Precipitation averages about 13 inches per year, with 75% of the average precipitation occurring during the growing season, which is from April through September. Summer precipitation is often in the form of brief, intense thunderstorms. Annual evaporation exceeds annual precipitation. The prevailing winds are from the northwest quadrant and the mean annual wind speed is about 8 to 10 mph. The Powder River Basin is part of the Northwestern Great Plains Ecoregion of Omernik (Environmental Protection Agency, 1993). The area is characterized as an ecological transition zone between the true short grass plains to the east and the northern desert shrub type to the west. Within the Wyoming portion of the basin, the potential natural vegetation is primarily grama-needlegrass-wheatgrass or wheatgrass needlegrass (Kuchler; U.S. Geological Survey, 1985).

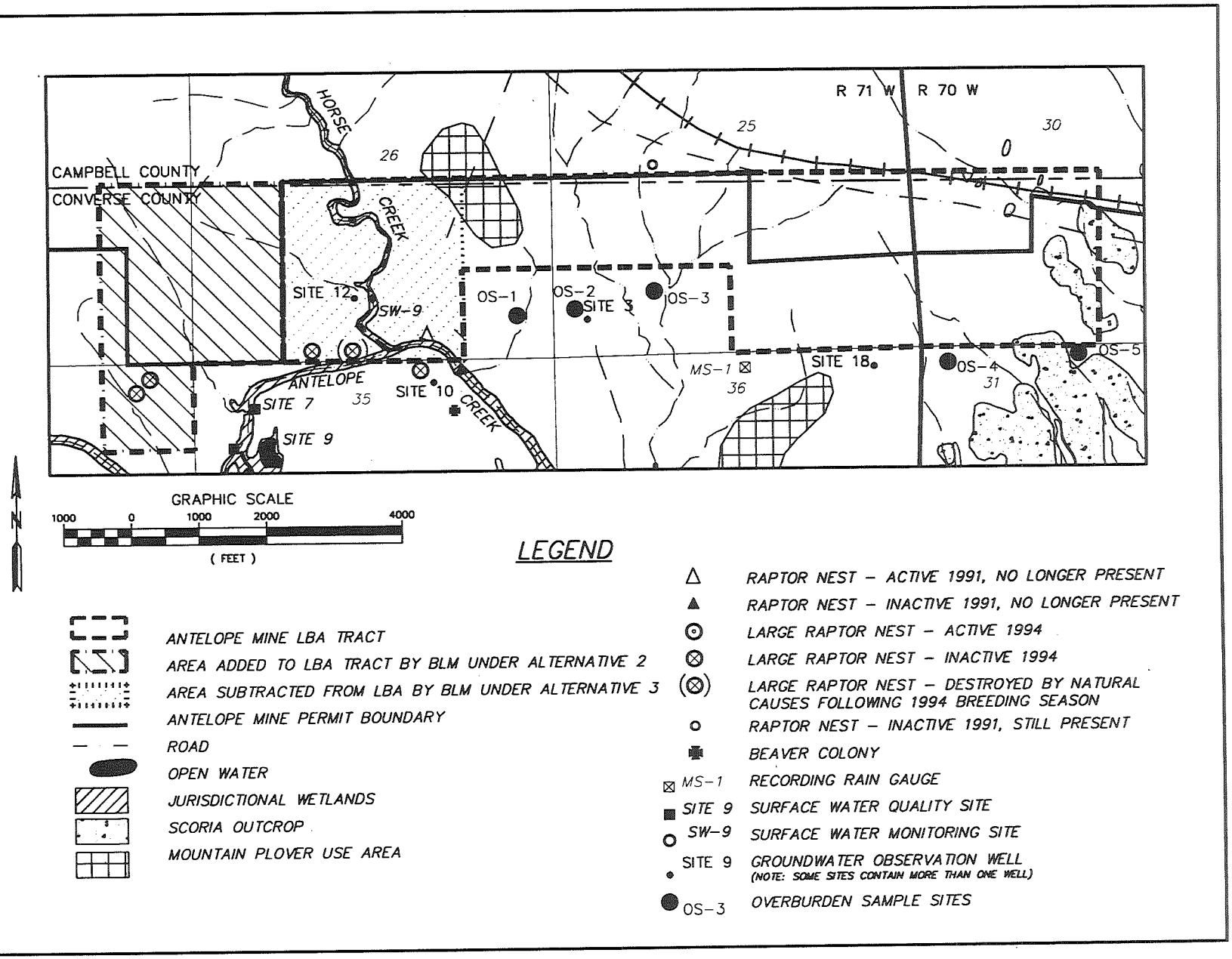


Figure 4. Map of Alternative LBA Tracts

The Antelope Mine permit area is transected by Antelope Creek, an intermittent stream which meanders from west to east. The landscape is further dissected by several small, north-south drainages which are classified as ephemeral, meaning that they flow only in direct response to precipitation or snowmelt runoff events. Figure 5 shows the major hydrologic features of the permit area and LBA tract. Antelope Creek is a tributary of the Cheyenne River, which joins the Missouri River in South Dakota. ACC's approved mining plan avoids disturbing the Antelope Creek Valley.

3.2 Affected Resources

3.2.1 Geology and Topography

The Powder River Coal Field of northeastern Wyoming lies within the boundaries of the Powder River structural and topographic basin. The basin is a broad northwest-southeast trending syncline bounded on the west by the Big Horn Mountains, on the east by the Black Hills, and on the south by the Casper Arch, Laramie Mountains, and the Hartville Uplift. The basin extends northward into Montana. The syncline is asymmetrical and the axis of the syncline (the deepest part of the basin) is west of the geographical center of the basin.

The Antelope Mine is located on the eastern limb of the structural basin and is near the southern end of the basin. The regional dip in the area of the mine is approximately one degree to the northwest. There are local areas where the shallow strata are dipping at higher angles. This is generally due to local folding or faulting.

In general, the coal in the LBA tract is as deep as the coal in the existing leases at the Antelope Mine. This means that approximately as much overburden must be removed from the proposed lease as from the existing leases in order to mine the coal.

Stratigraphic units of interest in the mine area include, in descending order, recent (Quaternary age) alluvial deposits, the Eocene age Wasatch Formation, and the Paleocene age Fort Union Formation (which contains the target coal beds) (see Figure 6). There is no distinct boundary between the Fort Union and Wasatch formations. In fact, one recent paper suggests the upper Fort Union and the Wasatch should be combined and renamed the Kleenburn member of the Fort Union Formation because there is not a valid reason to separate them (Boyd, Wyoming Geological Association, 1994). In the area of the basin where coal is being mined, the contact between the Fort Union Formation and the Wasatch Formation is generally arbitrarily designated as the top of the main coal seam in the Fort Union Formation. This main coal seam, referred to as the Wyodak-Anderson, is the seam being mined in most of the Wyoming Powder River Basin. At the Antelope Mine and LBA there are two minable coal seams, locally referred to as the Anderson and Canyon seams. The upper seam, the Anderson, ranges in thickness from 18 to 44 feet and is thickest in the northern part of the Antelope Mine area. The Canyon seam has a thickness of 30 to 36 feet, but contains numerous splits in the southern half of the Antelope Mine area, forming five separate and relatively thin seams. There are areas within the existing permit area where the Anderson seam has been removed by erosion. Within the LBA tract, both seams are present and each is relatively uniform in thickness. A few miles north and northeast of the LBA area, at the North Antelope Mine, the Anderson and Canyon coal seams coalesce to form the Wyodak-Anderson coal seam.

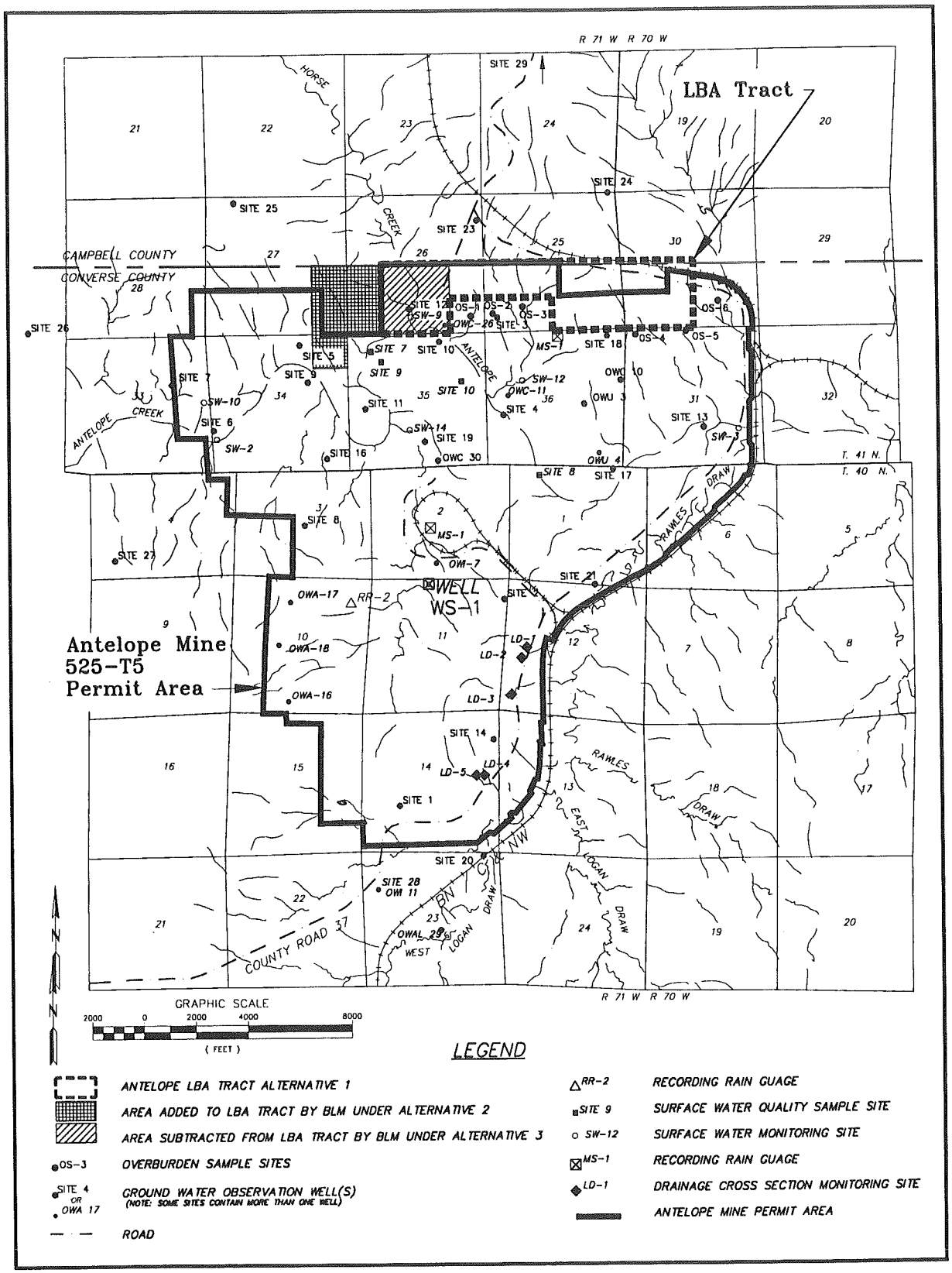
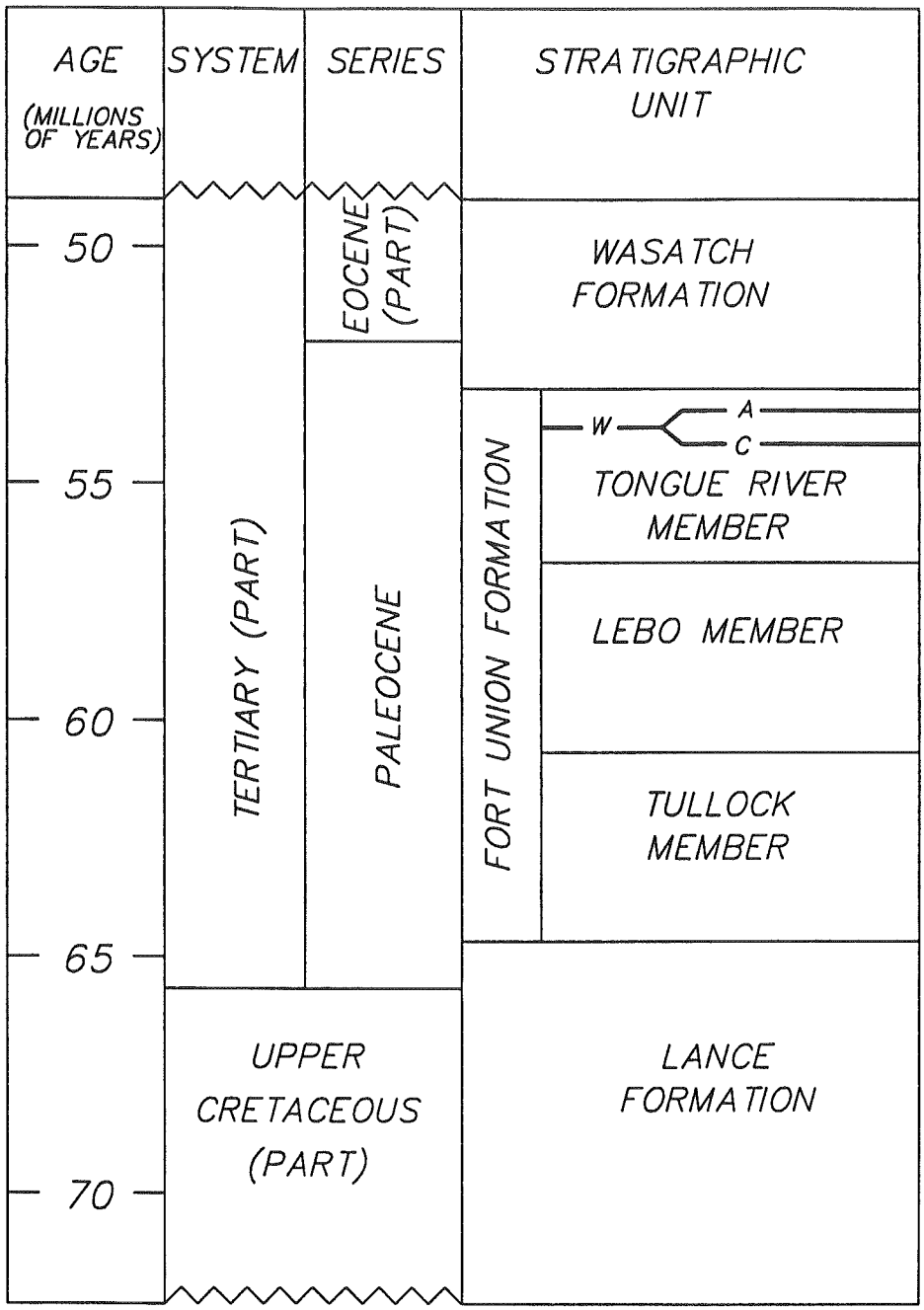


Figure 5. Antelope Mine LBA Hydrologic Features



W – WYODAK COAL SEAM
A – ANDERSON COAL SEAM
C – CANYON COAL SEAM

From Brown, USGS, 1993, & Law, Rice, & Flores, RMAG, 1991

Figure 6. Generalized Stratigraphic Chart for the Latest Cretaceous and Early Tertiary Periods, Powder River Basin, Wyoming

On the extreme eastern part of the LBA area, small areas of scoria (also called clinker) are present because the overburden has been thermally altered from the burning of the Anderson coal seam (see Figure 4). The overburden generally thickens toward the north in the LBA area as the topography rises away from the Antelope Creek valley.

There are Quaternary alluvium and colluvium deposits located along Horse Creek and several of the other minor drainages within the LBA. Within the LBA tract, there are also alluvial deposits located along Antelope Creek (see figures 4 and 5). The alluvial deposits consist of fining-upward sequences with gravel at the base and very fine sand or silt at the top locally (Budai and Cummings, 1984). These deposits have been the subject of AVF investigations and determinations (refer to Section 3.2.2.3).

The Wasatch Formation crops out over much of the surface of the Wyoming Powder River Basin. It consists of interbedded shales, siltstones, thin discontinuous coals, and lenticular sandstones. Where sandstones in the Wasatch Formation are of sufficient porosity and areal extent, they serve as aquifers supplying water for stock and domestic uses.

The Fort Union Formation consists of noncarbonaceous to highly-carbonaceous shales, mudstones, siltstones, lenticular sandstones, and coal. It is approximately 3,100 feet thick in the area of the Antelope LBA tract, based on data from geophysical logs from two exploratory oil wells drilled in the vicinity of the Antelope LBA (the HPC Hedgehog Federal 1-25, SW/4 SW/4, Section 25, T.41N., R.71W.; and the HPC Woods Hedgehog 1-36, SE/4 NW/4, Section 36, T.41N., R.71W.) The Fort Union Formation is divided into three members, the Tongue River, Lebo Shale, and Tullock (in descending order; see Figure 6). The thicknesses listed for these three members in the LBA area in the following discussion are based on correlation of the geophysical logs cited above.

The Tongue River member consists of sandstone, conglomerate, siltstone, mudstone, limestone, coal, and carbonaceous shale. It reaches thicknesses of 1,750 feet in the Powder River Basin (Law, Rice, and Flores; Rocky Mountain Association of Geologists, 1991). In the LBA area, it is approximately 1,400 feet thick, and consists of around 60% sand (Lewis and Hotchkiss; U.S.Geological Survey, 1981). The Anderson and Canyon coal seams are located at the top of this member in the LBA area. Below the Anderson and Canyon coal seams, interbedded shales, siltstones, sandstones, and thin coal beds comprise the rest of the Tongue River member.

The Anderson and Canyon coal seams are subbituminous in rank, and they are generally low sulfur, low ash coal deposits. Glass (Wyoming Geological Association, 1991) reported average ash, sulfur and Btu/pound values of 5.1%, 0.36%, and 8,580, respectively for coal in the eastern portion of the Powder River Basin of Wyoming that is currently being mined. According to a Wyoming State Geological Survey report, (Wyoming State Geological Survey, Vogler et al., 1995), in 1994 the

coal delivered by the Antelope Mine had an average Btu/lb of 8,826, an average ash content of 5.21%, and an average sulfur content of 0.28%. In a geophysical log from an oil well located close to the LBA (HPC Hedgehog Federal 1-25, SW/4 SW/4, Section 25, T.41 N., R.71 W.), the Anderson coal is approximately 40 feet thick, while the Canyon coal is approximately 32 feet thick. At this location, there is approximately 106 feet of overburden above the Anderson coal and approximately 22 feet of interburden between the Anderson and Canyon coals, based on the gamma ray log run in the oil well. An estimate of the thickness, average heating value, ash content, and sulfur content of the coal in the lease application area based on the BLM geologic and engineering report will be included in the sale notice for the tract.

The middle member of the Fort Union Formation is the Lebo Shale Member. It reaches a maximum thickness of approximately 3,000 feet in the Powder River Basin and consists of sandstone, siltstone, mudstone, coal, and carbonaceous shale (Law, Rice and Flores; Rocky Mountain Association of Geologists, 1991). In the lease application area, it is 300 to 400 feet thick and consists of 30% to 40% sand (Lewis and Hotchkiss; U.S. Geological Survey, 1981).

The lower member of the Fort Union Formation is the Tullock, described as follows by Brown (U.S. Geological Survey, 1993). The Tullock Member ranges in thickness from 370 feet in the northwestern Powder River Basin (in Montana) to 1,440 feet in the southeastern Powder River Basin (in northeastern Converse County and northwestern Niobrara County). It consists of fine-grained sandstone, sandy siltstone, shale, rare thin limestone, and coal. Where it crops out along the southeastern edge of the Powder River Basin, east of Bill, Wyoming, the Tullock is primarily siltstone and mudstone (greater than 75%) with minor zones of coal and carbonaceous shale. Thin, lenticular sandstone beds comprise the remainder of the member. In the area of the proposed lease it is approximately 1,300 feet thick and consists of 40% to 50% sand (Lewis and Hotchkiss; U.S. Geological Survey, 1981).

A fourth geologic unit, clinker (also known as scoria), is baked or fused rock formed by prehistoric burning of coal seams. Clinker formed by burning of the Anderson coal seam is present along the outcrop of this seam. There are clinker deposits in the central and eastern parts of the Antelope Mine permit area, and clinker from these deposits is used for mine road surfacing material. Three clinker deposits extend onto the eastern portion of the LBA tract (see Figure 4).

The terrain in the vicinity of the Antelope Mine area is gently rolling. Overall, the Antelope LBA tract is similar to the rest of the current permit area, where slopes range from flat to 34% and average about 5%. Slope analyses would be done for any new areas that would be added to the Antelope Mine permit area if the tract is leased and it is necessary to amend the permit boundary.

Methane, the natural gas used to heat homes, occurs in association with coal beds because it is a by-product of coal maturation. Some of the methane produced by coal beds escapes from the coal beds, migrates upward, and is dispersed in the atmosphere. Some of it is trapped in the coal by overburden pressure and the

pressure of water that occupies fractures in the coal. Generally, there is more methane in coal beds that are deeper and less in shallow coal beds because the lower pressures at shallower depths trap less gas. Under certain geologic conditions, however, methane from coal beds can be trapped at shallow depths both in and above the coal beds. These geologic conditions include low matrix porosity and permeability in the coals, association of the gas with structurally high features in structurally deformed areas, and the existence of effective seals (Law, Rice and Flores; Rocky Mountain Association of Geologists, 1991). Without the existence of these conditions which act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere.

Methane has historically been reported flowing from shallow water wells and coal exploration drill holes in the Powder River Basin. According to DeBruin and Jones (Wyoming Geological Association, 1989), most of the documented historical occurrences have been in the northern Powder River Basin. Olive (U.S. Geological Survey, 1957) references a water well in T. 54 N., R. 74 W. which began producing gas for domestic use in 1916. Occurrences of methane gas in shallow wells in and around Gillette have also been the subject of newspaper articles in the *Gillette News-Record* over the years (for example: "Gas Accompanies Flow of Water in Railroad's Well," 1/18/36, well located in the railroad yard, depth 740 feet; "Vein of Gas Struck on L.C. Reed Ranch," 5/25/48, location 30 miles northwest of Gillette, depth to gas 262 feet; "Gas Struck in Water Well on Ted Barlow Ranch," 4/5/51, ranch location 13 miles west of Gillette, depth to gas 305 feet; and "City Paying $464,000 to Get Gas Out of Water," 7/10/84, referring to six Fort Union water wells in the city).

Most of the gas generated by the coal beds in the Powder River Basin has gradually escaped to the atmosphere because the coals in the Powder River Basin are at shallow depths, and not much methane is trapped in the coal by overburden and water pressure. The occurrence of producible amounts of methane at shallow depths in the northern part of the Powder River Basin appears to be due to geologic conditions like those described above.

In some areas of the country, most notably in the San Juan Basin of Colorado and New Mexico and the Black Warrior Basin of Alabama, methane from coal beds is being commercially produced in significant quantities. There has been commercial production of coal bed methane in the Wyoming Powder River Basin at Rawhide Butte Field since 1989. Coal bed methane projects are also in testing or commercial stages between Gillette and Wright (BLM, October 1992 and March, 1995) and near the Pumpkin Buttes (BLM, September 1992).

Rawhide Butte Field is located just west of the AMAX Eagle Butte Mine. Methane leakage at the ground surface was known in that general area for many years. The gas accumulation in the coal at Rawhide Butte Field is in an area that is structurally deformed (Law; Wyoming Geological Association, 1976). The coal beds in the basin are interbedded with shales which form effective seals. There is more gas production and less water production from wells in relatively higher structural positions in this field. The increase in production in structurally higher wells is

probably due to proximity of the coal to the top of the water table in that area (Law, Rice and Flores; Rocky Mountain Association of Geologists, 1991). In the late 1980s, methane leakage became a serious hazard at two subdivisions (Rawhide Village and Horizons) located near the AMAX Eagle Butte Mine, and a number of houses had to be moved or abandoned. The state of Wyoming prepared a report on the methane hazards in the subdivisions in support of the governor of Wyoming's appeal to the President of the United States to declare the area a major disaster area (Office of the Governor, et. al, State of Wyoming, 1987). Two of the producing wells in the Rawhide Butte Field were initially drilled at the request of the WDEQ to investigate the methane leakage in the subdivisions. AMAX conducted an investigation of the geologic and hydrologic conditions in the area of Rawhide Village in response to requests from the WDEQ. The purpose of this investigation was to evaluate the impact of future mining operations at the Eagle Butte Mine on the situation at Rawhide Village. The investigation concluded that "there is no evidence that mining activities at the Eagle Butte Mine have caused or aggravated the historic phenomenon of gas seepage in the area of Rawhide Village." This study and its results are included as Appendix 3.5-9 in AMAX's 428-T2 permit renewal document.

The situation that produced the gas seeps in the vicinity of the Eagle Butte Mine is not known to exist in the vicinity of the Antelope Mine. According to Budai and Cummings (1984), in the central part of the Antelope Mine area the Anderson seam does roll over the top of sandstone-siltstone lenses in the interburden. This results in fold-like structures in the Anderson coal which are similar to those described in the vicinity of the Rawhide Butte Field by Law (Wyoming Geological Association, 1976). However, Budai and Cummings (1984), also describe local areas where Antelope Creek and its tributaries have cut into and through the Anderson coal seam, and they show interfingering shale and sandstone beds directly overlying the Anderson. If there is not a continuous shale overlying the coal, there is not an effective seal continuously overlying the Anderson to act as a trap for the gas escaping from the coal. In the Antelope Mine area, there is an absence of prominent rolling in the Canyon coal seam in the mine area that could act as a trapping mechanism for coal bed methane. There is no coal bed methane production in the vicinity of the Antelope Mine at this time.

3.2.2 Water Resources

3.2.2.1 Groundwater

In the area of the Antelope Mine, there are five major geologic units containing groundwater that could be impacted by coal mining. These units are the Quaternary alluvium, the Wasatch overburden, the clinker (or scoria), the Wyodak-Anderson coal seam, and the Fort Union Formation underlying the coal.

The extent of alluvium within the LBA tract is shown on Figure 4. Although some alluvium is present in tributaries to Antelope Creek, the alluvium there is generally thin, fine-grained, and in places dry. Exceptions are near the mouths of these tributary ephemeral streams, where the alluvium of the tributaries coalesces with that of Antelope Creek. In general, the alluvium in the tributary streams does not

constitute a significant aquifer. The alluvium along Antelope Creek is comprised of up to 40 feet of saturated sand and some gravel with numerous lenses or layers of clays and silts.

The Wasatch overburden is not a regional aquifer due to its discontinuous lithology which is a matrix of siltstones and shales interbedded with lenticular sandstones, thin discontinuous coal seams, and clinker deposits. Where saturated, the sandstones and coal seams in the Wasatch can provide water to stock and domestic wells but generally do not have the areal extent of the Wyodak-Anderson coal seam, which is split in the lease application area into the Anderson and Canyon coal seams. The Wasatch contains little water in the Antelope Mine area. Recharge to the Wasatch is from infiltration of precipitation and lateral movement of water from adjacent clinker bodies. Regionally, water is discharged from the Wasatch by evaporation and transpiration, by pumping wells, and by small springs and seeps along stream drainages. No springs or seeps which discharge water from the overburden occur on the LBA tract, and mining the LBA tract under any of the alternatives would not directly affect any springs or seeps.

Regional flow in the overburden is generally toward the south (toward Antelope Creek) in the vicinity of the LBA area, although the flow pattern is poorly defined due to the discontinuous nature of the permeable units in the overburden. The quantity of water involved is small and the rate of movement is slow because the permeabilities within the overburden are low. Martin, et. al (U.S. Geological Survey, 1988) reported that hydraulic conductivity in the Wasatch ranged from 10^{-4} ft/day to 10^{2} ft/day, and geometric means of hydraulic conductivity range from 0.2 ft/day to 0.35 ft/day.

The Wyodak-Anderson coal bed is the most continuous shallow hydrologic unit in the Powder River Basin, although conditions are somewhat different in the vicinity of the Antelope Mine area. At the North Antelope Mine, located several miles northeast of the Antelope Mine, the Wyodak-Anderson is a single coal seam. At the Antelope mine, the single Wyodak-Anderson coal seam has split into two seams, the Anderson (upper) and Canyon (lower). There are areas within the current permit where the Anderson seam has been removed by erosion, and in the southern part of the mine the Canyon seam splits into as many as five separate seams. South of Antelope Creek, the Anderson seam is dry or partially saturated and the Canyon seam is partially saturated. Within the LBA tract and to the north, both coal seams are present and relatively uniform in thickness. In this area both seams are saturated, and the Canyon seam has a significant piezometric head. In fact, in the northeastern part of the permit area, which would include the LBA tract, ACC is implementing plans to dewater the coal seams with wells in advance of mining. This is intended to reduce problems associated with groundwater seepage into the pit.

Within the Powder River Basin, the use of the coal seams as aquifers is due more to their shallow depth, continuity, and thickness than their permeability and quality. Recharge to the coal aquifer occurs primarily from clinker along the outcrop areas. The regional flow pattern in the coal is generally westward and northwestward

from the outcrop toward discharge areas in the northern reaches of the Powder River structural basin (Daddow; U.S. Geological Survey, 1986). Locally, the coal seams discharged to Antelope Creek prior to mining and now also discharge to mining pits at the Antelope Mine and other mines to the north.

Because of its westward dip and relatively small yields, the coal seam ceases to be an economically viable aquifer as overburden thickness increases westward from the outcrop. There has been little use of the coal as an aquifer where it is more than a few hundred feet deep because the shallower sandstones and coal seams in the overlying Wasatch Formation can generally provide adequate water of similar quality more economically. Due to the discontinuities in the Anderson seam, the splits in the Canyon seam to the south, and the proximity of the coal outcrop to the east, the most significant drawdowns in the coal as a result of mining activity at the Antelope Mine will be to the north and northwest of the mine. According to the Antelope Mine permit document on file with WDEQ/LQD (Volume VII, Appendix D6, Hydrology) there are no water users of record withdrawing water solely from the Anderson or Canyon coal seams to the west or northwest of the Antelope Mine within the area subject to impact by the mining operation.

A groundwater analysis was performed by ACC for the recently-approved 525-T5 Term of Permit Mine Plan utilizing the MODFLOW model, a numerical groundwater flow simulation. In their modeling studies of the Anderson seam, ACC used a transmissivity of 2,080 gallons per day per foot (gpd/ft) and a specific yield of 0.05. Assuming a thickness of 38 feet, this transmissivity would correspond to a permeability of about 7.3 feet per day (ft/day). For the Canyon seam, a transmissivity of 3,000 gpd/ft and a storage coefficient of 0.00015 were used. For an average thickness of 33.5 feet, this transmissivity corresponds to a permeability of about 12 ft/day. The U.S. Geological Survey reports an average permeability of about 0.8 ft/day for the Wyodak-Anderson coal seam in the Powder River Basin (Martin, et. al, U.S. Geological Survey, 1988). These figures indicate that the coal seams in the Antelope Mine area are more permeable than the basin-wide average.

The subcoal Fort Union can be divided into three hydrologic units: the Tongue River aquifer, the Lebo Member, and the Tullock aquifer (Law; Wyoming Geological Association, 1976). 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; U.S. Geological Survey, 1981). The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone. Transmissivities are generally higher in the deeper Tullock aquifer, and many mines in the Powder River Basin have water-supply wells completed in this interval (Martin, et. al; U.S. Geological Survey, 1988). The average transmissivity for this member as reported in McIntosh, et. al (Office of Surface Mining, 1984) is 290 ft^2/day.

Flow patterns in the subcoal Fort Union aquifer are similar to those of the coal, with recharge occurring in outcrop areas east of the coal outcrop and regional flow trending to the west and north.

The clinker (or scoria) is the most permeable geologic unit in the Powder River Basin coal region. It has a high recharge capacity. It can supply large volumes of water to wells, depending on its areal extent and saturated thickness. Saturated clinker is an important recharge source for the coal, and is so permeable relative to coal that drawdowns in coal normally do not appreciably affect water levels in the clinker. Very little saturated clinker is found in the Antelope Mine area. Portions of three clinker deposits extend into the LBA tract, but these deposits cover only about 15 acres (about 2.5%) of the LBA tract (see Figure 4). Several small clinker deposits are present outside the LBA area and where unsaturated are used as borrow sources for mine road surfacing materials and aggregates.

The saturated thicknesses of the various hydrologic units give an indication of the extent of the groundwater resource present in each. At the Antelope Mine, the thickness of saturated overburden varies from 0 to about 50 feet. The Anderson coal seam saturated thickness varies from 0 to about 40 feet. The Canyon seam has only a few feet of saturated thickness in some areas, but in the LBA tract and north from there the seam has a potentiometric head of 150 feet and more. According to Martin, et. al (U.S. Geological Survey, 1988), the subcoal Fort Union aquifers average 2,000 feet thick (all saturated), of which the deeper Tullock member comprises an average of 785 feet.

Water chemistry in the coal aquifer varies as a function of distance from the outcrop. Near the outcrop, where recharge occurs from the clinker and overburden, the dominant ions are calcium, magnesium, sodium, and sulfate. As water moves down-dip away from recharge areas, sulfate is reduced, and the water becomes dominated by sodium and bicarbonate ions. At the Antelope Mine, water from the Anderson coal seam is generally of the sodium-sulfate type, while water in the Canyon seam is of the sodium-bicarbonate type. The sodium-bicarbonate water typically has a lower total dissolved solids concentration (TDS) than does the sodium-sulfate water.

TDS concentrations in the water from the Anderson coal seam on the Antelope Mine vary widely, and based on the most recent data range from about 478 mg/L to about 5,208 mg/L and average about 2,153 mg/L (ACC, December 1993). The 478 mg/L is within the range generally considered suitable for drinking water (recommended limit of 500 mg/L), while the 5,208 mg/L exceeds the recommended limit for livestock water (5,000 mg/L). The average value is slightly in excess of the recommended limit for irrigation water (2,000 mg/L) (WDEQ/Water Quality Division, 1980).

TDS concentrations in the water from the Canyon seam on the Antelope Mine are also variable, ranging from 318 to 2,846 mg/L and averaging 804 mg/L (ACC, December 1993).

Groundwater in the Wasatch Formation is not monitored for water quality in the Antelope Mine area because the formation contains so little water in this area. Two wells completed in the Fort Union below the coal are monitored for water quality, and the TDS concentrations were 384 and 416 mg/L in these wells in 1993 (ACC, December 1993). Water in the alluvium of Antelope Creek generally has higher TDS concentrations than the other shallow aquifers. Recent data showed TDS concentrations from three alluvial monitor wells ranging from 820 to 4,426 mg/L, with an average of 2,877 mg/L (ACC, December 1993).

The primary water supply for the Antelope Mine is obtained from water supply well WS-1 (see Figure 5). Water-supply well WS-1 is completed to a total depth of 2,528 feet and has eight screened intervals between a depth of 1,436 feet and the bottom of the well. In 1993, the production of this well averaged about 33 gallons per minute (gpm). It is estimated that this well could supply a sustained pumping rate of 300 gpm. Total usage for 1993 was 17,419,400 gallons. This water, which meets drinking water standards, is used for dust suppression, equipment and facility cleaning, and employee showers. Additional water for dust control is obtained from pit dewatering. Water for dust suppression on haul roads is obtained from the Old Antelope Pit, Old Best Pit, and the mine pit sump. These sources are expected to provide sufficient water for foreseeable uses for the duration of the mining operation, with or without the LBA.

Water from well WS-1 is a sodium-bicarbonate type with a TDS concentration of about 520 mg/L. This water is generally suitable for domestic, stock, and agricultural purposes. Although water from well WS-1 is sampled annually and analyzed for water quality and fecal coliform, potable and drinking water is provided to the mine by a commercial bottled water contractor.

According to information provided in the Antelope Mine permit document (ACC, Permit 525-T5 Renewal and Revision, Mine Plan, 1993) there are no valid water rights for water-supply wells on the LBA tract.

3.2.2.2 Surface Water

The drainage system on and near the LBA tract is illustrated on figures 4 and 5. The LBA includes a small portion of the valley of Antelope Creek and the lower reaches of Horse Creek, a southward-flowing tributary of Antelope Creek. A short reach of Antelope Creek crosses the LBA tract and drains eastward toward the Cheyenne River. In the vicinity of the LBA, Antelope Creek is a meandering, braided, intermittent stream into which flow small, gullied ephemeral streams. Antelope Creek has an approximate gradient of 0.3% and a 10-year average discharge (1981 to 1991) of 2.8 cubic feet per second. Annual streamflow data reveal a 10-year average inflow of 2,063 acre-feet in Antelope Creek at the west permit boundary and an average outflow of 2,032 acre-feet at the east permit boundary. This indicates that the section of Antelope Creek that traverses the Antelope Mine permit area may be losing surface water to the groundwater and to evapotranspiration (Ecotone, 1992). The water in Antelope Creek and other local channels comes from three general

sources: 1) groundwater contained in the shallow alluvial aquifer, 2) lateral inflow of groundwater from surrounding bedrock, and 3) surface water from the large watershed upstream.

Flow in Antelope Creek during the winter months is very low, and the stream often has no flow due to freezing. In the early spring, Antelope Creek begins to flow in response to ice breakup and snowmelt runoff. The majority of this flow is from upstream drainage with a small percentage of runoff being contributed locally. A small springtime base flow in Antelope Creek occurs from discharging groundwater from the Anderson coal seam in the drainage upstream of Antelope Mine. The total discharge of groundwater from the Anderson coal seam to Antelope Creek or its alluvium in the Antelope Mine vicinity is estimated at 129 acre-feet per year (80 gpm) (ACC Mine Permit Document, Vol. VII, Appendix D6, Hydrology). This discharge is not sufficient to overcome consumptive uses during the summer time, and therefore the stream has extended no-flow periods during each year.

Antelope Creek has a drainage area of approximately 854 square miles above the Antelope Mine. The existing permit area consists of 7,535.76 acres, or about 1% of the Antelope Creek drainage area at this location. The LBA tract comprises an additional 617.2 acres, or about one tenth of one percent of the drainage area of Antelope Creek at this location.

Horse Creek has a drainage area of about 15 square miles. This stream is classified as ephemeral, flowing only in direct response to snowmelt or rainfall runoff events. This stream is typical of small ephemeral drainages for the region, and flow events are closely reflective of precipitation patterns. Flow events of relatively small magnitude can result from snowmelt during the late winter and early spring. Although peak discharges from such events are small, the duration and therefore percentage of annual runoff volume can be considerable. During the spring, general storms (both rain and snow) increase soil moisture, hence decreasing infiltration, and can result in both large runoff volumes and high peak discharges.

Flows and water quality in Antelope Creek and several minor tributaries are monitored on and near the permit area and reported annually. The surface water quality varies with stream flow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration. The surface water is typically a calcium-sodium-sulfate water and generally contains more than 1,500 mg/L of TDS. This water is usually unsuitable for domestic use, marginal for irrigation, and suitable for stock and wildlife (OSM, 1981).

3.2.2.3 Alluvial Valley Floors

The entire permit area and adjacent area, including the LBA tract, have been investigated for the presence of alluvial valley floors. A report of this investigation is contained in the Antelope Mine permit document (Appendix D-11, Alluvial Valley Floors). Along Antelope Creek, the only areas designated as AVFs within the permit are classified as "possible sub-irrigated AVF of minor importance to agriculture." A

total of less than 140 acres of this type of AVF were identified, a very small portion of which is within the LBA tract. Along Horse Creek within the permit area and for a distance of 2 miles upstream (which includes the LBA tract), a very narrow band adjacent to the channel was designated as "possible sub-irrigated AVF for which no material damage is predicted." At the time this designation was made, ACC did not plan to mine through the lower portion of Horse Creek. The material damage conclusion would change if the LBA is issued, since the LBA includes the lower portion of Horse Creek.

The alluvial deposits along Antelope Creek consist primarily of sand and gravel, and groundwater levels in this alluvium show a rapid response to changes in streamflow levels in Antelope Creek. In general, these deposits will not be mined because the Antelope Creek Valley will not be disturbed. Minor effects are predicted where the pits come in close proximity to the valley floor. The alluvial deposits along Horse Creek, some of which will be removed by mining, are generally discontinuous beds of sand, silt and clay. All AVFs in the Antelope Mine permit area, including those along Horse Creek that will be mined, have been declared by the WDEQ/LQD to be insignificant to agriculture, which means they are not precluded from mining (State of Wyoming; Hanson and Valerius, 1988).

3.2.2.4 Wetlands

A jurisdictional wetlands delineation (delineation of wetlands that are within the extent of U.S. Army Corps of Engineers regulatory overview) of the Antelope Mine was conducted for ACC in 1992 (Ecotone, 1992). The project area was comprised of the existing mine permit area and adjacent areas, including the LBA tract. ACC received U.S. Army Corps of Engineer's concurrence for these delineations in a letter dated April 28, 1993. A total of 148 acres of special aquatic sites (geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values) were delineated within the project area. Delineated jurisdictional wetlands are located within the special aquatic sites. In addition to the special aquatic sites, there are approximately 35 miles of active stream channel waters of the U.S. within the mine. The locations of jurisdictional wetlands and stream channels within the LBA tract are shown on Figure 4.

Within the mine as a whole and within the LBA tract, areas of jurisdictional wetlands are restricted to the lowest portions of the alluvial bottomland of Antelope Creek as well as the major ephemeral tributaries. Horse Creek, an ephemeral tributary of Antelope Creek which flows through the LBA tract, contains approximately 5 acres of jurisdictional wetlands, including two wet meadows and several aquatic beds lying in a narrow channel about 4,000 feet in length.

3.2.3 Soils

The entire permit area and a large adjacent area, which includes the LBA, was subjected to a complete first order soils inventory as a part of the original mine

baseline studies (Commonwealth Associates, Inc., 1980). The soils baseline studies covered a total area of about 16,000 acres, compared with a permit area of 7,535.76 acres. The results of this investigation are presented in Volume VIII, Appendix D7, Soils, of the Antelope Mine permit document. The soils information has been used by ACC to estimate the volume of suitable soil to be stripped and salvaged for use in reclaiming the disturbed lands. For the entire disturbed area, the average topsoil depth that will be replaced on reclaimed lands is about 2 feet.

A total of 44 soil types, soil complexes, or other units occur within the baseline study area. Seventeen of these mapping units are located within the LBA tract. The 1980 soil baseline assessment in the mine permit document contains complete physical descriptions and laboratory data for these soils. The following is a list of the soils series/map units found on the 617.2-acre LBA tract. The soils considered hydric are so noted (Soil Conservation Service, 1991).

Soils developing predominantly in stream laid alluvium

- Cushman sandy loam, 0-6% slopes
- Glenberg sandy loam, 0-3% slopes
- Haverson loam, 0-3% slopes

Soils developing predominantly in alluvial fan deposits

- Absted-Arvada-Bone complex, 0-6% slopes (hydric in depressions)
- Dillingson loam, 3-6% slopes
- Kim loam, 0-3% slopes
- Kim loam, 3-6% slopes
- Ulm clay loam, 0-6% slopes (hydric)
- Zigweid loam, 3-6% slopes
- Zigweid clay loam, 3-6% slopes

Soils developing predominantly in residuum

- Razor clay loam, 0-16% slopes
- Samsil clay, 0-15% slopes
- Shingle clay loam, 0-15% slopes
- Thedalund clay loam, 0-6% slopes
- Sear-Wibaux complex, 0-15% slopes
- Shingle-Samsil complex, 3-30% slopes
- Rock outcrop-Shingle-Samsil-Tassel complex, 3-30% slopes

Soil observations were taken at 158 sample points in suspected wetlands as a part of the 1992 wetlands delineation survey for the Antelope Mine (Ecotone,

1992). Predominant soil textures at these sample locations were sandy clay loam, silty sand, and sandy loam. Of the 158 sample points, 94 points exhibited positive indicators of hydric soils.

The most abundant soil type on the LBA tract, as well as on the entire permit area, is the Rock outcrop-Shingle-Samsil-Tassel complex on 3% to 30% slopes. Another soil unit covering large areas is the Shingle-Samsil complex on 3% to 30% slopes. ACC has determined, on the basis of their soils inventory, that a total of 1,322,450 cubic yards of topsoil would be salvageable within the LBA tract for use in reclamation. For a disturbed area of about 462.2 acres, this equates to an average topsoil thickness of 1.8 feet.

Table 5. Comparison of Topsoil Suitability Criteria and Mine Overburden Parameters

Topsoil suitability parameter (1)	Suitable for topsoil	Marginal topsoil	Unsuitable for topsoil	Mine overburden near the LBA tract (2)	Mine overburden from areas not near the LBA tract
pH	5.5 - 8.5	5.0 - 5.5 8.5 - 9.0	< 5.0 > 9.0	7.3	7.3
EC (conductivity, mmhos/cm)	0 - 8	8 - 12	> 12	2.7	2.7
Saturation percentage	25 - 80	< 25, > 80	--	--	--
Texture	--	clay, silty clay, sand	--	--	--
SAR (sodium adsorption ratio)	0 - 10	10 - 12 (fine-textured soil) 10 - 15	> 12 (fine-textured soil) > 15	4.8	6.1
Selenium (parts per million)	< 0.1	> 0.1	--	0.23 (3) 0.16	0.19 (3) 0.13
Boron (parts per million)	< 5.0	--	> 5.0	0.37	0.29
Coarse fragments (percent volume)	< 25	25 - 35	> 35	--	--

Notes: (1) From WDEQ/LQD Guideline No. 1, Table I-2.
(2) Statistical mean values for overburden samples from the six sampling sites shown on Figure 4.
(3) Two selenium concentrations are those calculated by two different methods.

Extensive sampling and testing of overburden has been completed at Antelope Mine. The six existing overburden sampling sites that are located closest to the LBA tract are shown on Figure 4. Table 5 (above) includes a comparison of current WDEQ/LQD topsoil suitability criteria to the statistical mean values for test parameters for overburden from the six sampling sites shown on Figure 4 and to mean values for overburden from all other mine sampling sites. WDEQ/LQD may permit use of overburden as cover soil during mine reclamation if the overburden meets topsoil

suitability criteria and if the volume of stripped topsoil is not adequate. The data in Table 5 (above) indicates that, if required, overburden from within the existing mine lease boundary and from the LBA tract may be suitable for use as cover soil during reclamation.

3.2.4 Vegetation

As with the soils, baseline vegetation studies were conducted on a large study area that includes the current permit area, the LBA, and a considerable surrounding area (Commonwealth Associates, Inc., 1980). The baseline vegetation studies are reported in the Antelope Mine permit document as Appendix D8, Vegetation, Vol. IX. The total area covered in the vegetation baseline studies was about 16,000 acres, or more than twice the area within the current permit boundary.

Seven vegetation types were identified in the vegetation baseline studies, of which six are found within the LBA. All are native rangeland vegetation types; there is no cultivated land on the permit area. The following is a brief description of the vegetation types on the LBA. These seven vegetation types are underlined in the following discussion.

The blue grama upland vegetation type typically occurs in large expanses on the uplands of the southern and western portions of the permit area, with smaller occurrences located throughout the area on alluvial fans and terraces in the larger valleys. This vegetation type covers scattered areas within the LBA which comprise about 90 acres or 1% of the total LBA tract as applied for. Major species are blue grama (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), needle-and-thread (*Stipa comata*), and plains pricklypear (*Opuntia polyacantha*). About half the foliage cover is blue grama. This vegetation type occupies the moderately deep to deep, level to somewhat sloping, loam, clay loam, and sandy loam soils.

The birdsfoot sagebrush upland type is located principally on the uplands and alluvial fans in the western and southern portions of the baseline study area. This type is found in areas scattered throughout the LBA tract and covers about 132 acres or 21% of the LBA tract as applied for. Major species include birdsfoot sagebrush (*Artemisia pedatifida*), western wheatgrass, blue grama, and plains pricklypear. About half of the foliage cover is birdsfoot sagebrush and blue grama. The vegetation is low growing and sparse, resulting in this type having the greatest amount of bare soil of the vegetation types present in the baseline study area. The birdsfoot sagebrush upland type occurs on shallow to deep, level to moderately sloping, clay and clay loam soils.

The silver sagebrush lowland vegetation type occupies large areas on the lower stream terraces along Antelope Creek and to a lesser extent the smaller draws to the north and south. Silver sagebrush is found along Horse Creek and Antelope Creek within the LBA tract and covers about 32 acres or 5% of the LBA tract as applied for. Dominant species include silver sagebrush (*Artemisia cana*), needle-and-thread, western wheatgrass, and blue grama. The silver sagebrush type occurs on the deep,

level to sloping loamy sands, loams, and sandy loams which are developing in stream-laid alluvium. Scattered clusters of cottonwood trees (*Populus deltoides*) were mapped within the silver sagebrush lowland vegetation type, particularly along Antelope Creek in the downstream (eastern) portions of the baseline study area. The Antelope Creek riverwash channel is included in the silver sagebrush vegetation type. In the western half of the baseline study area, most of the channel is barren sand which is continually shifting with the seasonal rise and fall of streamflows. The eastern portion of the channel bottom contains small- and medium-sized rocks with small areas of vegetation consisting of annuals and short-lived perennials.

The greasewood lowland vegetation type occurs along Antelope Creek and in small areas of draws on the second terraces and alluvial fans. This vegetation type is found in two small areas of the LBA tract and covers only about 8 acres or 1% of the LBA tract as applied for. Major species include blue grama, western wheatgrass, greasewood (*Sarcobatus vermiculatus)*, needle-and-thread, and Gardner saltbush (*Atriplex gardneri*). The greasewood lowland type occupies deep, level to somewhat sloping fine sandy loams which are highly alkaline.

The clinker hills in the eastern third of the baseline study area, including the eastern portion of the LBA tract, are vegetated by the bluebunch wheatgrass roughland vegetation type. Bluebunch wheatgrass covers the clinker hills within the eastern LBA tract, and these hills comprise about 26 acres or 4% of the LBA tract as applied for. Prominent species include blue grama, bluebunch wheatgrass (*Agropyron spicatum*), big sagebrush (*Artemisia tridentata*), and needle-and-thread. This type is confined entirely to the steep, shallow, very channery soils (soils that include thin, flat fragments of limestone, sandstone, or schist up to 6 inches in diameter) on the porcelanite (clinker) hills, although small inclusions of other vegetation and soils in the hills are included in this type.

The most extensive vegetation type in the baseline study area and on the LBA tract is the blue grama roughland. This type is a heterogenous group of communities of the other six vegetation types which are too small and irregular to map individually. This vegetation type covers about 330 acres or 54% of the LBA tract as applied for and is found in all portions of the tract. Predominant species are blue grama, western wheatgrass, big sagebrush, birdsfoot sagebrush, buckwheat (*Eriogonum* spp.), greasewood, plains pricklypear, and saltbush (*Atriplex* spp.). This vegetation type occurs on the sloping to steep uplands which are characterized by small scale and irregular topographic variations including sloping to rolling uplands, valley side slopes and smaller eroded upland drainages. The soils are generally shallow, rolling to very steep loams, clay loams, sandy loams, and undeveloped rock outcrops.

The big sagebrush draw vegetation type does not occur on the LBA tract. It occurs on the bottoms of the upper reaches of shallow draws, mainly in the southern and western parts of the baseline study area.

The recent wetlands delineation study of Antelope Mine (Ecotone, 1992) identified six wetland vegetation types in the mine, including upland shrub, upland

meadow, riparian forest, wet meadow, marsh, and open water/aquatic bed/ unconsolidated bed vegetation. The report also quantifies the jurisdictional wetlands areas covered by each type of vegetation. Upland shrub vegetation and upland meadow vegetation are not found within jurisdictional wetlands except as a secondary component of wetland ground cover, as in some riparian forest areas. Locations of jurisdictional wetlands within and near the LBA tract are shown on Figure 4.

Riparian forest vegetation occupies lower stream terraces and point bars as well as sandy islands within stream channels. This type of vegetation includes plains cottonwood trees over upland meadow-type ground cover in areas located outside jurisdictional wetlands or over hydrophytic ground cover within jurisdictional wetlands. A few riparian forest areas include sandbar willow and peach-leaf willow. Riparian forest vegetation covers about 4 acres of jurisdictional wetlands within the mine, or about 3% of total mine wetlands.

Wet meadow vegetation occupies the lowest terrace level along steam channels as well as areas along vegetated channel banks and is typically found within jurisdictional wetlands. Wet meadow vegetation occurs along all sections of Antelope Creek and along major tributaries, with cover widths varying from 10 feet to more than 350 feet. This type of vegetation generally lacks an overstory of trees or shrubs, and forb and grass species dominate. Species include sedges, Baltic rush, alkali muhly, alkali bluegrass, prairie cordgrass, alkali cordgrass, saltgrass, spikerush, smooth scouring rush, American licorice, and yellow dock. Wet meadow vegetation covers about 83 acres of jurisdictional wetlands within the mine, or about 56% of total mine wetlands.

Marsh cover occurs where water is ponded for longer periods of the growing season and typically occupies the lowest positions within stream channels. A large portion of the banks and channels of Antelope Creek is occupied by marsh vegetation. Species include soft-stem bulrush, three-square bulrush, spikerushes, American sloughgrass, duckpotato arrowhead, sedges, common cattail, and white-water buttercup. Marsh vegetation covers about 7 acres of jurisdictional wetlands within the mine, or about 5% of total mine wetlands.

Open water/aquatic bed (inundated bed)/unconsolidated bed (intermittently exposed bed) vegetation occurs primarily in the deeper portions of stream channels and at beaver dams. This cover type occurs in a mosaic with wet meadow and marsh. Plant species include various species of algae, white-water buttercup, and scattered bulrush and spikerush. Open water/aquatic bed/unconsolidated bed vegetation covers about 54 acres of jurisdictional wetlands within the mine, or about 36% of total mine wetlands.

3.2.4.1 Threatened or Endangered Plants

In August 1994, Mr. B. E. Nelson of the Rocky Mountain Herbarium in Laramie, Wyoming found the listed threatened plant Ute Lady's Tresses (*Spiranthes diluvialis*) on a sandy bank area of Antelope Creek near a cattail marsh located approximately

25 miles upstream of Antelope Mine. This plant is typically found in moist soils along with grasses and sedges. Mining within the proposed LBA tract would not disturb delineated wetlands that are potential habitat for this plant along Antelope Creek but would disturb wetlands along Horse Creek, an ephemeral tributary of Antelope Creek. A survey of the LBA tract for Ute Lady's tresses was conducted on August 2, 1995, by Walter Fertig of The Nature Conservancy at the request of ACC. The survey area covered the portion of Horse Creek included in the LBA tract, as well as a 500 foot buffer north of the northern LBA boundary and the portion of Antelope Creek that is inside the LBA tract. No populations of Ute lady's tresses were found at the site during the field survey, and no special management actions were recommended at the site as the survey indicated that suitable habitat is not likely present for this species in the LBA area (The Nature Conservancy, 1995).

According to a December 1992 Wyoming Natural Diversity Database search, there are no other federally listed threatened or endangered plant species known to occur in Converse or Campbell County; likewise, no species strongly likely to be listed (in the form of Category C1 species) are known to occur in Converse County (The Nature Conservancy, 1992). No rare, threatened or endangered species and no species of interest to Wyoming Natural Diversity Database at the state level have been found on the Antelope Mine permit area or the LBA tract.

3.2.5 Ownership And Use Of Land

The surface on the Antelope LBA tract is owned by Antelope Coal Company and the United States of America. The federally owned land is part of the Thunder Basin National Grassland, administered by the USFS. Surface landownership for the Antelope Mine permit area and the LBA tract and adjacent areas is summarized in Table 6 and is shown on Figure 7. Powder River Coal Company owns a tract of land immediately adjacent to the LBA tract which could be affected by overstripping or surface disturbance (see Figure 7). ACC intends to negotiate a surface agreement with Powder River Coal Company that covers overstripping for the revised LBA mine plan. If an agreement is not negotiated, a small amount of coal along this property boundary could be unrecoverable.

The premining land uses of the Antelope Mine permit area are described in the Land Use Baseline Study, Volume IV, Appendix D1 of the mine permit document. The land within the LBA tract is currently used for livestock grazing, wildlife, and transportation (County Road 37 and BN/C&NW railroad rights-of-way). Prior to mining, the entire current permit area of 7,535.76 acres was used for livestock grazing and wildlife with the exception of 75 acres of miscellaneous roads and abandoned mines. Coal mining on one federal coal lease included in the Antelope Mine dates back to the 1930s (see Figure 8).

The grazing capacity of native rangeland in the area is a function of topography, soils, and other factors and is related to the vegetation types discussed in Section 3.2.4. Grazing capacity is the highest in the big sagebrush draw (which does not occur on the LBA tract) and silver sagebrush lowland vegetation types with 0.6 and

0.5 animal-unit months (AUMs) per acre, respectively. The lowest grazing capacity is in the birdsfoot sagebrush upland with 0.1 AUMs per acre. The blue grama upland, blue grama roughland, and the bluebunch wheatgrass roughland vegetation types have a grazing capacity of about 0.2 AUMs per acre. The greasewood lowland vegetation type has a grazing capacity of about 0.3 AUMs per acre.

Table 6. Summary of Surface and Mineral Ownership Within Antelope Mine and the Alternative LBA Tracts (1)

Current Permit Area

Owner	Surface ownership (ac)	Mineral ownership (ac) (2)
Thunder Basin National Grassland (U.S.A.)	3,534	5,915 -- all minerals 799 -- coal only
State of Wyoming	814	814 -- all mineral
Antelope Coal Company	3,188	0
Ollie M. Kane et. al	0	188 -- other minerals
H. R. Matheson et ux	0	192 -- other minerals
J. and F. Dilts	0	108 -- other minerals
W. W. Dauner et. al	0	319 -- other minerals

LBA Tract -- Alternative 1

Owner	Surface ownership (ac)	Coal ownership (ac)
Thunder Basin National Grassland (U.S.A.)	455	617
Antelope Coal Company	162	0

LBA Tract -- Alternative 2

Owner	Surface ownership (ac)	Coal ownership (ac)
Thunder Basin National Grassland (U.S.A.)	661	823
Antelope Coal Company	162	0

LBA Tract -- Alternative 3

Owner	Surface ownership (ac)	Coal ownership (ac)
Thunder Basin National Grassland (U.S.A.)	455	455
Antelope Coal Company	0	0

Notes: (1) Areas are approximate.
(2) "Other minerals" include all minerals except coal.

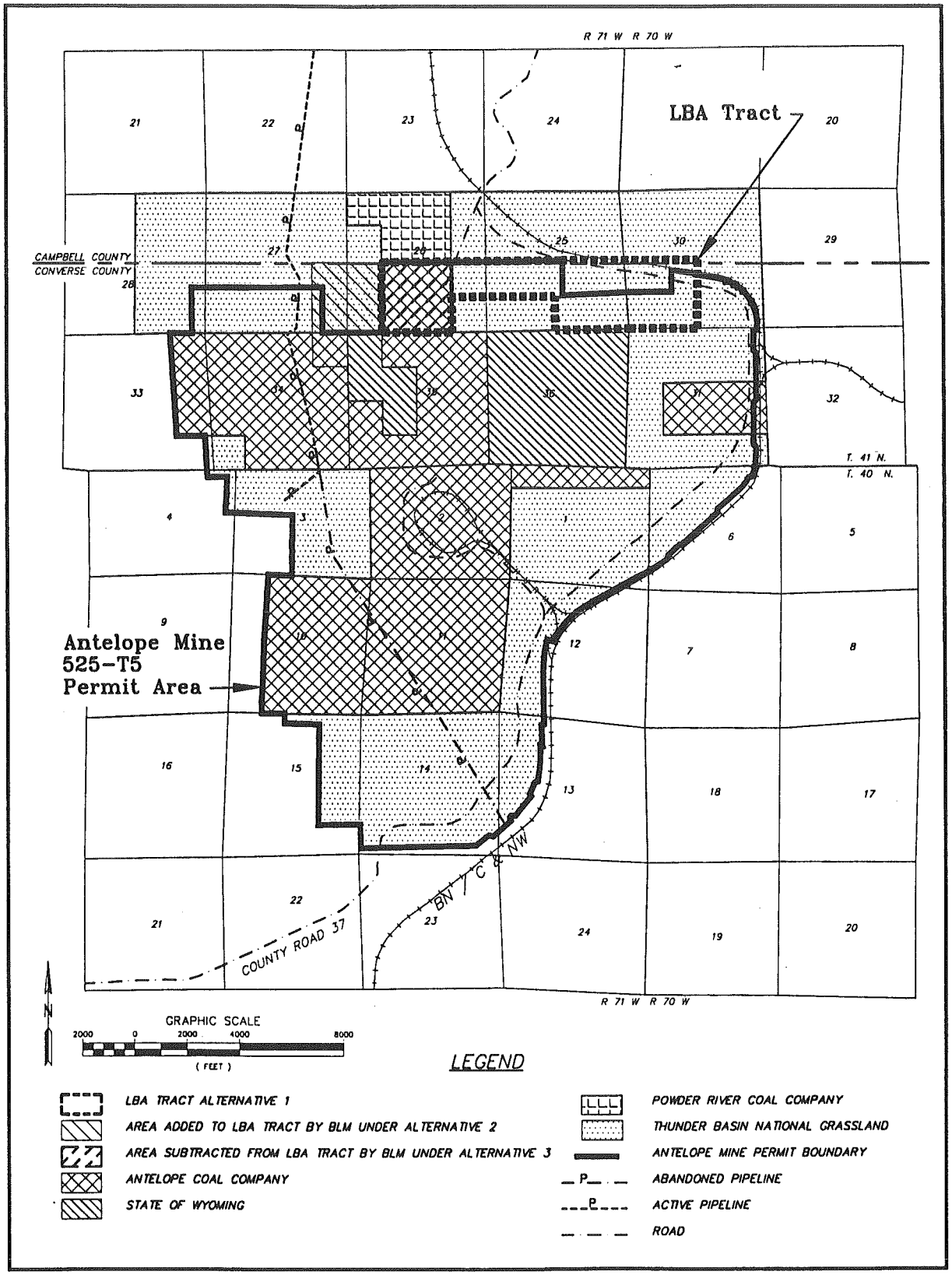
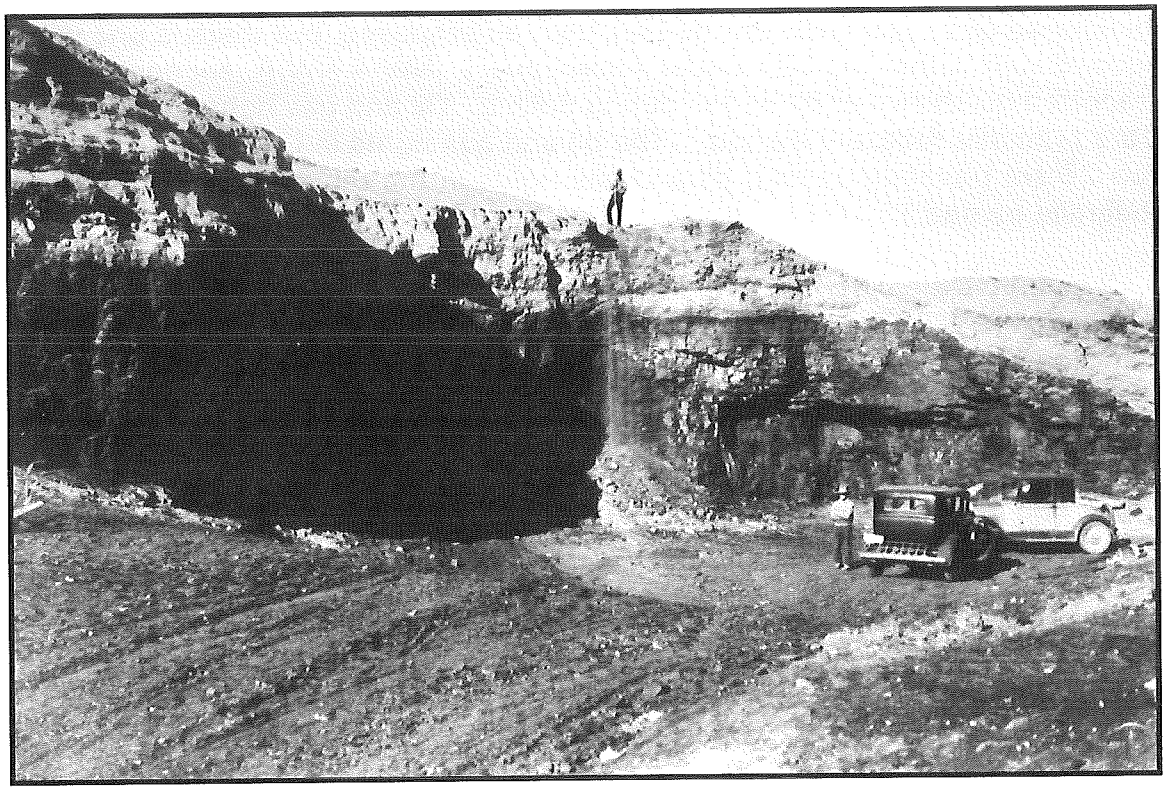
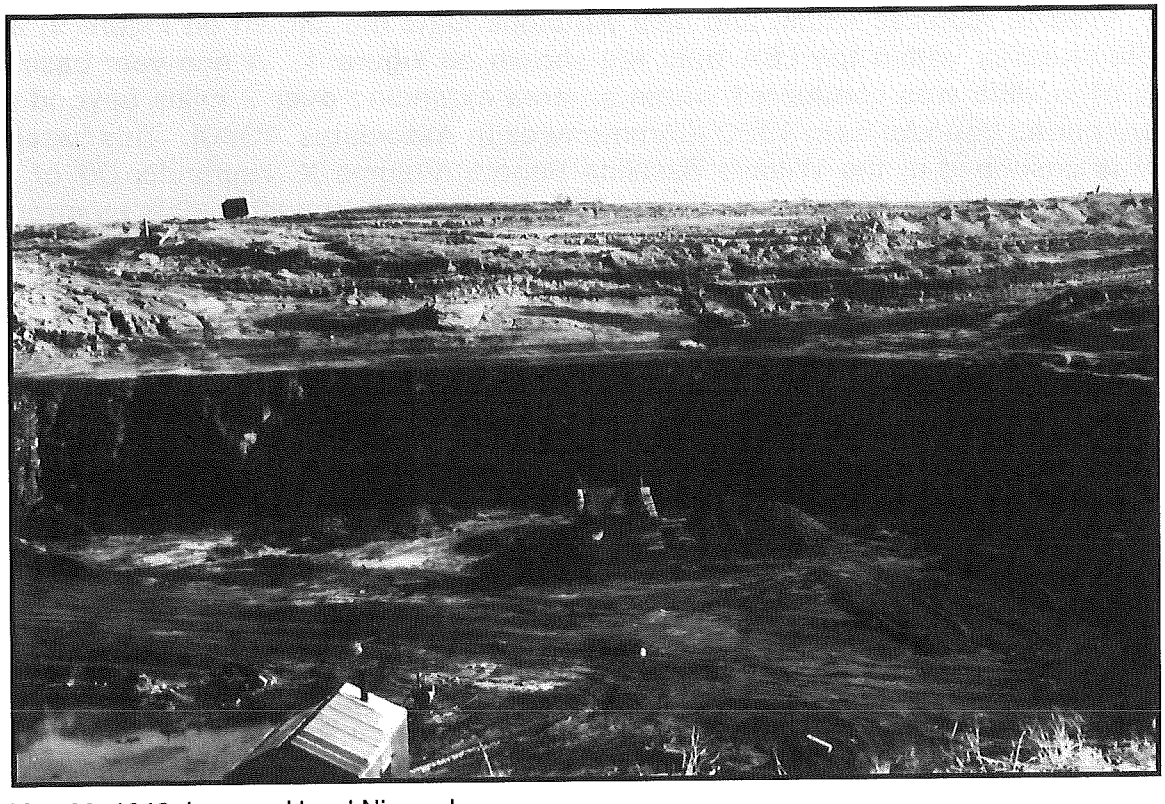


Figure 7. Surface Ownership Map of Antelope Permit and LBA Area Vicinity

Figure 8. Historical pictures of Federal Coal Lease B-031719, Antelope Mine Area



October 15, 1932; Lessees: Felix Niemcyk and Elmer Gladson



May 26, 1949; Lessee: Hazel Niemcyk

There are currently no producing oil or gas wells on the LBA tract. There are no abandoned oil or gas wells on the LBA tract as proposed, but there is one dry and abandoned well within the LBA under Alternative 2 (NW/4 NW/4, section 34). This well reported no shows of oil or gas during drilling. Oil and gas rights underlying the tract are primarily federally owned. (The oil and gas rights in Lots 11, 14 and 15 of section 26 are privately owned, oil and gas rights in the remainder of the LBA tract are federally owned.)

Two buried pipelines cross the Antelope Mine permit area. One pipeline passes to the west of the LBA tract and is not expected to be disturbed by mining in the LBA. This pipeline will be relocated according to existing agreements when the need arises. The other crosses the LBA tract but has been abandoned and will be removed as stipulated by the existing agreement between the original owner (Phillips Petroleum) and ACC. A portion of Converse County Road 37 which formerly crossed the mine area was relocated to the alignment shown on Figure 7 in 1993. The BN/C&NW Railroad was discussed previously (see Section 1.2).

No occupied dwellings occur on the proposed lease area. The nearest is a set of ranch buildings adjacent to Antelope Creek about 19,000 feet (3.6 miles) east of the southeast corner of the LBA. Because much of the land surface within the LBA is in public ownership, administered as part of the Thunder Basin National Grassland, it is available for public uses such as hunting and other recreational activities.

3.2.6 Wildlife

Wildlife features within and near Antelope Mine are shown on Figure 9, and wildlife features within the LBA tract are shown on Figure 4. A one-year baseline study of wildlife was conducted within an area extending over 2 miles beyond the current permit boundaries in 1980 (Commonwealth Associates, 1980). This baseline study is described in the Wildlife Baseline Report, Volume X, Appendix D9 of the Antelope Mine permit document. Since 1982 the ongoing, annual wildlife monitoring program for the mine has also covered the LBA tract. The monitoring survey results are presented annually to the WDEQ/LQD in the required reports. The ongoing monitoring activity [including big game, raptors, upland game birds and migratory birds of high federal interest (MBHFI)] covers nearly 60 square miles, or some 37,800 acres, and includes lands within a large perimeter around the Antelope Mine permit area that completely encompasses the LBA tract. During the initial baseline studies, a total of 125 wildlife species were observed. Since that time, 79 additional species have been observed, bringing the total number of observed species to 204. In 1992, 99 species of wildlife were observed on the Antelope Mine study area. This included 21 mammal species, 74 bird species, and 4 species of reptiles and amphibians. The following descriptions of habitats, faunal occurrences, and faunal abundance are drawn from both the baseline studies and the annual monitoring reports.

The LBA tract is primarily a dissected upland area with a small amount of bottomland along Antelope Creek and the lower reaches of Horse Creek. Wildlife use is closely related to topography and vegetation types.

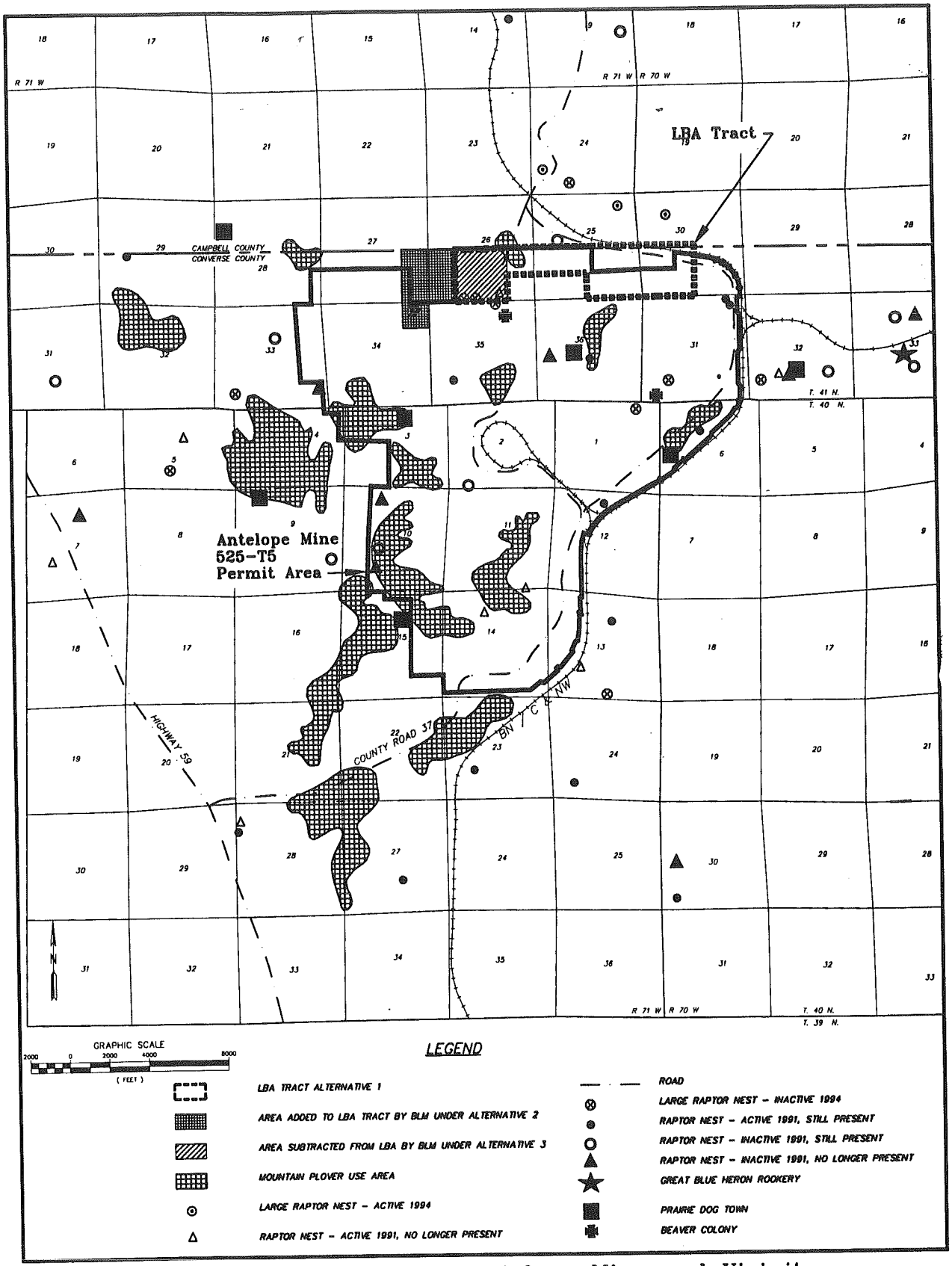


Figure 9. Wildlife Features of the Antelope Mine and Vicinity

Three big game species occur in the vicinity of the LBA: pronghorn, mule deer, and white-tailed deer. No critical big game habitat is recognized by the Wyoming Game and Fish Department (WGFD) in this area. Antelope Mine's seasonal trend counts for both pronghorn and deer are conducted along set driving routes that pass through the LBA. These counts provide big game herd composition and habitat use data in seasons other than winter.

Pronghorn are, by far, the most common big game species in the area. Mine permit maps indicate that the entire LBA tract under any of the three alternatives is classified as winter/yearlong habitat (habitat used by a portion of the pronghorn population yearlong and into which a significant influx of animals occurs during the winter) within the WGFD Lance Creek Herd Unit. The total occupied Lance Creek Herd Unit habitat is 4,329 square miles, of which 640 square miles are classified as winter/yearlong habitat and 3,451 square miles are classified as yearlong habitat (habitat used by a substantial portion of the pronghorn population yearlong). About 0.9% of the total occupied Lance Creek Herd Unit habitat area is within the disturbance boundaries of surface coal mines, with about 0.2% of the total occupied Lance Creek Herd Unit habitat area within the Antelope Mine disturbance boundary. The LBA tract occupies from about 0.02% to about 0.03% of the total occupied Lance Creek antelope habitat and covers from about 0.11% to about 0.20% of winter/yearlong Lance Creek antelope habitat, depending on the alternative that is chosen.

The WGFD estimated the post-hunting pronghorn population in 1992 was 23,566, and the 1992 objective was 27,000. The 1992 population of the entire hunt area equates to a population density of between 5 and 6 animals per square mile. The severe winter of 1992-1993 took a heavy toll on the pronghorn population in this hunt area, reducing the number of animals to 13,648 by the end of the winter (a reduction in population density to about 3 animals per square mile). Winter survey data for the Antelope Mine study area for January 1993, a moderately harsh winter, showed a total pronghorn count of 189 animals, which equates to a density of about 3 animals per square mile in the survey area. Winter survey data for the mine study area for March, 1994, a relatively mild winter, showed a total pronghorn count of 370 animals, equivalent to a density of 6 animals per square mile. Density for the last four complete ground coverage winter surveys has ranged from about 2.5 animals per square mile in 1987 to 7 animals per square mile in 1988. Variations in numbers are primarily a function of weather conditions.

Overall antelope habitat use remains dominated by the upland communities (blue grama upland vegetation, blue grama roughland vegetation, and birdsfoot sagebrush) typical of pronghorn preference. These types of vegetation predominate on about 552 acres or about 89% of the LBA tract as applied for.

Mule deer are present in the vicinity of the LBA tract in small to moderate numbers year-round. The tract is within the Thunder Basin Herd Unit, which has 3,065 square miles of occupied habitat. The WGFD estimated the 1992 post-season population to be 17,812 (5.8 animals per square mile); the herd objective is 13,000

(4.25 animals per square mile). Currently, the LBA tract is classified by WGFD as yearlong mule deer range.

Data from Antelope Mine's baseline and annual monitoring programs show that mule deer occur in far fewer numbers and considerably more restricted areas than pronghorn. Deer numbers also vary as a function of weather conditions. The 1993 winter big game count found 66 mule deer within the Antelope Mine study area (the permit area plus a 2-mile surrounding, contiguous area). This equates to an average of about 1 deer per square mile. The respective numbers for the 1994 winter big game count were 12 mule deer and an equivalent average of 0.2 deer per square mile. Ground conditions were less favorable for observations of mule deer during the 1994 survey. Favored habitat for mule deer is in the Antelope Creek riparian area in the central part of the permit area.

On a few occasions in the past several years, white-tailed deer have been recorded near Antelope Mine and the LBA tract. This species is uncommon in the vicinity of the Antelope Mine, and while sightings are logged, white-tailed deer are not specifically part of the annual wildlife monitoring. There are no recognized elk herd units in the vicinity of the LBA, and no elk are known to occur in the vicinity of the LBA tract.

ACC's wildlife baseline studies done in 1980 and subsequent annual monitoring since 1982 have identified 73 individual raptor nest sites within the study area, including man-made platforms and relocation sites, of which 45 large raptor nests have been located within the permit area. These totals include three new raptor nests discovered during the 1994 wildlife monitoring efforts. None of the new nests occur on the LBA area (ACC, Permit 525-T5, WDEQ/LQD Annual Report, October 1993-September 1994). Eleven large raptor nests were determined active in 1993. Two of these were destroyed by natural forces during the winter of 1993-1994. Six of the large raptor nests were active on the study area during the 1994 breeding season; none of these occurred on the LBA area. The locations of these nests are indicated on Figure 9, along with the locations of other key wildlife features within the study area. The raptor survey area includes the existing permit area, the LBA tract, and a considerable surrounding area as described above. Results of annual surveys are presented each year in the Antelope Mine's annual report to WDEQ/LQD. As Figure 4 shows, there are raptor nests on the LBA tract. A mitigation plan for raptor nests in the area has been developed by ACC in consultation with the U.S. Fish and Wildlife Service (USFWS) and the USFS. The raptor mitigation plan must be updated with each 5-year permit renewal or any time a major change in the mining or reclamation plan occurs. A raptor mitigation plan update would be required if the LBA is leased. Federally (USFWS and USFS) approved buffer zones, designed to reduce or eliminate human disturbances near active golden eagle nest sites, are currently in place for all nests on or within 2 miles of the Antelope Mine permit area, a region which includes the LBA tract.

Figures 4 and 9 show the location of the five raptor nests occurring on the LBA during the 1991-1994 period. Three of these nests occur within the area which

would be subtracted under Alternative 3. One of these is a red-tailed hawk nest that was in a tree that was cut down by beavers prior to the 1992 breeding season. The other two include a great-horned owl nest that was active from 1991-1993 but inactive in 1994, and a red-tailed hawk nest that was active when discovered in 1992, but either inactive or an alternate since that time. The latter nest was destroyed by natural causes following the 1994 breeding season (Powder River Eagle Studies letter dated July 31, 1995). The remaining two nests are located in the area that would be added to the lease under Alternative 2. They are golden eagle nests which are part of the same territorial complex. These two nests have alternated status as active/alternate during the 1991-1993 period; the complex was inactive during the 994 breeding season. There is an inactive ferruginous hawk nest to the north of the LBA boundary. This nest was new in 1986 but since that time the hawks have used alternate nest sites in Section 24, across the railroad tracks from the LBA (ACC, WDEQ/LQD Annual Report, Permit 525-T5, October 1993-September 1994).

Golden eagles and great-horned owls are the only year-round resident raptor species on the study area. Surveys for early nesting raptor species are conducted in March and April while nesting surveys for other species begin in June. Monitoring of raptor nesting activities are conducted monthly beginning in June of each year, and continue until fledging of active nests. Past nest sites are monitored and potential nesting habitats are surveyed annually, searching for newly established nest sites. The 1993 raptor breeding season was adversely impacted by wet, windy, relatively cool spring/summer weather. Although prey species were at or near maximal levels, only 13 raptor territories were documented occupied in 1993 and only 4 raptor pairs fledged young (ACC, WDEQ/AQD Annual Report, Permit 525-T5, October 1992 - September 1993). The 1994 raptor breeding season was adversely affected by a significantly decreased prey base. Population levels of lagomorph prey species experienced a dramatic cyclical decline phase during the winter of 1993-1994. Consequently, only eight raptor territories were documented occupied, and only four raptor pairs fledged young on the Antelope Mine study area (including the LBA) in 1994 (ACC, WDEQ/LQD Annual Report, Permit 525-T5, October 1993 - September 1994).

Mourning dove is the most prevalent species of upland game birds in the vicinity of the LBA. The proposed tract is within the area that has been surveyed by Antelope Mine for sage grouse leks annually since 1982. There are no leks on the proposed tract, and no sage grouse were observed on the entire study area during a recent annual report period. Lek searches in late April and early May, 1994 revealed no sage grouse breeding activities on the Antelope Mine study area. Four wild turkey observations occurred during a recent annual monitoring period. In December, 1992, a flock of 36 birds were observed feeding in a riparian tree area along Antelope Creek, at the far east edge of the study area. Two birds were observed feeding in a reclaimed site within the active mine area in April, 1993. In late May, single male turkeys were observed twice, one in a greasewood area along Antelope Creek north of the mine office complex and the other in a reclaimed area in the southern portion of the active mine area. Early morning spring 1993 searches along Antelope Creek

revealed no wild turkey breeding activities within the Antelope Mine study area, and no turkeys were observed during 1994 monitoring activities (ACC, WDEQ/LQD Annual Reports, Permit 525-T5, October 1992 - September 1993, and October 1993 - September 1994).

There was no successful waterfowl nesting documented on the Antelope Mine study area during 1993 or 1994. Nesting habitat remains available, weather permitting, in upland pond sites and along Antelope Creek.

The USFWS and WDEQ have expressed concern about 17 avian species or subspecies in the Powder River Basin coal region. These are classified as "migratory birds of high federal interest" (MBHFI). During the baseline studies and the annual monitoring performed since 1982, field surveys have been performed to document the occurrence and status of MBHFI at Antelope Mine. The annual surveys for MBHFI are conducted on and within 2 miles of the permit area, a region which includes the LBA tract.

Thirteen of the seventeen species of MBHFI have been recorded through time in the Antelope Mine study area (see Table 7). No additional species of MBHFI were observed during 1994 monitoring activities. Of the species that have been recorded, only the mountain plover has been identified as being of concern to the USFWS at the Antelope Mine site. This concern stemmed from the fact that nesting mountain plover have been identified in the wildlife baseline study area. Two other species, golden eagle and ferruginous hawk, are addressed under raptors above.

As shown on Figure 9, a number of mountain plover habitat areas exist within and near Antelope Mine. Part of one mountain plover habitat area extends into the LBA tract (see Figure 4). The last year of recorded mountain plover use of this area was 1989. ACC conducted a 4-year mountain plover monitoring program, incorporating comprehensive company monitoring in conjunction with a 2-year intensive contract study by the USFWS-Cooperative Wildlife/Fisheries Research Unit (Oelklaus, W., 1989, and Parrish, T., 1988). These studies drew upon historic observations at the mine to augment new findings in documenting: 1) mountain plover distribution in the permit area as well as the surrounding region, 2) population size, and 3) extent and use of suitable breeding habitat. Both reports referenced above compared new data with the historic literature on mountain plover, and both reports concluded that development of the Antelope Mine could occur without impacting the region's mountain plover population. Because of the special concerns regarding the mountain plover, ACC takes measures to protect and reclaim appropriate habitat and to monitor the success of these measures as agreed to in the management plan approved by the USFWS.

Monitoring of mountain plover has taken two approaches at the Antelope Mine. Mine personnel and representative consultants conduct annual intensive searches of all parts of the mine permit area, previously identified mountain plover use areas, and contiguous areas within ½ mile. This monitoring is conducted annually from mid-April until the end of August and will be continued until the end of mining. Coverage is

Table 7. MBHFI Status in Northeast Wyoming and Expected Occurrence Near Antelope Coal Mine

SPECIES	SEASONAL STATUS/BREEDING RECORDS IN NE WYOMING	NO. OF YEARS SIGHTED IN 10 YEARS OF MONITORING	EXPECTED OCCURRENCE IN ANTELOPE MINE AREA
White pelican	Summer/Nonbreeder	2	Rare
Double-crested cormorant	Summer/Breeder	4	Uncommon
Canvasback	Summer/Breeder	3	Uncommon
Ferruginous hawk	Summer/Breeder	10	Common
Golden eagle	Resident/Breeder	10	Common
Bald eagle	Winter/Nonbreeder	10	Common in Winter
Osprey	Summer/Breeder	0	Rare
Prairie falcon	Resident/Breeder	10	Common
American peregrine falcon	Migrant/Historical breeding records	2	Rare
Richardson's merlin	Resident/Breeder	5	Uncommon
Whooping crane	Never Recorded	None	Very Rare
Sandhill crane	Migrant/Nonbreeder	0	Rare
Mountain plover	Summer/Breeder	10	Common
Long-billed curlew	Summer/Breeder	2	Rare
Burrowing owl	Summer/Breeder	1	Rare
Lewis' woodpecker	Summer/Breeder	1	Rare
Dickcissel	Summer/Breeder	0	Rare

Compiled from Wyoming Game and Fish Department (1982), includes Campbell and Converse Counties.

Sighting Record References: From Antelope Coal Company Permit 525-T5 Annual Report, October 1992 - September 1993

most exhaustive in the habitats and areas previously utilized by the birds. Each observation is recorded separately, noting location, habitat, behavior, numbers, age, weather, time and date. Yearly results are compiled and discussed in the mine's annual report.

The monitoring and intensive contract studies of the mountain plover have helped to:

- determine the current status of mountain plover in the southern Powder River Basin of Wyoming,
- evaluate the habitat used by the mountain plover to nest, rear young, and flock in the latter part of the summer,
- determine the behavioral attributes of the mountain plover utilizing the areas in the southern Powder River Basin, and
- make recommendations for reclamation of areas that allow the continued support of a mountain plover population.

A habitat recovery and replacement plan for mountain plover was developed and approved by the USFWS on August 7, 1990 for lands to be disturbed by development of the Antelope Mine. This plan has been incorporated into the ACC WDEQ/LQD mining permit.

Other wildlife resources of particular interest in the study area include a great blue heron rookery along Antelope Creek downstream from the mine area and two beaver colonies (see locations on Figure 9). The heron rookery was established in 1992 and was again active in 1993. Both beaver colonies are located at groundwater discharge points along Antelope Creek. According to ACC's annual monitoring reports, these beaver colonies have significantly enhanced the area for numerous species of wildlife and plants. Their most significant contribution is the retention and availability of water throughout the summer and fall. While this reach of Antelope Creek is classified as intermittent (surface flow not present all year), both colony ponds retained water throughout the year. Beyond the water availability to wildlife and livestock, the raised water table and its availability along and downstream from the colonies is resulting in more lush vegetative growth, including establishment of cottonwood trees. Additionally, pond storage capacities serve to attenuate storm flows, decreasing flood event quantities and extending flow periods (ACC, WDEQ/LQD Annual Report, Permit 525-T5, October 1992 - September 1993). As stated previously, ACC does not intend to mine the area along Antelope Creek.

3.2.6.1 Threatened or Endangered Wildlife

The USFWS has determined that there is potential habitat for three threatened or endangered (T or E) animal species in the area of the LBA: the bald eagle, peregrine falcon, and black-footed ferret (C.P. Davis, September 22, 1994 letter to

BLM). Bald eagles are relatively common winter visitors in northeastern Wyoming. The only roosting habitat (wooded canyons or large tree groves) that exists on or within 1 mile of the proposed lease area is the riparian zone along Antelope Creek that will remain largely undisturbed. Bald eagles have commonly been observed on and near the area during the winter surveys, but no unique source of prey occurs there.

No suitable nesting habitat (cliffs) for peregrine falcons exists on or near the LBA. Peregrines may pass through the area during migration, but there is no unique source of prey to attract them to the area. Peregrine falcons have been observed in the vicinity of the Antelope Mine or proposed lease area in two years of the ten years of monitoring (see Table 7).

Black-footed ferrets have been known to reside almost exclusively in prairie dog towns. No ferrets have been sighted in the vicinity of the Antelope Mine, although seven active prairie dog towns exist within the wildlife baseline study area (see Figure 9). Special searches for black-footed ferrets were conducted in July and September 1980. No sign of this species was found. No prairie dog towns occur on the LBA tract.

3.2.7 Cultural Resources

The entire Antelope Mine permit area plus a surrounding area, which includes the proposed LBA under all three alternatives, has been subjected to a Class III cultural resource inventory (Greiser et. al, Historical Research Associates, 1982, and Webb et. al, Mariah Associates, Inc. 1993). The inventory was conducted in several surveys prior to and including the baseline effort.

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

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

By letter of August 10, 1988, the Wyoming State Historic Preservation Office (SHPO) confirmed acceptance of the final report of the primary cultural resource data

collection program for the Antelope Mine permit (Marceau, T.E.; State of Wyoming, August 10, 1988 letter to OSM). This approval letter confirmed that the cultural resources inventory and report meets the research design standards established for this project and adequately documents the significant data in the study area. Subsequent surveys have been conducted to include permit revisions, coal exploration, or to investigate or mitigate a site not found in the original surveys. In January 1992 SHPO provided clearance of a triangular area north of the Converse County line bounded by the railroad right-of-way to the north and County Road 37 to the west (this was prior to the relocation of this road) (Gary Stephenson; State of Wyoming, January 24, 1992 letter to BLM). In February 1992 SHPO provided clearance of the six sites left unmitigated under the 1988 clearance (Gary Stephenson, February 24, 1992 letter to WDEQ/LQD). The remaining site mentioned in the February 1992 clearance letter (not within the LBA area) was a site not discovered in the original surveys. This site was mitigated and the mitigation was approved by SHPO in 1993 (John T. Keck; State of Wyoming, May 21, 1993 letter to WDEQ/LQD).

Table 8. Status of Known Cultural Sites Within the LBA Tract

SITE	TYPE	LOCATION	NRHP STATUS
48CO-451	Prehistoric	Lease	Ineligible
48CO-452	Prehistoric	Lease	Mitigated
48CO-453	Prehistoric	Lease	Ineligible
48CO-455	Prehistoric	Lease	Mitigated
48CO-457	Prehistoric	Lease	Mitigated
48CO-462	Prehistoric	Lease	Ineligible
48CO-464	Prehistoric	Lease	Ineligible
48CO-465	Prehistoric	Lease	Ineligible
48CO-488	Prehistoric	Lease	Ineligible
48CO-502	Prehistoric	Lease	Mitigated
48CO-503	Prehistoric	Lease	Ineligible

A total of 11 cultural sites were identified on the proposed LBA area (see Table 8, above). These included five open lithic sites; three open camps with groundstones; one open camp and hearth; one open camp, groundstone and hearth; and one stone enclosure. Four sites on the LBA area have been mitigated, and none of the sites is eligible for the NRHP. Results of the survey suggest that the proposed tract will have no effect on any significant cultural resources. Cultural resource clearance has been received for the entire LBA area under any leasing alternative (1, 2 or 3). An area north of the LBA tract in Campbell County has been subjected to a cultural resource inventory for areas around coal exploration drill holes.

3.2.8 Native American Consultation

Native American consultation and coordination as required by the Archeological Resources Protection Act and the American Indian Religious Freedom Act was conducted at the time of the draft EA public review period, and will be conducted during the time of the final EA public review period. When the draft and final EAs are released, affected tribes are sent certified letters requesting their comments concerning any religious or cultural areas within or near the LBA tract.

3.2.9 Paleontological Resources

The sedimentary Eocene Wasatch and Paleocene Fort Union formations are exposed in the vicinity of the LBA tract. Both are known to contain fossil remains. Vertebrate fossil remains were described from the Wasatch Formation of the Powder River Basin in the early 1900s and include specimens of fish, turtle, champosaur, crocodile, alligator and mammals. The Fort Union also contains fossils of plants, reptiles, fish, amphibians and mammals. No significant paleontological localities have been recorded on federal lands in or near the project area which is within the BLM Platte River Resource Area and the Thunder Basin National Grassland (BLM, 1985; US Forest Service, 1985).

Paleontological resource surveys of the Antelope Mine area were conducted in conjunction with the archeological surveys, and the results of those surveys are included in the archeological reports (Greiser et. al, Historical Research Associates, 1982, and Webb et. al, Mariah Associates, Inc., 1993). In the future, paleontologic surveys on federal lands should be conducted by a professional paleontologist. The surveys to date found no significant fossils. Fossil plants were observed during the surveys, but no vertebrate fossils have been located prior to or during the course of mining at the adjacent Antelope Mine.

3.2.10 Visual Resources

The Antelope Mine facilities and some mining activity are currently visible from County Road 37. Under the mine plan for the existing leases, mining has approached and will approach this public road closely at times and be plainly visible to passers-by. This would also be true of the proposed tract, where mining would approach the relocated county road. Most of the people travelling this road are commuting to work at Antelope Mine or the nearby North Antelope and Rochelle coal mines. In several places in nearby Campbell County, mining is readily visible from public roads. These locations often attract tourists who are curious about the Powder River Basin and its large surface coal mines. Several mines have constructed viewing platforms and conduct tours to accommodate interested tourists and other persons.

For management purposes, the BLM conducts an inventory that evaluates visual resources on all land under its jurisdiction. Once inventoried, these lands are classified into various visual resource management classes. These classification ratings range from I to V as follows:

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

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

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

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

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

When development is proposed, the degree of contrast between the proposed activity and the existing landscape is measured. This is called a contrast rating. In this process, various factors such as form, line, color, texture variety, contrast, and lighting are evaluated.

The lands included in the tract are generally classified as visual resource management Class V with some Class IV. The natural character of the landscape on and adjacent to the LBA tract is already interrupted by numerous disturbances. A recently relocated county road, remnants of the former county road, the relatively new BN/C&NW railroad, and existing mining activity are visible from most sites on the tract. Mining activity would not encounter any BLM visual classification that would prohibit or restrict surface coal mining. Contrast would remain virtually unchanged.

The USFS has classified the visual resources on lands within the Thunder Basin Natural Grassland that are under USFS management. The USFS visual resource management classes are as follows:

Preservation - P - Only ecological changes are permitted. Human alterations and management activities, except for very low scenic-impact recreation facilities are prohibited.

Retention - R - Allows human alterations and managements activities that are not visually evident.

Partial Retention - PR - Human alterations and management activities must remain visually subordinate to the characteristic landscape.

Modification - M - Human alterations and management activities may dominate the original characteristic landscape, but they must borrow from naturally established form, line color and texture so completely and at such scale that the scenic characteristics are those of natural occurrences within the surrounding area.

Maximum Modification - MM - Human alterations and management activities of vegetative and landform may dominate the characteristic landscape, however when viewed as background, the visual characteristic must be of those of natural occurrences within the surrounding area.

The five objectives listed above are the measurable standards for the visual management of national forests. The proposed lease area is required to meet the visual quality objective of modification within three years after completion of the project except for riparian areas, playas, floodplains, and wetlands which are required to meet partial retention within one year after completion of the project.

3.2.11 Noise

An individual's judgement of the loudness of a noise correlates well with the A-weighted sound level (dBA) system of measurement. The A-weighted sound level, or A-scale, has been used extensively in the U.S. for the measurement of community and transportation noises. Figure 10 relates A-scale decibel (db) readings to equivalent sounds of daily life. Existing noise sources in or near the proposed LBA are: a county road, a railroad track, coal mining activities, wind, and agricultural activities. From these sources, the current noise level or loudness (commonly measured in decibels) is estimated to be in the range of 40 to 60 db and possibly higher, depending on time of day and location. Mining would increase the noise level to a range of 85 to 95 db where actual operations are occurring.

3.2.12 Air Quality

The air quality of the Powder River Basin area is generally good with an average annual geometric mean (the nth root of the product of n numbers) for total suspended particulates (TSP) concentrations of 15 micrograms per cubic meter ($\mu g/m^3$). Average particulate concentrations in the basin are therefore one-tenth the maximum allowable concentration in Wyoming (see Table 9). Visibility for more than 60 miles is common. Significant reductions in visibility are generally weather-related, although major forest fires to the west and northwest have impaired visibility in the Powder River Basin in past years.

The basic regulatory framework which governs air quality in Wyoming is the Environmental Quality Act, the accompanying Air Quality Rules and Regulations, and the State Implementation Plan approved by the Environmental Protection Agency (EPA) under the Clean Air Act. This regulatory framework includes state air quality standards, which must be at least as stringent as National Ambient Air Quality

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

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

Figure 10. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life

Standards, and allowable increments for the prevention of significant deterioration (PSD) of air quality. The air quality standards which apply to coal mining are listed in Table 9.

Table 9. Regulated Air Emissions for Wyoming

Emissions	Averaging Period	Wyoming Standard ($\mu g/m^3$)	National Standard ($\mu g/m^3$)
Total suspended particulates (TSP)	24-hour[a]	150	---
Particulate matter finer than 10 microns (PM_{10})	24-hour[a] annual[b]	150 50	150 50
Nitrogen oxides (NO_x)	annual[b]	100	100
Photochemical oxidants (O_3)	1-hour[a]	160	235
Sulfur dioxide (SO_2)	3-hour[a] 24-hour[a] annual[b]	1,300 260 60	--- 365 80
Carbon monoxide (CO)	1-hour[a] 8-hour[a]	40,000 10,000	40,000 10,000

[a] Standards not to be exceeded more than once per year.
[b] Annual arithmetic mean not to be exceeded

The PSD program is designed to protect air quality from significant deterioration in areas already meeting state standards. In other words, an increase or increment is allowed above baseline pollution levels so long as the state standard is not exceeded. The size of the increment allowable under PSD depends on the area's designation as a Class I, II, or III area, with Class I areas allowed the smallest increment and Class III the largest. The mine area is Class II, as is all of Wyoming outside the national parks and wilderness areas. The Class I area that is closest to Antelope Mine is Wind Cave National Park in southeastern South Dakota. This national park is approximately 80 miles east of the mine. The PSD regulations do not currently affect coal mining because surface coal mines are not one of the 28 EPA-listed major emission sources and point-source emissions from these mines do not exceed the emissions threshold of 100 tons per year.

Particulates are the most significant emission source at surface coal mines. The large areas of disturbed land, blasting, crushing, loading, and hauling of coal

associated with mining all produce dust. Wyoming's PSD standards for particulates are identical to federal standards, except that Wyoming has not adopted Class III standards (see Table 10).

The initial federal particulate standard was the TSP standard, which is based on measuring all particle sizes. Recently, the federal standard was amended to PM_{10}, which measures particles 10 micrometers or less in diameter. Wyoming has kept the 24-hour TSP standard in addition to the PM_{10} standard. The current PM_{10} particulate standards in Wyoming are an annual average of 50 $\mu g/m^3$ and 24-hour average of 150 $\mu g/m^3$. The current Wyoming TSP standard is a 24-hour average of 150 $\mu g/m^3$ for TSP. The 24-hour standards are not to be exceeded more than once per year.

Table 10. Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality: Particulates

EMISSION	AVERAGING TIME	MAXIMUM ALLOWABLE INCREMENTS OF DETERIORATION (μg per cubic meter)		
		Class I	Class II	Class III
Total Suspended Particulates (TSP)	Annual Mean	5	19	37
	24-hour[1]	10	37	75

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

The various motor vehicles used in mining and transporting coal and people also produce carbon monoxide, nitrogen oxides, sulfur dioxide and, by secondary processes, ozone, though these are seldom at levels to cause regulatory concerns at Wyoming's surface coal mines. The Wyoming standards for these parameters are shown in Table 9.

A detailed description of the air quality of the Powder River Coal Region was prepared for the BLM in 1983 (PEDCo, 1983). Prior to and subsequent to that study, air quality monitoring has been conducted in the areas where mining is occurring. In November 1990, the state of Wyoming submitted a proposed revision to the State Implementation Plan to the EPA. One purpose of the revision was to modify Section 24, which covers PSD. Prior to submitting the proposed revision to the EPA, the WDEQ/Air Quality Division (AQD) held a series of public hearings. During one of the hearings, the WDEQ/AQD presented testimony documenting that the air quality resource had not been diminished from 1980 through 1988, although coal production increased significantly during that period. Air quality data from that report is provided as Table 11. During the period covered in the WDEQ/AQD report, the number of mines producing coal in the Wyoming portion of the Powder River Basin increased from 10 to 16 while annual coal production escalated from 58.8 million tons to 139.1 million tons. The number of mines monitoring air quality increased from 12 to 16. The number of actual monitoring sites varied from a low in 1980 of 29 to a high of 46 in 1986. In 1988 there were 45 operating sites. Some of these sites include

more than one sampler, so the number of actual high volume air samplers is greater than the number of monitoring sites. Data collection has continued since this report was prepared, but the report has not been updated.

In an effort to summarize the monitoring data in comparative form, averages of the geometric means from all sites were calculated for each calendar year for this study. The averages ranged from a high of 30.8 $\mu g/m^3$ in 1980 to a low of 20.5 $\mu g/m^3$ in 1986. Over 23,000 samples were collected during the period covered by this study.

Table 11. Summary of WDEQ/AQD Report on Air Quality Monitoring in Wyoming's Powder River Basin, 1980-1988

YEAR	NUMBER OF MINES PRODUCING/ MONITORING	# SITES	COAL PRODUCED (MMTPY*)	OVERBURDEN (MMBCY*)	TSP AVERAGE OF ALL GEOMETRIC MEANS ($\mu g/m^3$)	ANTELOPE MINE GEOMETRIC MEAN TSP ($\mu g/m^3$)
1980	10/12	29	58.8	93.2	30.8	----
1981	11/13	34	68.9	108.0	30.4	----
1982	11/15	43	81.4	120.7	23.1	9.6
1983	13/15	41	88.0	157.2	24.3	11.6
1984	14/15	44	106.8	166.6	24.3	14.0
1985	16/15	45	113.8	196.3	24.3	17.0
1986	16/16	46	114.6	169.6	20.5	14.4
1987	16/16	45	124.6	180.9	25.6	19.4
1988	16/16	45	139.1	209.8	29.3	22.9

Notes: 1. Mines include Buckskin, Rawhide, Eagle Butte, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Antelope/Rochelle, Antelope, and North Rochelle.
2. Antelope Mine's first year of operational monitoring data was 1982
3. From WDEQ/AQD, 1989 (This study has not been updated).

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

Table 11 shows that the average of the geometric means went up during 1987 and 1988. The cause of this increase is not clear. Speculation is that it was due to mining activity approaching monitoring sites and to dry conditions due to the regional drought. The third quarter of 1988 could have been impacted by emissions from the forest fires in Yellowstone Park.

The WDEQ/AQD has researched air quality data in the Powder River Basin. The data set includes numerous monitoring sites where TSP monitors are co-located with PM_{10} monitors. Since 1985, the historic data set consistently indicates that PM_{10} is 30% of TSP at sites near mining activities. This correlation is the basis of all emission inventories conducted in the Powder River Basin by AQD since 1985. These emission

inventories are, in turn, the basis of all permits approved by the WDEQ/AQD since 1985.

The rightmost column in Table 11 shows the annual geometric mean TSP concentrations for the Antelope Mine. Before the TSP annual standard was replaced by the PM_{10} standard, the TSP annual standard was 60 $\mu g/m^3$. As the table shows, the annual averages are well below this former standard. Assuming that PM_{10}, which was not monitored during the years shown in Table 11, was about 30% of the TSP values (as explained above), and further assuming that the geometric and arithmetic means are similar, it can be inferred from Table 11 that the Antelope Mine has historically been well within the current annual PM_{10} standard of 50 $\mu g/m^3$. The 1989-1994 TSP data from nearly 1600 samples collected at the Antelope Mine indicates that emissions have remained within the current standard. From 1989 to 1994, the TSP geometric means for the Antelope Mine, in micrograms per cubic meter, using the same averaging techniques applied to Table 11, are as follows: 1989 = 20.91; 1990 = 25.63; 1991 = 25.16; 1992 = 24.23; 1993 = 25.86; and 1994 = 31.79 (ACC, WDEQ/AQD Annual Reports for the calendar monitoring years 1989 through 1994.)

The information presented by the WDEQ/AQD indicates that air quality in the Wyoming portion of the Powder River Basin did not deteriorate while coal production increased nearly 2.5 times in the 1980-1988 period. This is due in part to the conditions that are attached to air quality permits. These conditions stipulate control measures that must be implemented by the mine operators in order to meet air quality standards. These measures include increased sprinkling, use of approved chemicals to control dust, limiting the amount of disturbed area, temporary vegetation of disturbed areas, and contemporaneous reclamation.

The removal of coal on the Antelope LBA tract will eventually require blasting and mining operations near the relocated County Road 37 and the BN/C&NW railroad right-of-way. This has the potential to affect highway travelers and trains if blasting and/or fugitive dust cause visibility impairment or if flyrock approaches the right-of-way. These issues will be addressed in the mine's blasting plan and in the air quality permit which must be obtained from WDEQ/AQD if the lease is issued. Throughout the life of the Antelope Mine, the active pit was frequently within ½ mile of County Road 37 prior to its relocation in 1993 without creating dust- or blasting-related problems.

3.2.13 Transportation Facilities

County Road 37, two pipelines, and a railroad main line pass through or near the Antelope LBA tract. Transportation facilities are shown on Figure 7 (in Section 3.2.5). County Road 37 formerly ran through the Antelope Mine area. It was relocated to its present position, adjacent to the railroad around the eastern edge of the mine, in 1993 to facilitate coal recovery. In this present location it runs parallel to the railroad main line. It would not be economically feasible to relocate it again, with or without the LBA tract. Thus this is considered a permanent relocation of

County Road 37. The railroad right-of-way and relocated county road make some of the coal within the LBA area unrecoverable, due to unsuitability for mining (as discussed in Section 1.2), or for economic reasons. As discussed in Section 3.2.5, there are two pipelines that traverse the Antelope Mine area.

3.2.14 Socioeconomics

The proposed lease area lies in Converse County within the Powder River Basin in northeastern Wyoming. The major Converse County community of Douglas is located approximately 55 miles to the south via County Road 37 and Highway 59.

Douglas is the county seat for Converse County. It is the major trade center and the largest community within the affected area of the proposed coal lease. Douglas is the home of most Antelope Mine employees and is the community within the region that is most likely to attract new area residents due to its current population level along with services and shopping amenities that exceed those of lesser populated communities within commuting distance of the Antelope Mine and proposed lease area.

Douglas had a population of 5,076 in 1990 according to the 1990 census, relative to a 1990 population for Converse County of 11,128 (U.S. Department of Commerce, 1990). Glenrock, a smaller community in Converse County with a 1990 population of 2,153 people, is about 25 miles west of Douglas and is not currently nor likely to become the home of a significant number of Antelope Mine employees. Wright, Wyoming, about 30 miles northwest of the Antelope Mine in Campbell County, and rural Campbell and Converse counties are home to about 20% of the Antelope Mine employees.

Converse County ranked 14 in population among counties within the state in 1990 with a total population of about 11,128. With a total area of about 4,250 square miles, Converse County's population density was about 2.6 persons per square mile in 1990, compared to an average of slightly over 4.6 persons per square mile for the state. The 1990 census placed the state's population at 453,588 (U.S. Department of Commerce, 1990).

According to the 1990 census, Converse County contained 5,234 housing units that year, of which 2,267 were in Douglas (U.S. Department of Commerce, 1990). Vacant housing units for sale or rent in Douglas in 1992 were estimated to total about 59 units, including 24 single-family homes, 30 mobile homes and 5 multi-family units (Douglas, Wyoming Community Profile, 1992). The overall vacancy rate is about 2.6%. As a maintenance tract, sale of the Antelope Mine LBA lease would not directly create additional jobs. However, current available housing in Douglas would be sufficient to accommodate over 50 additional workers.

Converse County's economy is based largely upon coal mining, oil and gas extraction, energy production (specifically power generation), and agriculture. Converse County's 1993 mineral valuation on 1992 production equalled $189.6

million. The 1993 state total was $3.62 billion. Coal valuation in 1993 totaled $28.4 million for Converse County and $1.12 billion for the state. Thus, Converse County represented about 5.2% of the state's total 1993 mineral valuation and about 2.5% of the state's total coal valuation (State of Wyoming; Department of Revenue, 1993).

The 1992 oil production in Converse County was valued in 1993 at $139 million, or about 1% of the state's output of $1.39 billion. The 1992 natural gas output in Converse County was valued in 1993 at $14.3 million, which is about 2% of Wyoming's $866 million valuation for 1993 (State of Wyoming; Department of Revenue, 1993).

Converse County placed third among Wyoming counties in oil production with 7.2 million barrels (bbls) in 1992. Natural gas production in the county totaled 9,283 million cubic feet (MMCF) in 1992. By comparison, the state's oil production totalled 84.6 million bbls in 1992; natural gas production was 765,254 MMCF in 1992 (State of Wyoming; Department of Commerce, 1993).

Table 12. Historic Coal Production for Wyoming and Converse County

YEAR	1988	1989	1990	1991	1992	1993	1994
Wyoming*	163.5	171.1	183.9	193.9	189.5	209.9	236.9
Percent Change	---	+4.4	+7.0	+5.2	-2.3	+10.8	+14.3
Converse Co.*	5.7	6.1	7.9	8.2	8.5	10.2	11.4
Percent Change	---	+7.0	+29.5	+3.8	+3.7	+20.0	+11.8
Campbell Co.*	135.7	143.8	154.7	164.9	159.6	181.9	205.5
Percent Change	---	+6.0	+7.6	+6.6	-3.2	+14.0	13.0
Campbell & Converse Co.*	141.4	149.9	162.6	173.1	168.1	192.1	216.9
Percent Change	---	+6.0	+8.5	+6.5	-2.9	+14.3	+12.9

*Production is in Millions of Tons
Source: Wyoming State Geological Survey/Wyoming Geo-Notes, No. 46, May, 1995; and State of Wyoming/Annual Report of the State Inspector of Mines, January, 1995.

Recent coal production figures for Wyoming, and for Campbell and Converse counties are shown in Table 12 (above). Converse County's coal production increased from about 6.1 million tons of coal in 1989 to about 11.4 million tons in 1994, an increase of 78% in five years. The county's output consistently represented 4% to 5% of the state's total coal output during those five years. State output increased from 171 million tons in 1989 to 236.9 million tons in 1994, making Wyoming the largest coal producer among the 50 states. The Wyoming State Geological Survey is predicting annual increases of about 4.5% in Wyoming coal production through 1998 (Wyoming State Geological Survey, May, 1995). Antelope

Mine produced 3.5 million tons of coal in 1989, 5.2 million tons in 1990, 5.4 million tons in 1991, 5.7 million tons in 1992, 7.2 million tons of coal in 1993, and 8.3 million tons in 1994.

Employment in Wyoming's coal mining industry has remained relatively constant during the same five year period. Employment totaled 4,560 in 1989, 4,623 in 1990, 4,663 in 1991, 4,648 in 1992, 4,553 in 1993, and 4,571 in 1994. In comparison, Converse County employed 230 in 1989, 272 in 1990, 271 in 1991, 269 in 1992, 279 in 1993, and 301 in 1994 within the coal mining sector (Wyoming State Geological Survey; 1990, 1991, 1992, 1993, 1994, 1995). The Antelope Mine employed 52 persons in 1989, 99 in 1990, 97 in 1991, 94 in 1992, 103 in 1993, and 119 in 1994.

The average unit valuation of coal sold in Converse County, Wyoming has declined from $4.88 per ton in 1989 to only $3.34 per ton in 1993 (State of Wyoming; Department of Commerce, 1994). The statewide average price of coal in 1993 was $7.44, compared to $8.63 in 1989. The statewide average is heavily skewed upward by prices for coal from the southern coal fields. The average price paid for coal from northeastern Wyoming mines has declined from $7.02 per ton in 1989 to $6.18 in 1993 and is expected to continue to decline for the near future (Wyoming State Geological Survey, February 1994). The average coal price reflects a composite of historic contract prices that have escalated over time, new contract sales, open market (spot) coal sales, and renegotiated longer-term contracts. Contracts at $12.00 to $14.00 per ton are expiring and being replaced by spot market sales and shorter term contracts. Spot market, short-term contracts, and renegotiated longer-term contracts (all under $5.00 per ton) comprised 5% of Wyoming's production in 1985, with a substantial increase to 37% in 1992, and a projected additional increase to 51% by 1995 (Wyoming State Geological Survey, May 1993). Spot prices in the Wyoming Powder River Basin rose in early 1994 as a result of a shortage of coal in the basin (Riley; Casper Star Tribune, March 14, 1994). The shortage was due to cold weather, rail disruptions, and other market factors. These conditions no longer exist and spot prices are returning to pre-1994 levels. The accepted bid for one recent spot coal solicitation was $4.44/ton freight-on-board (F.O.B.) for coal from the Jacobs Ranch Mine, and a coal contract running through 1997 was awarded to the Caballo Mine at a price of $4.05/ton F.O.B. (Wyoming State Geological Survey, February, 1995).

The 1993 Wyoming Income and Employment Report (State of Wyoming; Department of Administration and Information, Division of Economic Analysis, 1993) shows that Converse County's agricultural sector employed 473 in 1987, 461 in 1988, 457 in 1989, 453 in 1990, and 445 in 1991. This compares to state figures of 13,036, 12,746, 12,590 and 12,528, and 12,306 respectively.

Labor force data for selected years are presented in Table 13. Average annual unemployment in Converse County was 5.8% in 1990, 5.4% in 1991, 5.7% in 1992, and 5.8% in 1993. This compares to average statewide figures of 5.4 and 5.1, 5.6 and 5.4% for years 1990 through 1993, respectively. Average annual unemployment

in the county was 345 in 1993 (State of Wyoming; Department of Employment, Research and Planning Division, April 1994).

Table 13. Labor Force Data for Selected Years for Wyoming and Converse County

YEAR	WYOMING	CONVERSE
1980	278,019	7,694
1985	278,287	6,781
1990	268,138	5,770
1992	278,680	6,130

Source: Wyoming Income, Employment, and Gross State Product Report, State of Wyoming, Department of Administration and Information, Division of Economic Analysis, September, 1994.

Total personal income in Converse County was $156.1 million in 1987, $157.0 million in 1988, $157.3 million in 1989, $159.0 million in 1990, and $166.9 million in 1991. This represented a 0.55% increase from 1987 to 1988, a 0.24% increase from 1988 to 1989, a 1.06% increase in from 1989 to 1990, and a 5.0% increase from 1990 to 1991. State personal income for those years totaled about $6.38 billion, $6.57 billion, $6.92 billion $7.45 billion and $7.80 billion, respectively, which is a 3.04% increase from 1987 to 1988, a 5.34% increase from 1988 to 1989, a 7.62% increase from 1989 to 1990, and a 4.70% increase from 1990 to 1991 (State of Wyoming; Department of Administration and Information, December 1993). In Converse County, total personal income earned from all mining (including oil extraction) totaled $31.5 million in 1987, $36.1 million in 1988, $31.2 million in 1989, $26.0 million in 1990, and 26.9 million in 1991. Total personal income in the county's agricultural sector was $5.09 million in 1987, $7.15 million in 1988, $5.00 million in 1989, $7.09 million in 1990, and $10.74 million in 1991 (State of Wyoming; Department of Administration and Information, December 1993).

By comparison, earnings by place of work for the state totaled $4.62 billion in 1987, $4.78 billion in 1988, $4.93 billion in 1989, $5.24 billion in 1990, and $5.50 billion in 1991. Earnings from coal mining amounted to about $238.57 million in 1987, $251.02 million in 1988, and $257.15 million in 1989. Earned income from oil and gas extraction statewide was about $319.17 million in 1987, $333.72 million in 1988, and $318.52 million in 1989. The state's agricultural sector produced earnings of over $101 million in 1987, over $132 million in 1988, nearly $122 million in 1989, and $158.5 million in 1990 (State of Wyoming; Department of Administration and Information, 1991).

In 1991 the largest industries in Wyoming in terms of employment were services, retail trade, and the government sector, with 59,993, 46,631 and 60,286 occupied positions, respectively. These three sectors accounted for 61.8% of all the

occupied jobs in Wyoming in 1991. That same year, the mining sector in Wyoming had 20,756 occupied jobs. This was well below the 41,880 jobs in the mining sector at its peak in 1981, but 1991 was the third year in a row that the number of jobs in the mining sector increased. In 1991, the mining sector accounted for 7.7% of all occupied jobs in Wyoming (State of Wyoming Department of Administration and Information, December 1993).

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to those changes. The national labor force in the coal mining industry grew during the 1970s, but declined during the 1980s. Since 1973 overall production has risen while employee numbers have decreased. The employment decline followed heavy industry investments in capital between 1973 and 1979. Through 1976 the majority of capital investment was for boosting productivity and output. Output per employee has increased dramatically due to improved technology. The cutbacks in the number of employees needed to produce large quantities of products have left in place a skilled workforce, most with many years of experience. Jobs in mining now frequently require technical training in operating computers or other specialized equipment (U.S. Department of Labor, Bureau of Labor Statistics, October, 1992).

The state's per capita personal income averaged $13,363 in 1987, $14,123 in 1988, $15,046 in 1989, $16,467 in 1990, and $16,968 in 1991. In these same years, Converse County per capita income averaged $12,427, $13,024, $13,658, $14,440 and $14,895 respectively (State of Wyoming; Department of Administration and Information, 1993).

Douglas, Wyoming has two elementary schools, one junior high school, one high school, one junior college (a branch campus of Eastern Wyoming College), one private school, and one vocational school (Wyoming Law Enforcement Academy). Four rural schools serve the outlying area around Douglas. In 1992, the elementary and junior high schools had a teacher-pupil ratio of 1:14, while the high school had a teacher-pupil ratio of 1:15. The number of enrolled students in Douglas in the 1991-92 school year was 1,799 (Converse County Economic Development Council, 1992). This number has declined from a peak of 2,119 in 1982-83, following a general decline in the minerals industry. Current school staff includes 112 teachers, 9 administrative staff, 10 support staff and 52 classified staff, and the annual school budget is about $8.1 million (Douglas, Wyoming, undated).

4.0 ENVIRONMENTAL IMPACTS

4.1 Impacts Of The Proposed Action: Leasing Under Alternatives 1, 2 or 3

The proposed action is to issue the Antelope LBA tract as a maintenance lease for an existing mine, either as applied for (Alternative 1) or with an altered tract boundary (alternative 2 or 3). As applied for, the LBA tract comprises about 617 acres, but due to the presence of the railroad and county road, coal is recoverable from only about 462 acres. The coal reserve beneath this 462-acre area is estimated at 63.1 million tons. ACC's existing approved mine plan avoids mining the Antelope Creek valley. This makes another 3.1 million tons underlying the LBA unrecoverable, leaving a minable reserve of approximately 60 million tons under Alternative 1. Assuming a recovery of 95%, the net production of coal under Alternative 1 would be approximately 57 million tons. Alternative 2 would increase the area of the LBA by about 206 acres and add about 25 million tons of coal as compared to the LBA as applied for. Alternative 3 would decrease the area of the LBA by about 162 acres and remove about 20 million tons of coal. Alternative 3 excludes the area of Antelope Creek that would be leased but not mined under alternatives 1 and 2.

This section describes the environmental impacts that would result if ACC is the successful bidder and acquires the Antelope LBA tract as a maintenance lease for the adjacent Antelope Mine. The environmental impacts of mining the Antelope LBA tract as part of the existing Antelope Mine (alternative 1, 2 or 3) are included in this discussion. Impacts are quantified for each resource component addressed in Section 3.0 of this report. Section 4.2 addresses impacts of Alternative 4, the No Action Alternative, primarily by comparison to the impacts of the proposed action. Subsequent sections describe mitigation measures that would reduce or eliminate adverse impacts, residual impacts that might remain in spite of mitigation measures, and cumulative impacts of the proposed action and alternatives.

4.1.1 Geology and Topography

Surface coal mining permanently alters both the geology and the topography of the affected land. Overburden is drilled, blasted, and removed from the coal by earthmoving equipment. In the case of the Antelope Mine, this equipment includes scrapers, trucks and shovels, and a dragline. Coal is blasted and removed by trucks and shovels. The overburden is either stockpiled or replaced directly into a mined-out area. After it is replaced, the surface of the overburden is contoured to approximate the original premine topography according to an approved mine plan.

A comparison of the area that would be impacted under the existing mine plan and the three alternate tract configurations is included in Table 14. Most of the LBA tract as applied for and the reduced LBA tract under Alternative 3 are within the current Antelope Mine permit area. Much of the area that would be added to the tract under Alternative 2 is not within the current Antelope permit area, but baseline data for this area were collected during the baseline studies described in the previous

chapter. Because of contemporaneous reclamation efforts, not all of this area would be disturbed at one time. Approximately 95 acres of the tract would be disturbed by overstrip activities in order to recover coal in the existing Antelope leases under any of the three alternatives.

Table 14. Comparison of Impacts of Alternative LBA Tracts on Existing Mine Disturbance Area

Mine Configuration	Additional area to be mined (acres)	Additional coal to be mined (1) (million tons)	Total area to be mined (acres)	Percent increase in area to be mined	Total area to be disturbed (acres) (2)	Percent increase in area to be disturbed
Existing Mine Permit	--	--	4,301	--	4,896	
Alternative 1	462	57	4,763	11	5,358	9.4
Alternative 2	668	82	4,969	16	5,564	13.6
Alternative 3	300	37	4,601	7	5,196	6.1

Notes: (1) These values are based on a coal recovery efficiency of 95%, which WDEQ/LQD documents indicate is a typical value for Powder River Basin mines.

(2) Areas disturbed by activities other than mining include the mine facilities area, haulroads and access roads, the mine railroad loop, stockpiles, and miscellaneous other areas.

During the process of reclamation, the overburden is put back into the mined-out areas. The replaced overburden, or spoil, is physically different from the in-place overburden. As described previously, the overburden consists primarily of discontinuous, lenticular sandstone beds and sandstone channels surrounded by siltstone and shale. The replaced spoil is a mixture of these materials with physical characteristics (bulk density, porosity, hydraulic conductivity, etc.) that vary as a function of mining methods and relative percentages of sand and finer-grained sediments in the overburden.

The topography of the lease area is subject to considerable change during the mining process. Due to the thickness of the coal seam, the average elevation of the mined-out and reclaimed area is generally lower than the premining elevation. The reduction in elevation is generally less than the thickness of the coal because of overburden swelling. The ratio between the in-place overburden volume and the spoil volume is termed the swell factor. The swell factor currently used for mine planning at Antelope Mine is 20% (ACC Permit 525-T5 Renewal and Revision, 1993).

A typical average overburden thickness for mines in the Powder River Basin is about 150 feet. At Antelope Mine, overburden in the currently approved mine area averages about 83 feet thick. Coal thickness at Antelope Mine varies, but the average thickness of the minable seam in the currently approved mine area is approximately 33 feet. Thus, removal of the coal and swelling of the overburden by 20% results in a reduction in average elevation for the currently approved mine area of:

$$83\ (0.20) - 33 = -16.4 \text{ feet.}$$

Dividing the total swelled overburden volume by the in-situ volume of overburden and coal yields a ratio of 0.87 for the currently approved mine area. This ratio indicates that the Antelope Mine is classified as a "thin overburden" mine (ACC Permit 525-T5 Renewal and Revision, 1993). Exploration drilling results indicate that both overburden and coal thicknesses on the LBA tract are larger than the averages used in the preceding equation. Overburden thickness increases with distance from the Antelope Creek valley, and the coal thickness in the LBA tract is greater than the average coal thickness in the currently approved mine area because both seams are present in most of the LBA tract and the Anderson seam is missing in much of the current mine area. However, the LBA tract under any of the three leasing alternatives would comprise a relatively small percentage of the total mine area, so mining the LBA would not appreciably alter the change in average elevation from that calculated for the existing permit area. Without the LBA, Antelope Mine will recover about 240.8 million tons of coal over the life of the mine. The LBA would add between 37 and 82 million tons of recoverable coal to this amount, depending on which leasing alternative is selected. The additional coal removal and increased stripping ratio are not large enough to cause the mine to be reclassified from the current thin overburden classification.

The premining topography of the LBA tract is rolling to dissected uplands, and the post-mining landscape has been designed to be relatively similar. Reclaimed areas are generally less topographically diverse than they were before mining. Reduction of topographic diversity (also referred to as topographic moderation) on reclaimed land can reduce habitat diversity, which can result in a reduction of wildlife carrying capacity in reclaimed areas for some species. It can also reduce areas available to big game species as winter range. The most significant habitat feature in the area, the Antelope Creek Valley, will not be mined. The Horse Creek drainage would be disturbed under Alternatives 1 and 2, but not under Alternative 3 (see Figures 4 and 5). The Horse Creek drainage would be restored after mining if alternative 1 or 2 is selected.

Another potential impact of topographic moderation is a decrease in surface water runoff after precipitation events. This is because the gentler slopes allow increased absorption of the precipitation.

The historic occurrences of coal bed methane in other parts of the Powder River Basin suggest the possibility that shallow accumulations of coal bed methane could be present in the Antelope Mine area. However, monitoring wells in the area do not indicate that the coal seams contain significant amounts of methane, and in nearly nine years of mining at Antelope no hazardous mining conditions or mining difficulties have been encountered due to methane.

4.1.2 Water Resources

It is generally recognized that surface coal mining impacts local hydrology, including both the surface and groundwater systems. As a result, the analysis and

mitigation of hydrologic impacts is carefully planned during the preparation of mining permit application documents and is reviewed during the mining permit process.

4.1.2.1 Groundwater

The general impacts to groundwater as a result of surface coal mining include the following:

- Removal of the coal aquifer and any overburden aquifers within the mine area, and replacement of these aquifers with spoil material.

- A lowering of static water levels in the coal and overburden aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries. This reduction in static water levels would not be permanent, recharge would occur as mined areas are reclaimed.

- A local lowering of static water levels in the subcoal Fort Union Formation if the mines pump from this formation to provide water for sanitary and industrial uses. Most mines in the Powder River Basin, including Antelope Mine, have water-supply wells completed in the subcoal Fort Union Formation.

Other groundwater impacts, which may or may not occur, or which may occur only at specific locations, include changes in water quality (usually deterioration) outside the area that is mined and reclaimed as a result of communication between the reclaimed aquifer and the unmined alluvial and coal aquifers, and changes in recharge-discharge conditions and/or groundwater flow patterns.

The Anderson and Canyon coal aquifers, the overburden and the interburden between the coals would be removed from the LBA tract, as well as from the rest of the Antelope coal leases, during the mining process. These aquifers would be replaced with spoils whose origin is the previously moved overburden and interburden materials. As described in Section 4.1.1, the physical characteristics of the reclaimed spoil material are dependent upon mining methods and premining overburden lithology. Research in other coal-mining areas in the northern Great Plains indicates that hydraulic conductivity in the reclaimed spoil material would be large enough to consider the material an aquifer (Groenewold, 1979). The final hydraulic conductivity of the reclaimed spoil aquifer would probably approximate the geometric mean values of hydraulic conductivity for the undisturbed Wasatch aquifer (0.2 ft/day) and the Wyodak coal aquifer (0.8 ft/day) (Martin, et. al; U.S. Geological Survey, 1988, p. 23). Given the expected final saturated thickness, the reclaimed spoil aquifer could supply water of adequate quantity for supply of the small yields needed for stock and domestic wells. This hydraulic conductivity could also be sufficient for the reclaimed spoil aquifer to support flow patterns that are similar to premining patterns, allowing for the fact that one aquifer (the reclaimed spoil aquifer) would replace two aquifer systems (coal and overburden) in areas that are mined and reclaimed.

The following discussion of recharge, movement, and discharge of water in the spoil aquifer is excerpted from the Powder River Basin Cumulative Hydrologic Impact Assessment (CHIA) (Martin, et. al, U.S. Geological Survey, 1988, p. 24):

The potential for recharge to the backfilled spoil would be greater than in areas not disturbed by mining. The natural bedding will be destroyed, creating a more isotropic condition in the spoil, resulting in generally greater vertical permeability than exists in undisturbed areas. The infiltration capacity of the backfilled and reclaimed spoil will be greater than that of the undisturbed Wasatch aquifer and Wyodak coal aquifer. However, the infiltration rate for reclaimed soils is less than that for natural soils due to the lack of root structure and other paths for vertical movement of water. After several years, infiltration rates for reclaimed soils will increase to approximately the same rates as for undisturbed soils. As infiltration rates increase to approximate premining conditions, groundwater recharge rates also will increase to approximate premining conditions.

Although the recharge potential of the reclaimed mine areas will increase, the actual recharge rate after reclamation probably will approximate or be somewhat greater than premining recharge. Actual recharge will depend on how well the surface contours are restored. A flatter average slope of the reclaimed land would increase the potential recharge by decreasing the rate of runoff from reclaimed areas. Recharge will increase locally where water is allowed to pond in surface impoundments. Also, some increase in recharge along re-constructed channels probably will occur during the infrequent periods of surface runoff.

Postmining recharge rates and mechanisms will not change in areas where lateral movement of groundwater from adjacent clinker is a major source of recharge. This is because, in general, the clinker will not be disturbed by mining operations. After mining and reclamation have been completed, water will move laterally from clinker to the spoil aquifer.

Recharge to the spoil aquifer will be from infiltration of precipitation, lateral flow from the undisturbed clinker and the Wasatch aquifer and Wyodak coal aquifer, and leakage from surface water impoundments and stream channels. Estimates of the time required for the groundwater system to re-establish equilibrium varies from a few tens of years to hundreds of years. The anticipated potentiometric surface of the spoil aquifer will resemble a composite of the premining potentiometric surfaces in the Wasatch aquifer and Wyodak coal aquifer. After equilibrium is re-established, groundwater flow patterns will approximate premining conditions. Discharge from the spoil aquifer will flow into the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west (regional flow) or to reclaimed stream channels (local flow). The quality and quantity of groundwater that may be discharged from the spoil aquifer is not known, and so impacts of surface coal mining cannot be fully addressed in this area.

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 Wasatch aquifer and 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.

The currently approved Antelope mine and reclamation plan indicates that ACC will install 19 wells to monitor recovering water levels and water quality in the replaced spoils at Antelope Mine. To date, no backfill monitoring wells have been drilled at the mine because mining has taken place in areas with limited groundwater. The first of the backfill wells will be installed in 1995.

A regional study of the cumulative impacts of coal mining found the median concentrations of dissolved solids and sulfates to be larger in water from spoil aquifers than in water from either the Wasatch Formation overburden or the coal aquifer (Martin, et. al; U.S. Geological Survey 1988). This is expected because blasting and movement of the overburden materials exposes more surface area to water, increasing dissolution of soluble materials, particularly when the spoil materials were situated above the saturated zone in the premining environment. On the basis of studies done in North Dakota, it was estimated that at least one pore volume of water must leach through the spoil before the dissolved-solids concentration in the water would be similar to the premining dissolved-solids concentration (Houghton, et. al; U.S. Geological Survey, 1987). One pore volume of water is the volume of water which would be required to fill the pore space or open space in the spoils following reclamation. The time required for one pore volume of water to pass through the spoil aquifer would be greater than the time required for the postmining groundwater system to re-establish equilibrium. As quoted above, estimates of the time required for the groundwater system to re-establish equilibrium vary from a few tens of years to hundreds of years.

ACC has conducted column leach studies on overburden samples from the Antelope Mine as a means to predict postmining groundwater quality. Results basically confirmed those described above. Dissolved constituents decrease and then stabilize after about one to two pore volumes pass through the overburden samples, and final quality is similar to the premining water quality (ACC Permit 525-T5 Permit Renewal and Revision, 1993).

ACC has used the MODFLOW model to predict the extent of water drawdown in the coal and overburden aquifers as a result of mining at the Antelope Mine. The model considers operations at adjacent mines in order to predict the cumulative impacts of all mining in the area on groundwater levels. The results of the groundwater modeling are reported in Mine Plan Section M.P.5.2 and Addendum MP-J of the Antelope Mine 525-T5 permit document (ACC Permit 525-T5 Permit Renewal and Revision, 1993). A life-of-mine drawdown map is included as Figure 11. The drawdown predictions described below and shown on Figure 11 include the effects of the dewatering wells installed to lower water levels in advance of mining north of Antelope Creek, and mining the LBA as applied for. The dewatering plan is included in the Antelope Mine permit document as Mine Plan Addendum MP-G (ACC Permit 525-T5 Permit Renewal and Revision, 1993).

Drawdown in the coal aquifer is expected to extend much farther beyond the mine boundaries than would drawdown in the overburden. In fact, the overburden contains so little water at the Antelope Mine that it was not considered in the

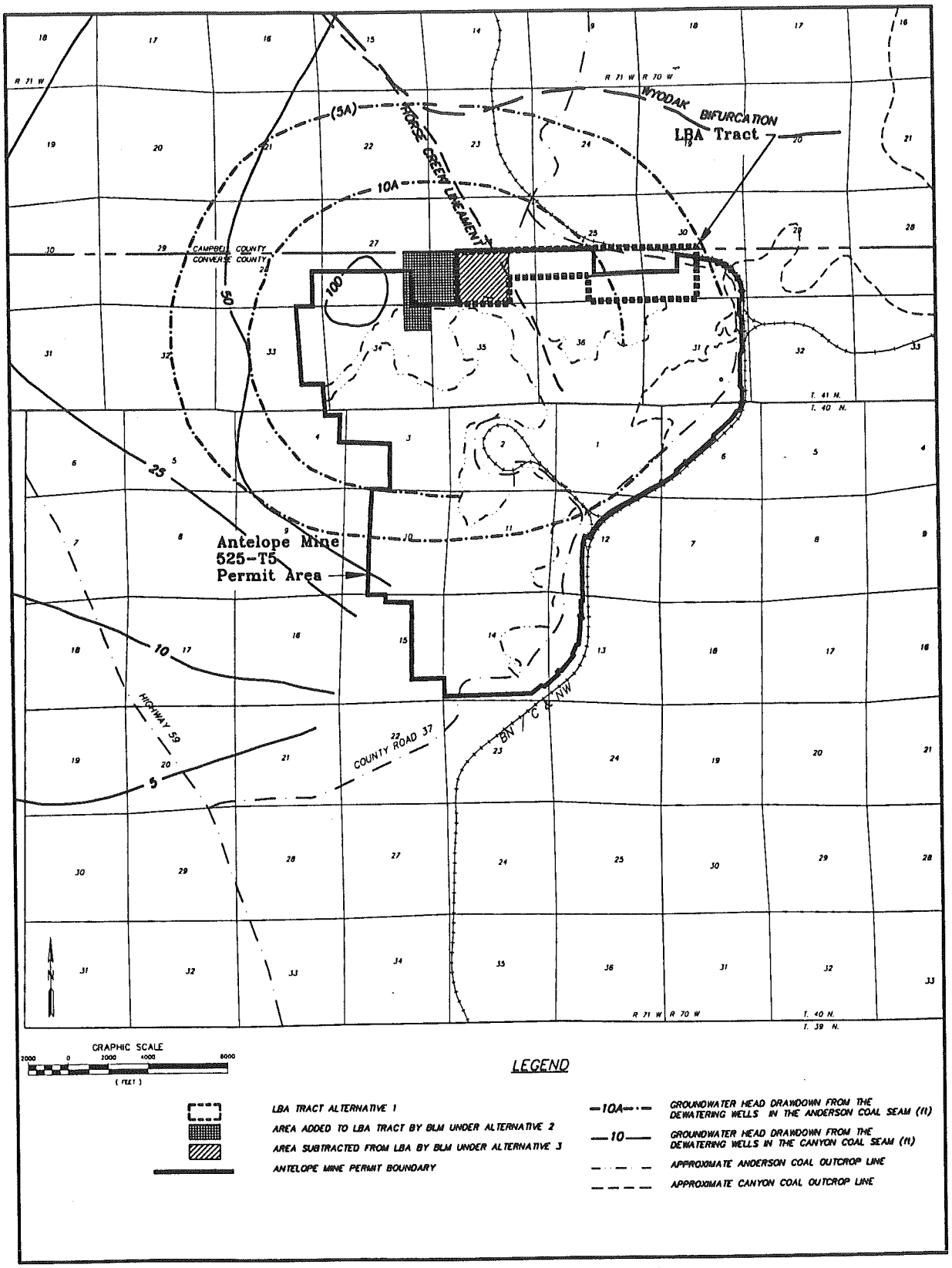


Figure 11. Life of Mine Groundwater Drawdown Map

drawdown analysis. Drawdown would extend much further in the Canyon seam than in the Anderson seam due to the fact that the Canyon seam has a much larger potentiometric head. Due to boundary conditions in both seams, such as no-coal zones, outcrops, and areas where the coal is unsaturated or only partially saturated, the model indicates that drawdown would extend toward the north and west much farther than in any other direction. The five-foot drawdown contour for the Canyon coal seam was predicted by the model to extend about 7 miles west and about 5 miles southwest of the current permit boundary. Drawdown in the Canyon seam would not extend to the south or east because it splits to the south and the coal outcrop is located to the east. Near the outcrop the coal is only partially saturated. Drawdown in the Canyon seam would extend to the northwest and north of the Antelope Mine more than 10 miles. The extent of drawdown in the Canyon seam is not well defined to the north and northwest by the model because of "...poorer grid resolution and less reliable aquifer properties information for the northern area of the grid..." (ACC Permit 525-T5 Renewal and Revision, Addendum MP-J, 1993). The model indicates that drawdown in the Anderson coal would not extend more than about 2 miles to the north and west and would not extend beyond the permit boundary toward the south and east.

The LBA tract as applied for under Alternative 1 is included in the drawdown analysis shown in Figure 11. Under Alternative 2, coal removal in the LBA would be extended westward by about ½ mile compared to Alternative 1, but the LBA does not extend as far westward as the existing leases under any of the alternatives. Alternative 3 would reduce the amount of coal mined. Therefore, the westward extent of drawdown would not be increased by any of the leasing alternatives. Alternative 2 may increase the extent of drawdown from that shown in Figure 11 by ½ mile or less in a northwestward direction. In any of the three leasing alternatives, the incremental effect on drawdown would not be significant and may not be within the model's ability to detect since the predicted extent of drawdown toward the north and west is approximate as discussed above. The modeling considers mining activity at the mines north of the Antelope Mine, and predicts an area of cumulative drawdown effects where drawdown from the Antelope Mine overlaps drawdown from the North Antelope Mine.

According to ACC, the effects of the predicted drawdown on possible neighboring groundwater users is predicted to be negligible, because no permitted water users withdrawing water solely from the Anderson or the Canyon coal seams to the west and northwest of the mine have been identified within the area of influence of the drawdown cone (ACC Permit 525-T5 Renewal and Revision, Mine Plan, p. MP5-66, 1993). As shown on Table 15, ACC has identified 12 groundwater appropriations that may be disturbed by mining. Of these, four are abandoned coal mine pits and five are wells in areas that are not scheduled to be disturbed under the current mine plan. Three wells will be physically removed and will require replacement by ACC as required by SMCRA and Wyoming statutes. None of the potentially affected water rights are on the LBA tract.

Table 15. Existing Groundwater Appropriations To Be Disturbed By Mining

State Engineer's Office Permit Number	Owner	Depth of Principal Aquifer	Appropriation Amount	Anticipated Date of Disturbance	Proposed Replacement or Replacement Cost
11652(2)	R.E. Isenberger	Anderson Coal (abandoned mine pit)	25 GPM	2002	Antelope Creek Reservoir
16602	H.R. Matheson	Anderson Coal (abandoned mine pit)	500 GPM	2005	Antelope Creek Reservoir
23594(2)	P.L. Isenberger	600-640 ft	20 GPM (flowing)	(5)	N/A
23596(2)	P.L. Isenberger	unknown	5 GPM (flowing)	(5)	N/A
23597(2)	P.L. Isenberger	unknown	6 GPM	2002	Antelope Creek Reservoir
23605(2)	P.L. Isenberger	4-8 ft	25 GPM (flowing)	(5)	N/A
37364(2)	USDA - Forest Service	530-585 ft	10 GPM	(5)	N/A
44496(1)	Industrial Pipelines South Central, Inc.	unknown (cancelled)	35 GPM	(5)	N/A
46168	State of Wyoming	220-235	5 GPM	1996	$17.00/ft
46191(2)	Neosho Construction South Central, Inc.	185-205 222-245	10 GPM	2003	Antelope Creek Reservoir
46983(3)	Antelope Coal Co.	Anderson Coal (abandoned mine pit)	75 GPM	2002	Antelope Creek Reservoir
75814(4)	Antelope Coal Co.	Anderson Coal (abandoned mine pit)	800 GPM	2005	Antelope Creek Reservoir

(1) Possibly abandoned.
(2) Water right located on property acquired Antelope Coal Company. Antelope Coal Company now possesses a prior right.
(3) Replaces State Engineer's Office Permit No. 11652
(4) Replaces State Engineer's Office Permit No. 16602
(5) Not affected by current life of mine progression. If appropriation is impacted by mining, current estimated replacement cost is $17.11/ft.

To monitor the effects of mining on water levels, ACC has drilled over 100 coal, overburden, interburden, subcoal and alluvial monitoring wells on and adjacent to the Antelope Mine permit area. Locations of individual monitoring wells and sites at which more than one well is located are shown on Figures 4 and 5. During the year ending September 30, 1993, ACC monitored 71 of these wells. Three currently-monitored wells are located on the LBA tract: 1 overburden well, 1 Anderson seam well, and 1 alluvial well at Site 12 near Horse Creek. As of October 1993, the overburden monitoring well in the LBA tract showed 1.67 feet of drawdown. The Anderson seam well showed 1.2 feet of drawdown. The alluvial well in Horse Creek showed 2.19 feet of drawdown in October 1993 compared to its baseline level, but the hydrograph (water monitoring record) for this well indicates that there has been no downward or upward trend in water levels in this well. In fact, all the alluvial wells at the Antelope Mine show normal seasonal fluctuations in water levels but no declining trend (ACC Annual Report to WDEQ/LQD for October 1992-September 1993, Hydrology, Table 10 and Appendix E, December 1993).

After mining and reclamation, water levels in the coal and overburden aquifers would begin to recover, and eventually an equilibrium flow pattern would develop. The mine reclamation plan predicts that the time required to saturate the reclaimed mine will be 35 years in the northeast mine area, 45 years in the central west area of the mine, 60 years in the northwest area of the mine, and 70 years in the south and central portions of the mine. Under typical conditions, water from the spoil aquifer would enter the adjacent, unmined coal. This would initially result in increased dissolved-solids concentrations in the coal aquifer water, but since there is a finite quantity of soluble salt in the spoil material this increase would be temporary. At the Antelope Mine, the postmining groundwater flow patterns would be similar to premining patterns, in which the flow direction would be from unmined coal and recharge areas off the property through the mine spoils to discharge areas in the Antelope Creek alluvium (ACC Permit 525-T5 Renewal, Reclamation Plan, 1993).

Martin, et. al (U.S. Geological Survey; 1988) point out that, in general, current and future water from the spoil aquifers will meet state standards for livestock, which is the current major use of water from the coal and overburden aquifers. This conclusion was based on 336 chemical analyses of samples collected from 45 wells completed in spoil aquifers at ten existing mines. Antelope was not one of the mines included in that investigation, but the nearby North Antelope mine was. As noted previously, dissolved-solids concentrations in the backfill wells at Antelope are predicted from column leach studies to be similar to water in the alluvium to which the spoil aquifers will eventually discharge. Since the water quality in the spoil aquifer will be within the range of the alluvial groundwater quality in this area, there should not be a significant impact to the water quality in Antelope Creek or its alluvial aquifer. Adding the LBA tract to the area to be mined would not significantly change these impacts.

Martin, et. al, 1988, also point out that column leach tests indicate that the elevated levels of dissolved solids caused by coal mining will decrease over time. As soluble salts continue to leach from the spoil material, future postmining water

entering the adjacent coal aquifer should decrease in dissolved-solids concentration until a postmining equilibrium condition is attained (p. 92, Martin, et. al; U.S. Geological Survey, 1988). ACC conducted similar column leach tests and reached similar conclusions (ACC Permit 525-T5 Renewal and Revision, Reclamation Plan, 1993).

Regionally, clinker would be the major recharge source for the spoil aquifer, just as it is for the coal before mining. Although some clinker is mined for road surfacing material, saturated clinker is not generally mined at Antelope or any of the Powder River Basin mines since there is abundant clinker above the water table which does not present the mining problems that result from mining saturated clinker.

Water-level declines in the subcoal Fort Union Formation have been documented in the Gillette area. According to Crist (U.S. Geological Survey, 1991), pumpage for municipal use by Gillette and for public supply by the subdivisions around Gillette is the principal cause of water-level declines in the upper Fort Union measured in wells in the immediate vicinity of Gillette. Most of the water-level declines in the subcoal Fort Union aquifer occur within 1 mile of the pumped wells (M.A. Crist, p. 30, Martin, et. al; U.S. Geological Survey, 1988). Since the mine facilities are separated by distances of a mile or more, there is little interference between mine supply wells.

The Antelope Mine obtains water from a Fort Union Formation well as described in the previous chapter. The well was drilled to a depth of 2,620 feet and is capable of providing a sustained pumping rate of about 300 gpm. Actual use from this well has averaged between 30 and 50 gpm on an annual basis for the past few years. The well is monitored with the use of a totalizing flow meter, and annual use is reported each year to the State Engineer. The well is also sampled annually for water quality analysis, and the results are included in ACC's annual reports to WDEQ/LQD. Two other Fort Union Formation wells are described in Antelope Mine permit documents. North Antelope Coal owns a 2,050-foot deep well that is located about 5.5 miles northeast of the Antelope Mine well, and Phillips Petroleum owns a 1,820-foot deep well that is located about 9 miles northeast of the Antelope Mine well. Increasing coal production, with or without the LBA, would probably increase use of water from the Antelope Mine well, but it is expected to satisfy the mine water supply requirements for the life of the mine. Thus, if the LBA is mined as proposed under alternatives 1, 2 or 3, a need for additional water-supply wells in the subcoal Fort Union Formation is not anticipated.

There would be no direct impact to the Fort Union aquifers near Gillette as a result of mining operations at the Antelope Mine, with or without the proposed LBA tract. This is because the Antelope Mine is about 60 miles from Gillette, and there is no hydraulic communication between the deep Fort Union sands and the coal being mined. If mined by the existing operation, no additional facilities or facilities water would be required. This would be true under alternatives 1, 2 or 3. The Antelope Mine would not be expected to contribute to any cumulative impact on water supply wells for Wright, about 22 miles northwest of the mine, with or without the LBA under alternatives 1, 2 or 3.

4.1.2.2 Surface Water

General impacts to surface water resulting from surface coal mining include the following:

- Disruption of the surface drainage system (channels and tributaries) during mining, requiring replacement of these systems during reclamation.

- Changes in streamflow patterns during mining caused by the regulatory requirement to store runoff and settle out solids; by construction of flood control reservoirs or diversion systems needed to prevent unacceptable levels of runoff from entering the pit; and by discharges to streams of pit inflows or other sources of water in excess of the mines' water requirements.

- Possible changes in runoff rates due to changes in precipitation infiltration rates on reclaimed land.

- Possible changes in surface water quality.

The incremental impacts to the surface drainage system caused by mining the Antelope LBA tract would be minimal. The short reach of Antelope Creek within the LBA tract would not be disturbed. Horse Creek, an ephemeral stream, is located in the western portion of the LBA tract and joins Antelope Creek just inside the southern boundary of the LBA area. Under Alternative 3, the portion of the LBA area that contains Horse Creek would be excluded from the tract. Under alternatives 1 and 2, Horse Creek would be diverted around the pits in the LBA area. Following mining, the Horse Creek drainage would be restored. Horse Creek has a drainage area of about 14.9 square miles; streams with larger drainage areas have previously been successfully diverted around mine pits in the Powder River Basin.

Prior to mining, groundwater discharge to Antelope Creek in the vicinity of the Antelope Mine was estimated at about 0.4 cubic feet per second (cfs) (ACC Permit 525, Volume VII, Appendix D6, Hydrology). The model predicts that when the groundwater system reaches equilibrium after reclamation, discharge from the spoils to Antelope Creek and its alluvium would approximate premining conditions (ACC Permit 525-T5 Renewal and Revision, Reclamation Plan, 1993). Antelope Creek itself would not be mined, and its alluvium would be left largely undisturbed. During mining, discharges from the pit and from dewatering wells would help offset the loss of groundwater discharge that would result from dewatering the coal seam. The most severe impacts to the surface water system would occur after mining is completed and before postmining equilibrium flow patterns are established. During this time there would be no groundwater discharge to the stream in the vicinity of the mine. ACC has estimated that during this time low flows in Antelope Creek up to 1.1 cfs may be lost from the stream as recharge to the spoils. The short-term loss of up to 1.1 cfs from Antelope Creek would not be significant with respect to the majority of streamflow events, which occur in the form of large precipitation runoff events. The number of days of zero flow through the permit area may also increase temporarily

(ACC Permit 525-T5 Renewal, Reclamation Plan, p. RP7-29, 1993). Mining the LBA would not significantly change these impacts.

Postmining Antelope Creek streamflow downstream of Antelope Mine could be somewhat lower than premining flow as a result of two factors. ACC plans to construct a reservoir next to Antelope Creek which would be a permanent feature of the reclaimed topography, with or without the LBA. There would be a temporary decrease in Antelope Creek flows when the reservoir is filling, and then, once steady-state conditions are reached, Antelope Creek and its alluvial aquifer would realize an estimated decrease in flow due to evaporation from this reservoir. This evaporation loss has been estimated by ACC to average 250 acre-feet per year (0.35 cfs). In addition, reclaimed topography would be more subdued and regular than premining topography. As a result, somewhat more precipitation may be absorbed by the soil and postmining runoff quantities may be slightly lower than premining quantities. While impossible to quantify with accuracy, mine permit documents indicate that pre- and postmining peak discharges in channels that would be disturbed by mining compare favorably.

The decrease in post-mining runoff quantities due to topographic moderation may be offset somewhat by the fact that some studies indicate that infiltration rates are initially smaller on reclaimed lands than on unmined lands. A weighted average reduction of 29% has been found, with this reduction declining over time until the postmining infiltration rates recover to premining levels (Martin, et. al; U.S. Geological Survey, 1988).

Since runoff and infiltration rates have an inverse relationship, a short-term reduction in infiltration rates could cause a temporary increase in runoff and, hence, streamflows. Assuming that the runoff from reclaimed areas is 29% greater than that from premining areas (based on this change in infiltration rates noted above), U.S. Geological Survey determined that major streams in the Powder River Basin would see short-term runoff increases ranging from 0.4% for the Cheyenne River to 4.3% for Coal Creek. Antelope Creek near Teckla, Wyoming would see a short-term 0.6% increase in runoff (p. 109, Martin, et. al, ; U.S. Geological Survey, 1988). This temporary increase in Antelope Creek streamflow would partially offset the temporary 1.1 cfs decrease in flow during postmining recharge of the reclaimed spoils aquifer.

Downstream water rights would not be affected by Antelope Mine or by the addition of the LBA tract under alternatives 1, 2, or 3 to the existing operation. There are no direct diversions from Antelope Creek downstream from the Antelope Mine to the confluence with the Dry Fork of the Cheyenne River.

Although reclaimed soils may have smaller infiltration rates and be more erosive for the first few years after reclamation, sediment yield should not increase in area streams. The larger sediment production would probably not be delivered to area streams due to sediment deposition as a result of flatter slopes on reclaimed lands and sediment trapping by mandated sedimentation ponds. Surface water quality should

not be significantly affected by mining, based on studies conducted by the U.S. Geological Survey (Bloyd, et. al; U.S. Geological Survey, 1986).

Recently, concern has been expressed over the presence of certain forms of selenium in soils and overburden and the possible effects this selenium may have on surface water and groundwater quality. The WDEQ and the mine operators are cooperating in a joint effort to study this issue and to determine safe levels of selenium in overburden that is to be placed near the reclaimed surface, near reclaimed streams and impoundments, or in saturated spoils. ACC is a participant in the surface water monitoring pilot study sponsored by the Hydrology Subcommittee of the Wyoming Joint Selenium Committee regarding sampling and placement of overburden materials beneath and near stream channels and surface water fed impoundments. These measures reflect the best available technology, understanding and procedures for prevention of environmental effects due to selenium-bearing backfill. This issue is discussed further in Section 4.1.3.

4.1.2.3 Alluvial Valley Floors

Impacts to designated alluvial valley floors (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 mined. The determination of significance to agriculture is made by the WDEQ/LQD, and it is based on specific calculations relating to the size of the AVF and the size of the existing agricultural operations on the lands to be leased. The WDEQ/LQD has determined that potential AVF lands within and adjacent to the LBA tract are not significant to agriculture (May 9, 1988, State of Wyoming: WDEQ/LQD, Trip Report filed by Rob Hanson and Jane Valerius). 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. Antelope Creek and its AVF would not be disturbed by mining. Under alternatives 1 or 2, a small portion of Horse Creek, including part of the Horse Creek AVF, would be disturbed by mining. This area is within the Antelope Mine permit area and AVF studies have been completed for it. If ACC acquired the tract, they would be required to revise their mine plan to include the LBA. At that time, mining and restoration of the lower portion of Horse Creek, including the AVF, would be specifically addressed.

In general, AVF impacts can include several of the ground and surface water impacts listed above. Alluvial aquifers can be subject to water-table drawdown, channels subject to changes in flow patterns, and the interaction between surface water and groundwater can be altered.

4.1.2.4 Wetlands

As discussed in Section 3.2.2.4, a total of 148 acres of special aquatic sites, including jurisdictional wetlands, were delineated on the project area, which includes the LBA tract. These delineations received U.S. Army Corps of Engineer's

concurrence in a letter dated April 28, 1993. In addition to the special aquatic sites, there are approximately 35 miles of active stream channel waters of the U.S. in the project area. Wetlands along Antelope Creek within the LBA tract would not be disturbed. Horse Creek contains approximately 5 acres of jurisdictional wetlands, which would be included in the LBA tract under alternatives 1 and 2 and which would be removed during mining under either of those alternatives.

ACC has prepared a wetlands disturbance mitigation plan (ACC Permit 525-T5 Renewal and Revision, Reclamation Plan, Addendum RP-C, 1993). This plan would be revised to include mitigation of the Horse Creek wetlands within the LBA tract prior to the time the tract is mined, if it is leased under either Alternative 1 or 2. Additional review of the LBA tract and designations of Other Waters of the U.S. would also be completed during the mining permit revision process.

4.1.3 Soils

Without addition of the LBA tract, the Antelope Mine life-of-mine disturbance area would be about 4,896 acres. It is estimated that about 462 additional acres of soil resources would be disturbed in the proposed tract and adjacent disturbance areas under Alternative 1, thereby increasing the total disturbed area by about 9.4%. Alternative 2 would add about 668 acres, increasing the total disturbed area by about 13.6%. Alternative 3 would add about 300 acres, increasing the mine disturbance area by about 6.1%. Some of these lands would be disturbed to recover currently leased coal, with or without the LBA. See Table 14 for a comparison of disturbance areas under the existing mine plan and alternatives 1, 2, or 3.

The topsoil, like the overburden, is removed and replaced during the mining and reclamation process. The postmining topsoil is a composite of premining soils. However, there are important differences between premining and postmining soils. Premining soils occur in mappable units, or soil series, which are distinguishable by their physical and chemical characteristics, depths, locations in the landscape, and other factors. Prior to mining, the operator is required to map the soils, test them for physical and chemical suitability to support plant growth, and provide a plan for their salvage and replacement. Soil material determined to be unsuitable due to physical or chemical limitations is not salvaged or replaced.

The postmining soils are a more homogeneous mixture than the premining soils and are replaced at a more uniform depth. The average topsoil replacement depth at the current Antelope Mine is about 2.1 feet. Soils in the LBA tract are similar to those in the current mine area, but there is relatively more broken land with shallower soils. As a result, the average soil salvage depth on the LBA tract under Alternative 1 would be about 1.8 feet. This should be similar under alternatives 2 and 3. Because of the small size of the LBA tract relative to the total mine area, the average soil replacement depth for the entire mine area including the LBA tract under alternatives 1, 2, or 3 would not change significantly.

Infiltration rates of soils may be altered by the salvage and replacement activities. However, differences between infiltration rates for natural and replaced soils may be masked by the variability of infiltration rates among soils and by inherent inaccuracies in measuring infiltration rates. Average infiltration rates would probably be smaller soon after reclamation is completed, but over time, as the postmining vegetation root system develops and natural weathering action forms a new soil structure, infiltration rates should trend toward premining levels (Martin, et. al; U.S. Geological Survey, 1988).

Impacts to soil resources as a result of mining include potential changes in soil structure, texture, organic matter content, infiltration rate, permeability, water-holding capacity, nutrient level, soil microorganism composition, and soil productivity. Mining exposes lower soils or overburden material which could contain chemical constituents at levels which could be harmful to plants and animals. Stockpiling soil material potentially degrades biological, chemical, and physical properties. Stockpiling could also decrease organic matter content, disrupt nutrient cycles, increase bulk density, upset the carbon-nitrogen ratio and negatively affect the mycorrhizal response of stored soil material (U.S. Forest Service, 1984).

The exposure, compaction, and stockpiling of salvaged soil material can increase potential for soil loss from wind and water erosion until the soil is revegetated. Increases in surface runoff can cause increased soil erosion and subsequent sedimentation into drainage channels or impoundments. Erosion hazard is greatly reduced through successful establishment of reclamation measures.

Potential impacts to topsoil resources on the LBA under alternatives 1, 2, or 3 would be short-term and would not represent a significant change from the existing mine based on reclamation efforts on reclaimed areas of the adjacent Antelope Mine for similar soils. As is the case in disturbed areas within the current lease boundary, topsoil stripped within the LBA tract would be reapplied if possible or stockpiled if required. All mine topsoil stockpiles at the Antelope Mine are protected from disturbance and the effects of erosional influence.

No significant site-specific or cumulative impacts to soils have been encountered on the currently active Antelope Mine to date, and none are foreseen on the LBA tract. As stated previously, no prime farmland exists within the proposed lease area, and therefore none would be disturbed. Creek channels, pools, and other drainage features have been reconstructed at the existing Antelope Mine during reclamation, and similar reclamation techniques would be used on the LBA tract.

There has recently been some general concern expressed about levels of selenium in replaced topsoil and backfill within the Powder River Basin. Previous analysis on sampled soil series within the current Antelope permit area did not show levels of selenium over 0.1 part per million. Mean selenium concentrations in mine overburden are shown on Table 5. ACC is a participant in the Wyoming Joint Selenium Committee and has committed to adhere to the recommendations of the "Statement of Best Available Technology" prepared by that committee. At this time,

the chemistry of selenium in Powder River Basin soils is being studied to see if the current guidelines can reasonably be applied for this area. The joint committee is currently evaluating preliminary information and has planned additional studies before reporting results to the public.

The Wyoming Mining Association and the WDEQ/LQD have embarked on a comprehensive research program, in which ACC is involved, to address issues such as:

- appropriate analytical techniques for obtaining reproducible selenium measurements in soils;
- levels of selenium in vegetation on reclaimed areas and undisturbed ground;
- the interrelationship between selenium in soils and vegetation;
- the characteristics of selenium uptake by vegetation; and
- the potential for contribution of selenium to the groundwater or surface water resources from backfill areas.

The intent of this research is the potential promulgation, if appropriate, of rules for handling seleniferous soils to minimize or avoid long-term impacts to the environment. To date, impacts related to selenium have not been detected, and this research would help assure future selenium problems are not encountered. As further research provides additional information regarding reclamation practices as they pertain to selenium, ACC has committed to incorporate these as necessary into the reclamation plan (ACC Permit 525-T5 Renewal and Revision, Reclamation Plan, p. RP7-30, 1993).

4.1.4 Vegetation

Native vegetation types on the Antelope LBA tract are basically identical to those on the existing permit area. Mining the LBA tract along with the existing Antelope coal leases would increase the area of disturbance for the Antelope Mine, and thus the area of native vegetation removal for the mine, by 6.1 to 13.6%, depending on which alternative is chosen (see Table 14). Approximately 2,273 acres of the existing permit area had been disturbed by mining and mining-related activities, and about 155 acres had been permanently reclaimed at the Antelope Mine as of September 30, 1994 (ACC Annual Report to WDEQ/LQD, 1994).

Mining of the LBA tract under Alternative 1 would result in removal of about 77 acres of blue grama upland vegetation, about 90 acres of birdsfoot sagebrush lowland vegetation, about 14 acres of silver sagebrush lowland vegetation, about 8 acres of greasewood lowland vegetation, about 18 acres of bluebunch wheatgrass roughland vegetation, and about 256 acres of blue grama roughland vegetation. Approximately 20% to 30% of most types of premining vegetation would remain in

unmined portions of the LBA tract, except that no greasewood lowland vegetation would remain and about one-half of premining silver sagebrush lowland vegetation would remain. Modification of the LBA tract boundaries in accordance with Alternative 2 or Alternative 3 would be expected to result in vegetation removal rates comparable to those calculated for the LBA tract as applied for.

It is anticipated that the proposed lease would be revegetated using the same seeding processes and seed mixtures currently being used at the Antelope Mine, based on the similarity of the LBA tract to the existing mine. Seeding is done using drill and broadcast techniques. ACC uses three basic seed mixes: an upland range seed mix on the majority of the permit area; a channel seed mix in the bottoms of drainage areas; and a shrub mosaic seed mix on the lee sides of topographic highs or in shallow upland and lowland depressions conducive to big sagebrush development. These seed mixtures are subject to the approval of WDEQ/LQD. They are designed to provide self-sustaining vegetation communities of native plant species that would support the postmining land uses. ACC also occasionally transplants trees that are in the path of disturbance.

Native shrub species, including sagebrush, are included in the approved seeding mixtures; however, reclaimed areas in the Wyoming Powder River Basin are generally initially dominated by grasses. Existing permanent mine reclamation at the Antelope Mine is mostly upland range topography, and the shrub percentage on this land is less than 1%. Native shrub species do recolonize reclaimed areas, but the recolonization rate of shrub species such as sagebrush in reclaimed areas is not known. Estimates for the length of time required to establish shrubs at premining densities in reclaimed areas have ranged from 20 to 100 years. The actual time required to reestablish shrubs in a particular reclaimed area would be a function of the local topography, local weather patterns following reclamation, and land use following reclamation. Recolonization rates on the Antelope LBA would be expected to be similar to those in the existing permit area.

4.1.4.1 Threatened or Endangered Plants

There are no anticipated impacts to any federally listed threatened or endangered plant species as a result of leasing the Antelope LBA tract because there are no known occurrences of threatened or endangered plant species on the mine or in the LBA tract.

4.1.5 Land Use

During mining, portions of the Antelope LBA tract and adjacent areas would be unavailable for livestock grazing and wildlife use. At projected mining rates which peak at 12 million tons per year, new disturbance at the mine would average about 130 acres per year. Considering time required for topsoil and overburden removal in advance of mining and spoil grading and topsoil replacement following coal removal, the total area of disturbance at the mine at any given time would probably total 400 acres or more, exclusive of the area disturbed for facilities, railroads, haul roads, and

other out-of-pit disturbances. If the LBA tract is acquired under alternatives 1, 2, or 3, the total area of land disturbance at any one time is expected to be similar to that under the existing Antelope operation.

The reclamation plan must be designed such that the LBA tract would support both agriculture and wildlife use after mining. The WDEQ/LQD holds a reclamation performance bond on the land until it has been graded to the approved postmining topography. At that time the bond on that particular area may be reduced, but a portion of the bond would be held until postmining vegetation meets approved goals concerning species diversity, production, and cover. This bond is not released before a minimum of ten years. Grazing may resume on the reclaimed land prior to complete bond release.

Grazing and wildlife use on the existing mine would be restricted to unmined or reclaimed areas within the permit area during the life of the mine, and for at least ten years beyond that for the areas mined toward the end of the mine life. Mining of the LBA tract would result in a larger area of restricted use.

Public access to the Thunder Basin National Grassland areas within the LBA for hunting or other recreational purposes would be limited during the life of the mine. ACC has sporadically allowed hunting on restricted inactive portions of the permit area when circumstances allow this activity while assuring the safety of mine operations staff, hunters, and the public. No hunting was allowed during the last hunting season due to safety considerations. Hunting on the permit area in the future will probably remain sporadic, depending on the safety considerations during each hunting season.

4.1.6 Wildlife

The State of Wyoming is responsible for the management of wildlife in the state. BLM is responsible for managing wildlife habitat when making land use decisions involving federal surface or subsurface. In situations where BLM only administers the subsurface, we must consider the wildlife habitat impacts of our decisions, regardless of who owns the surface. BLM's habitat management responsibilities extend to game and non-game wildlife species.

Mining the LBA lease under alternative 1, 2, or 3 would disturb between 300 and 668 additional acres of winter/yearlong pronghorn habitat in the Lance Creek herd unit. This represents about 0.02% to 0.03% of the total occupied Lance Creek herd unit habitat and about 0.11% to 0.20% of the winter/yearlong habitat, depending on the alternative tract configuration that is chosen. The population within this herd unit was approximately 5 to 6 animals per square mile in 1992 (based on 4,329 square miles of occupied habitat and a WGFD 1992 post-harvest estimate of 23,566). During mining, pronghorn would be displaced from disturbed land, which could equal 400 acres or more at any one time. Undisturbed native habitat exists north, west and east of the tract, and the mine's reclaimed land would be available for wildlife use in previously mined areas. Pronghorn use of reclaimed areas at the Antelope Mine is seasonal at this point. More winter use of this land by pronghorn is expected as the

shrub component on reclaimed land increases; however, the carrying capacity of the reclaimed acreage for pronghorn would probably be reduced from premining levels as a result of topographic moderation and initially lower shrub densities. Due to the size of the proposed tract, leasing the Antelope LBA tract under alternatives 1, 2, or 3 would not significantly change the impacts to pronghorn that will occur as a result of currently permitted mining in this area.

Deer use both disturbed and reclaimed areas at Antelope regularly. The LBA tract is classified by WGFD as yearlong deer habitat. The 1993 winter big game count in the Antelope Mine study area, which includes the LBA tract, found an average of 1 deer per square mile. This compares to a 1992 post-season density of about 5.8 animals per square mile for the Thunder Basin Herd Unit, which has 3,065 square miles of occupied habitat. The deer prefer the bottomlands along Antelope Creek, which would not be directly disturbed by mining. The proposed tract represents about .03 of 1% of the Thunder Basin deer herd unit area. After mining, when native vegetation is established and the rolling topography is restored, the deer use at Antelope Mine (including the LBA tract) would be expected to return to a more normal situation.

There are no sage grouse leks on the proposed lease. Sage grouse use of the LBA tract is not high, and little or no brood-rearing habitat is found on the area. The impact of leasing and mining the tract would not be significant to sage grouse populations.

It is unlikely that raptor populations would be deleteriously impacted by development of the proposed lease. Very few raptors currently winter in the Antelope area. Under Alternative 1, the preferred alternative, one existing raptor nest would potentially be impacted. Two additional raptor nests are currently located in the area that would be added under Alternative 2, while none of the currently known raptor nests would be impacted under Alternative 3. Before ACC could mine the LBA, a new raptor mitigation plan would be completed as part of the required mining plan revision. Any nest sites that are still in existence as mining approaches would be relocated in accordance with that plan. Through 1991, five raptor stick nests (three ferruginous hawk ground nests and two tree nests used interchangeably by ferruginous and red-tailed hawks and great-horned owl) had been displaced by mining activities. Each nest was mitigated during seasons of inactivity to minimize possible impacts. There has not been any apparent reduction in area hawk populations due to mining activities or disturbance of nesting sites. Hawk sitings are common and steady or increasing hawk populations are assumed to be based in part on increasing populations of mice and small game. One pair of eagles whose nest was moved used the relocated nest for about a year, then constructed a new nest located just outside the mine disturbance boundary but still within the mine permit boundary. Prior to the disturbance of any raptor nest, special purpose permits were secured as necessary from both the USFWS Law Enforcement Division and the WGFD. Permit acquisition is coordinated through the USFWS Ecological Services Office in Cheyenne.

All active raptor nests within the Antelope Mine permit area are protected by buffer zones. Mine-related disturbances are not allowed to encroach the near vicinity of any active raptor nest from March until hatching. Disturbances near raptor nests containing nestlings is strictly limited to prevent danger to, or abandonment of, the young (ACC Permit 525-T5, Volume X, Appendix D9, Wildlife, "Mitigation Proposal for Golden Eagles and Other Large Raptor Nesting on or near the Antelope Coal Field"). The raptor mitigation plan applies to all nests on the Antelope permit area and must be updated each time new lands are added to the permit area, when the mine plan is significantly changed, or when the permit is renewed. Mitigation plans developed for the proposed LBA tract would be submitted to the USFWS for review and approval during the WDEQ/LQD permit application process.

The mountain plover is the only "migratory bird of high federal interest" (MBHFI) that has been identified as being of concern to the USFWS at the Antelope Mine (see Section 3.2.6, Table 5). There is a mountain plover use area on the LBA, and part of this area would not be available for mountain plover use during mining under any of the three leasing alternatives (see Figure 4). A habitat recovery and replacement plan for mountain plover approved by USFWS has been incorporated into the ACC WDEQ/LQD mining permit. This plan would be used to restore areas to a suitable condition for use by these birds following reclamation. The mountain plover use area on the LBA tract is small relative to other use areas on and near the permit area (see Figure 9), indicating that mountain plover in the region would have alternative use areas during mining of the LBA tract.

Because other MBHFI do not regularly use the area, mining would have a negligible impact on these species. No unique source of prey and no nesting habitat for bald eagles or peregrine falcons exists on or near the Antelope LBA tract; therefore, the impact of mining on these species would be negligible. Because no prairie dog towns exist on the LBA tract, there would be no impact on habitat for black-footed ferrets.

4.1.6.1 Threatened or Endangered Wildlife

No significant impacts to threatened or endangered wildlife species are anticipated as a result of leasing the Antelope LBA tract. The existing potential roosting habitat for bald eagle along Antelope Creek would not be disturbed. There is no suitable nesting habitat for peregrine falcons in the area. There are no prairie dog towns within the LBA tract, so there is no habitat for black-footed ferrets.

4.1.7 Cultural Resources

The entire LBA tract, under any of the three leasing alternatives, has been subjected to a Class III cultural resource inventory and has received cultural resource clearance under any of the three alternatives (see Section 3.2.7). All significant cultural resources located on the LBA tract or on adjacent lands within the limits of potential mining disturbance have been mitigated. All other known sites have been determined to be ineligible for registration on the NRHP. Lease and permit conditions

require that should previously unknown cultural sites be discovered, work in that area shall stop and measures taken to assess and protect the site. Should the boundaries of the affected area change, additional Class III survey work would be required prior to disturbance.

4.1.8 Paleontological Resources

No unique or significant paleontological resources have been identified on the LBA tract, and the likelihood of encountering significant paleontological resources 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 taken to assess and protect the site (see the special stipulation concerning paleontological resources cited in Section 2.1.1)

4.1.9 Visual Resources

No unique visual resources are found on the Antelope LBA tract. Removing and stockpiling overburden, extracting coal, and constructing facilities requires a major modification of landforms in coal lease areas. However, stringent reclamation guidelines require that these lands be restored to their pre-mine character to the extent practicable. Mining activities are already occurring in this area as a result of several nearby surface mining operations. One relocated county road and a railroad also affect visual classification of the LBA tract. The additional cumulative increment of mining on the LBA, when compared to the current visual classification, is not significant.

4.1.10 Noise

The proposed LBA lease is approximately the same distance from public access (County Road 37) as the existing operations. The nearest residence, a ranch house located next to Antelope Creek, is about 19,000 feet (3.6 miles) east of the southeast corner of the proposed lease area. The WDEQ/LQD regulates blasting noise and vibration from a mine within ½ mile of the mine permit boundary.

Potential onsite noise impacts to workers are regulated by the Mine Safety and Health Administration. The work-related hearing conservation programs of the Mine Safety and Health Administration are designed to ensure that impacts to workers on the proposed lease area are minimized. No workers would be housed at the mine site.

Section 3.2.11 of this report states that typical ambient noise levels at the mine are in the 40 to 60 db range, while the noise level in the immediate vicinity of mining operations is in the range of 85 to 95 db. Using the decibel unit of measurement for the relative volume or loudness of sound, it is possible to estimate the approximate distance one must be from a 100-db sound source in the mine to perceive a loudness of 40 db. The perceived loudness of sound (generally equated with intensity) decreases with increasing distance from the source of sound at a rate equal to the inverse square of the distance from the source of sound. The perceived loudness of

sound at a distance of 10 feet from the source of the sound is 0.01 times the loudness at the source, or:

$$0.01 = 1/10^2.$$

The base 10 logarithm of the ratio of two sound intensities is called a "bel." The commonly used unit of measurement for differences in sound intensity is the decibel (db), or 0.1 bel. A sound that is 10 times more loud (intense) than another sound has a loudness that is 10 db higher than the other sound, or:

$$\log_{10} 10 = 1 \text{ bel, and}$$
$$1 \text{ bel} = 10 \text{ db.}$$

A sound of 100 db is 1 million times more loud or intense than a sound of 40 db, or:

$$100 \text{ db} - 40 \text{ db} = 60 \text{ db,}$$
$$60 \text{ db} = 6 \text{ bels, and}$$
$$\log_{10} 1{,}000{,}000 = 6 \text{ bels.}$$

The distance required to reduce the perceived intensity of sound by a factor of 1 million would be 1,000 feet, or:

$$1{,}000{,}000 = 1{,}000^2.$$

Since the distance from the east side of the LBA tract to the nearest residence is approximately 19,000 feet regardless of the alternative LBA tract that is chosen, no noise impacts are anticipated from blasting or mining activities on the LBA tract.

4.1.11 Air Quality

ACC is currently authorized under Permit MD-108 issued by the WDEQ/AQD to mine at a rate of 12 million tons per year from multiple pits. The permit was issued based on the results of computer modeling that predicted that no violation of air quality standards would result from the mine plans. The modeling also showed that Antelope Mine emissions would not have any significant cumulative effect with neighboring mines (ENSR, 1990). The LBA tract is not closer to neighboring mines than the existing Antelope leases are.

The amount of air increment used by a particular operation is highly dependent upon the type of operation, the types of equipment, and the mining sequence. Under alternatives 1, 2 or 3, the air quality impacts would not be significantly different from those that would occur when Antelope Mine reaches full production of 12 million tons per year under the current mine plan. Acquisition of any of the three alternative LBA tracts would be used to increase the length of time during which full mine production occurs. No changes in mining methods are proposed if future mining operations include one of the alternative LBA tracts. There would not be additional sources of fugitive dust. The relative locations of emission sources, such as topsoil removal

areas, haul roads, and active pit areas, would change but the numbers and types of sources would not. ACC uses conveyors to move coal from the pit area to the preparation plant, so dust emissions are relatively independent of the distance from the pit to the plant.

Blasting, another source of emissions, would increase due to gradually increasing overburden thickness and increasing coal production, with or without the LBA. Mining at Antelope has historically occurred in an area of very thin overburden. Overburden is generally thicker on the remainder of the current lease and on the LBA tract.

Mining is currently being done south of Antelope Creek, although under the 525-T5 permit a pit is now being developed north of the creek. This pit would eventually extend through the LBA tract if it is acquired by ACC. Mining plans now on file with WDEQ/LQD show that coal production would increase to 12 million tons per year by 1999 and would remain at this level through year 2004. If the LBA tract as applied for is acquired by ACC, annual coal production would reach 12 million tons by year 1997 and it would be possible to sustain this production rate for about 18 years. ACC's current equipment is capable of producing coal at a rate of about 8 million tons per year. A larger coal handling facility would be required to achieve a production rate of 12 million tons per year. This facility would be constructed with or without the LBA tract and is included in the currently approved mine plan.

Before the LBA tract can be mined, even as an extension of an operating mine, the air quality permit must be amended and approved by WDEQ/AQD. While the amount of additional air quality resource that is available for future mining cannot be quantified without a rigorous technical evaluation, the analysis of emissions for the WDEQ/AQD permit modification would be similar to previous analyses since there are no proposed changes in mining methods or rates from the existing approved mine plan.

The net short-term effect to air quality would be determined ultimately through monitoring. Blasting is not a major source of emissions at Antelope Mine. The PM_{10} fugitive emissions inventory for the Antelope Mine showed that overburden and coal blasting comprise less than 1% of the total emissions at the mine. The major emission sources are overburden removal, wind erosion, and coal haul roads.

As with current operations, blasting and mining operations would at times be near County Road 37, making the dust from operations more visible to the public. The prevailing winds are westerly toward the relocated county road. Therefore, there is a potential for highway traffic to be affected on occasion by blowing dust as a result of the proximity of the pit to roads, with or without the LBA. Most of the traffic on this road are employees of the two neighboring mines. Specific mitigation addressing this for the existing operations is addressed in the current mine blasting plan. Specific mitigation for the LBA would be addressed in a revised mine blasting plan if the LBA is acquired.

In summary, the Antelope Mine is operating within the requirements of their current air quality permit. The mine proposes to mine the existing lease and the LBA using similar equipment and similar emission control methods. The overburden and coal thicknesses on the LBA are similar to parts of the existing coal leases. The mine does not propose to increase production above the currently permitted maximum rate of 12 million tons per year, with or without the LBA, but acquisition of the LBA will allow production at the maximum rate for a longer period of time. As a result, the air quality impacts of mining the LBA would not be expected to be significantly different than those predicted for mining the existing leases at the maximum permitted rate. Mining the LBA would extend the period of maximum production and result in relocation of some emission sources over time. Before the LBA could be mined, an amendment to the current Antelope Mine air quality permit must be approved by WDEQ/AQD.

4.1.12 Transportation Facilities

Mining the Antelope LBA tract by ACC would not increase the current level of impact on County Road 37 other than the potential for increased dust, as discussed above under air quality. As discussed in Section 1.1 and 1.2, no coal would be removed from within the railroad right-of-way because it has been designated unsuitable for mining. As discussed in Section 3.2.13, County Road 37 was relocated to its present location around the east side of the mine, adjacent to the BN/C&NW Railroad track, in 1993. This is intended as a permanent location, and the relocated road has been paved. It would not be necessary or economically feasible to move the road again under any of the leasing alternatives.

Essentially all of the coal mined at the Antelope Mine is transported by rail. The addition of the LBA will extend the period over which Antelope would produce at their maximum permitted rate of 12 million tons per year, which would extend the period over which this amount of coal would be transported at this rate from the mine.

No active pipelines cross the LBA tract under any leasing alternative. Relocation of an abandoned pipeline that crosses the tract (Figure 7) would be handled according to existing agreements when the need arises.

4.1.13 Socioeconomics

If the LBA tract is leased to ACC to extend the life of the Antelope Mine, a new mine and reclamation plan would be developed to show a logical mining sequence from the current pit into the LBA tract. Coal production would occur from both the LBA tract and the existing lease simultaneously. Although a new mine plan has not been fully designed, pending the outcome of the lease sale, ACC has made preliminary plans to include this tract in the Antelope mining sequence. These plans show coal production from the mine increasing to 12 million tons per year with or without the LBA. Production is weighted toward the current leases in the early years, since the LBA tract would be mined as a continuation of the northeast pit which would be initiated on the existing leases and extended northward into the LBA.

Employment at Antelope Mine currently averages about 100 employees. This results in annual wages to mine employees of about $4.5 million. Employment is predicted to increase slightly through 1997, when maximum production is expected to be reached. Without the additional coal in this LBA, the maximum production rate would be sustained for about 6 years. With the LBA tract as applied for, the maximum production rate would be sustained for a longer period. Thus, wages would probably continue at the maximum level for a longer period of time if the LBA as applied for is leased and mined. With or without the LBA tract, coal production and related employment are projected to cease after the year 2016.

Boomtown effects would not be created under alternative 1, 2 or 3 because maximum annual mine output (as well as labor and wage levels) would not increase from the current projected rate if ACC is the successful LBA tract bidder. Mining the LBA tract as a maintenance tract would extend the duration of maximum coal production at Antelope Mine, which would allow maximum staffing levels to be maintained for additional years.

If the tract is leased as proposed under alternative 1, 2 or 3, payment of royalties and taxes on coal production at the maximum rate would also be extended for additional years. Royalties and taxes that are paid on coal production include ad valorem taxes, severance taxes, sales and use taxes, Federal taxes (e.g., Black Lung and Reclamation), and Federal royalties. A study of the economic impacts of coal on Wyoming's economy prepared by the University of Wyoming estimated that for each train of Wyoming coal produced in the Powder River Basin during 1991, coal mines paid approximately $21,542 in taxes and federal royalties (Borden, et. al; University of Wyoming, 1994). In this report, the direct benefits to Wyoming per train were estimated at approximately $11,559.

Ad valorem taxes paid in 1993 on 1992 coal production in Wyoming amounted to $71,003,029. The assessed valuation of production that year was $1,124,159,350. Ad valorem tax is paid on production and property (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994). The 1993 rate was set at 6.316%. The assessed valuation per ton of coal was $5.92. The majority of these taxes are paid directly to the originating county.

Statewide, 1993 severance taxes and capital facilities taxes imposed on 1992 coal production amounted to $93,070,880 (State of Wyoming; Department of Commerce, Economic and Community Development Division, 1994). This tax was assessed on a coal production with an average 1992 price of $8.14 per ton (Wyoming State Geological Survey, February 1994, Table 3). In 1992, the severance tax on coal in Wyoming was set at a rate of 8.5% of the market value for surface mines and 5.25% of the market value for underground mines. In 1993, the severance tax rate dropped to 7% for surface mines and 3.75% for underground mines. Severance taxes are paid directly to the State of Wyoming. Wyoming's general fund and the permanent mineral trust fund receive the largest shares of the severance taxes (each 23.5%), followed by the water development and capital facilities revenue accounts

(each 17.6%), and the highway fund (11.8%), with the remainder to the budget reserve account (6%) (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994).

In 1993, sales and use taxes on Wyoming's coal industry totaled about $8.8 million (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994). The state sales tax rate was increased in 1993. Sales and use taxes are distributed between the state and the counties.

Federal black lung and reclamation taxes are based on production levels. They do not directly benefit the state.

Federal royalties of 12.5% of the market value of the coal are paid to the Federal government for production of coal from Federal lands. Royalty revenues would be $22.8 million under Alternative 1 (57 million tons of coal), $32.8 million under Alternative 2 (82 million tons of coal), and $14.8 million under Alternative 3 (37 million tons of coal) assuming a conservative price of $3.50 per ton, which is within the range of currently projected spot prices for Gillette area coal and close to the 1993 unit valuation for Converse County coal (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994). The Federal government returns 50% of these royalties to the state, and these funds are distributed as follows: Foundation Program--34.5%, Highway Commission for Counties--25.25%, University of Wyoming--6.75%, Highway Commission for Districts--2.25%, Incorporated Cities and Towns--7.5%, Capital Construction for Cities, Towns, Special Districts--7.5%, and Capital Construction for Schools, Community Colleges, and the State--15.25% (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994).

The 1993 unit valuation on coal produced in Converse County was $3.34 per ton, compared to a statewide average of $5.92 (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994). Assuming a future price of $3.50 per ton, the market value of the additional 57 million tons of recoverable coal leased under Alternative 1 would be about $199.5 million ($287 million for the 82 million tons under Alternative 2 and $129.5 million for the 37 million tons under Alternative 3). This is in addition to the expected market value of the coal from the existing Antelope leases. Estimated economic multipliers for determining the total economic impact to the local area from the additional coal range from 1.473467 (Borden; University of Wyoming, 1993) to 1.796 (Taylor, Campbell County Economic Development Corporation, 1993). Based on these economic multipliers and the above spot coal prices, the total economic impact to the local area from the additional coal in the LBA tract would range from $294 million to $358 million ($423 to $515 million under Alternative 2 and $191 to $233 million under Alternative 3), based a unit valuation of $3.50 per ton. Since long-term contract prices are generally higher than spot coal prices, the economic impacts would be larger if long-term contracts can be negotiated.

The state also receives half of any bonus bids the Federal government receives when the coal is leased. Bonus bids received for the five previously issued coal LBA tracts have ranged from 11.1 cents/ton to 29.1 cents per mineable ton of coal (see Table 1). The total bonus amount of the bonus bids for the five previously issued LBAs is $213,982,377.69. The bonus bids are payable over five years.

4.1.14 Waste Management

Waste is generated during mining operations at the Antelope Mine, as at all mines. Non-hazardous waste, which is similar to domestic or municipal solid waste, is currently disposed of both on-site and off-site. A commercial waste hauler removes office and shop wastes to a commercial landfill. Most of the larger wastes generated at the Antelope Mine that are not recycled are disposed of in the pit backfill. Disposal of these non-hazardous solid wastes, which include scrap iron, scrap lumber, packing material, and other items that are too large to haul to a landfill, is permitted under the mine's existing WDEQ/LQD permit to mine. Changes in the location of the solid waste pit, necessitated by pit advancement, are reported in the annual reports to WDEQ/LQD. A sign identifying the solid waste pit location is situated at each access to the site.

At Antelope Mine, materials that may be classified as hazardous, or are handled as hazardous, include some greases, solvents, paints, and other materials determined to be hazardous by the EPA under the Resource Conservation and Recovery Act. These types of wastes are disposed of at an EPA-permitted hazardous waste facility.

Waste oil removed from oil changes and routine maintenance is collected and stored in a waste oil storage tank. The waste oil storage tank is constructed and approved as an above-ground storage tank. The waste oil is removed by a private contractor for approved off-site energy recovery.

4.1.15 Other Effects Considered

Human health and safety, prime lands, global warming, consumers, civil rights, minority groups, women and other environmental factors listed in Forest Service Handbook 1909.15 Chapter 61, have been considered and would not be adversely affected.

4.2 Impacts of Alternative 4: No Action Alternative

Under this alternative, the Antelope LBA tract would not be leased. Disturbance of land on the tract would be limited to disturbance associated with overstripping necessary to recover coal within the current lease boundary. This disturbance would affect roughly 95 acres. The rest of the proposed lease area would remain undisturbed by mining. Except for the overstrip area, the basic topography and the geology underlying the lease area would not be affected. Aquifers in the coal and overburden on the LBA tract would not be physically removed and replaced, and

drawdown in the coal and overburden aquifers would be that associated with the current mining operation. Changes to the existing drainage system on the tract would be limited to the area of overstrip. The air quality would be altered primarily by the fact that the mining rate would begin to decline after 2004. Mining would not extend beyond the year 2016, with or without the LBA tract.

The economic benefits attributable to the LBA tract, including employees' wages, taxes and royalties, would be foregone under this alternative. There would be a loss of potential income from the sale itself (the bonus bid). There would be no income from future royalty revenues on approximately 57 million tons of recoverable coal (82 million tons under Alternative 2 and 37 million tons under Alternative 3) to the federal government, half of which would go to the State of Wyoming. Total royalty revenue on 57 million tons of recoverable coal would be $22.8 million under Alternative 1, $32.8 million for 82 million tons of recoverable coal under Alternative 2, and $14.8 million for 37 million tons of recoverable coal under Alternative 3 at a conservative price of $3.50 per ton, which is within the range of currently projected spot prices for Gillette area coal and close to the 1993 unit valuation for Converse County coal (State of Wyoming; Department of Commerce, Economic and Community Development Division, Energy Section, 1994). Economic losses would also affect the individual communities. Antelope Mine's current mine plan shows coal production ceasing after year 2016. It is anticipated that employment at Antelope, and the associated economic benefits to the local communities, primarily Douglas, would not extend beyond 2016 with or without the acquisition of additional reserves; however, under Alternative 4, the period of maximum employment at the Antelope Mine would be less than under alternative 1, 2, or 3.

The impacts of Alternative 4 would potentially be permanent for most, if not all, of the coal resources underlying this tract. If the coal in this tract, particularly in the eastern portion, is not leased and mined with the current Antelope Mine operation, it would become a narrow finger of coal which would potentially be bypassed because it would not be economically recoverable by another operator. The tract is bordered by the existing Antelope leases on the south and east, and by the county road and railroad mainline on the north and northeast.

4.3 Regulatory Compliance

A number of impacts related to surface coal mining that are routinely mitigated during the mine permitting process are described below. Mitigation of these impacts is required by SMCRA. As a result, this mitigation is not included in the following section on mitigation measures.

Impacts to topography caused by mining can be partially mitigated by proper design of the postmining surface. The design of the postmining topography would be reviewed by WDEQ/LQD during the permit application process. Specific recommendations pertinent to the Antelope LBA tract include providing stable channels that have natural-appearing meanders and pools, and rockpiles and shrub

mosaics designed and located so as to give a natural appearance and provide wildlife habitat and cover.

Impacts to groundwater quality can be partially mitigated by special handling of chemically undesirable overburden materials to assure that these materials are placed so as to minimize adverse effects on water quality. All mine permit applications submitted to WDEQ/LQD must include baseline data on overburden geochemistry and special handling plans for unsuitable materials. Development of channel pools and ponds on the reclaimed surface, similar to what ACC is proposing at the existing Antelope Mine, helps conserve surface water resources and resaturate the spoils aquifer. Because Antelope Mine is in a groundwater discharge area and is expected to remain so after reclamation is complete, a change in groundwater quality has little potential to impact off-site areas.

Impacts to groundwater supplies would be mitigated in accordance with state law. SMCRA and state regulations require that valid water rights which are interrupted by mining be mitigated by replacement with water from an alternate source of equivalent quality and quantity. Typically, wells which go out of production due to mine-related drawdown are replaced with deeper wells completed in formations below the coal.

Special care must be taken to provide stable channels on the reclaimed surface. The design of stable drainage basins is critical to the success of the overall reclamation plan, and this issue receives considerable attention during the permit process.

Impacts to soils can be mitigated by proper identification and handling of topsoils, protection of stockpiled and replaced soils from erosion hazards, and revegetating replaced soils as rapidly as possible. Nutrients lost during handling or stockpiling can be replaced. The erosion control, reclamation and revegetation program outlined by ACC and implemented on the adjacent Antelope Mine has provided an effective program that ensures successful erosion control and restoration of all land disturbance.

Continued emphasis on increasing vegetal species diversity on reclaimed lands, and particularly on establishing shrublands, would help increase use of reclaimed land by shrub-dependent wildlife species. Continued sampling and monitoring studies, such as those conducted by ACC, would provide valuable data for continuing improvements in revegetation practices.

Wildlife habitat impacts can be mitigated in part by continuing to consider wildlife habitat in the reclamation planning. Mitigation elements include topographic features such as rockpiles and playas; riparian features such as channel pools, islands, and impoundments; and revegetation features designed for wildlife, such as shrublands and trees where conditions permit. Although not all these elements are part of the premining landscape on the Antelope LBA, they would help to restore and/or enhance wildlife habitat on the area. Continued monitoring would provide

important feedback concerning the effectiveness of these measures and, hence, important data for future designs. Mitigation efforts would continue to include relocation of affected raptor nests and consideration of raptor nest sites in reclamation planning. The results of ACC's mountain plover studies would help provide information necessary to restore habitat for this important species.

There are currently no operating oil or gas wells within the LBA tract. Should any leases become active before mining enters the area, a mine plan study would have to be developed to address any impacts on the mining operation. Alternatives to manage any conflicts with such wells could include an economic evaluation to determine if they could be purchased or temporarily plugged and restored when mining has been completed. Under the Federal Land Policy and Management Act of 1976, multiple use and concomitant development of natural resources are governed by the Department of the Interior. The Department of the Interior has developed guidelines to address this type of situation. Moreover, the leased lands are managed according to the resource management plans. The coal lessee would need to coordinate the development of an agreement with the oil and gas lessees to facilitate maximum utilization of the mineral resources.

No cultural resource sites eligible for the NRHP that have not already been mitigated were identified within the potentially affected area. Should any previously unknown sites be discovered during mining, these would have to be evaluated for eligibility. Impacts to cultural resources are addressed through the Section 106 process of the National Historic Preservation Act of 1966, as amended, and through other appropriate legislation and regulations. This specifies that the federal land managing agency, in consultation with the Wyoming SHPO, would make final eligibility and effect determinations for all sites located within the proposed lease area. If any sites are found to be eligible for the NRHP and cannot be avoided, then an appropriate treatment plan would have to be developed and implemented prior to mining, in accordance with 36 CFR 800 and other relevant regulations.

Effects on transportation are not expected at the Antelope Mine. If conditions change and effects do occur, they can be mitigated by: timely relocation of highways to avoid inconvenience to commuters and other travellers, controlling dust to avoid visibility problems, and relocation of gas pipelines to avoid service interruptions.

All hazardous materials generated on the proposed lease area would be handled in accordance with current or future regulations.

4.4 Mitigation Measures

The purpose of many of the requirements of SMCRA, as well as Wyoming laws governing surface coal mining, is to ensure that surface coal mining impacts are mitigated. As a result, mitigation of impacts caused by surface coal mining are routinely resolved during the mine permitting process, as indicated above. Additional mitigation measures are not generally necessary due to the reclamation requirements of SMCRA and Wyoming state statutes. If impacts are identified during the leasing

process that cannot be mitigated during the permitting process within the range of authority of SMCRA or state statutes, stipulations designed to mitigate these impacts can be attached to the lease by BLM. In the case of the Antelope LBA, no impacts have been identified that would require mitigation beyond that required by SMCRA or by Wyoming law.

4.5 Residual Impacts

Despite reclamation planning and implementation of mitigating measures, there are impacts of mining that remain after reclamation is completed. The residual impacts on the LBA tract would be expected to be similar in nature and scope to the residual impacts for the existing mine because the LBA is similar to the existing mine. If the Antelope LBA is leased, the size of the area of disturbance at the Antelope Mine would increase by 6.1 to 13.6%, depending on the type of impact and which alternative is chosen (see Table 14).

The coal aquifer and any overburden aquifers would be replaced with spoil material. While indications are that this material functions as an aquifer and, in fact, is resaturating more quickly than generally predicted (p. 156, Martin et. al; U.S. Geological Survey, 1988), it would be some time before the spoils are fully saturated and a steady-state flow pattern is reestablished. In the meantime there would be no shallow groundwater source in portions of the reclaimed areas. Just as during mining, alternative sources of water would be required for these areas until the spoils aquifer can sustain water uses.

During resaturation of the spoils aquifer and re-establishment of a steady-state flow pattern through the spoils aquifer to the premining discharge areas along Antelope Creek, water quality in the spoils aquifer may be temporarily degraded compared to premining water quality in the coal. Studies indicate that concentrations of leachable minerals in groundwater should increase during saturation of backfilled overburden but should decrease to equilibrium levels that are comparable to premining values after passage of about two pore volumes of groundwater through the overburden. Groundwater discharge comprises about 6% of the Antelope Creek mean annual flow. Baseline Antelope Creek surface water quality is such that even worst-case estimated overburden groundwater quality should minimally impact surface water quality in Antelope Creek (ACC, Permit 525-T5 Renewal and Revision, Reclamation Plan, 1993).

Coal-aquifer drawdown toward the north and west of the mine could persist for several years after mining is completed. Few wells are completed in the coal in this direction because of the greater depth of the coal.

There would be some topographic moderation of the tract following reclamation. This is a permanent impact resulting in a reduction in habitat diversity and wildlife carrying capacity for some wildlife species. The LBA tract is similar topographically to the existing lease.

Re-establishment of stable native rangeland vegetation diversity, production and cover on the tract, including re-establishment of shrubs at premining densities, could take 10 to 100 years. This could also decrease carrying capacity for some species.

4.6 Cumulative Impacts

There are 19 operating mines and 1 proposed mine in the Powder River Basin of Wyoming (see Figure 12 and Table 16). (Note: The Clovis Point/East Gillette Mine was inactive for several years; however, production resumed at that mine in 1994). The Wyoming BLM has received 10 lease applications in the Powder River Federal Coal Region since it was decertified. Five leases, representing 6 of these applications, have been issued (see Table 1 and Figure 12). Four of these leases were maintenance-type tracts adjacent to operating mines. The fifth lease, West Rocky Butte, is adjacent to an undeveloped lease issued after the 1982 regional sale, and a new mine is proposed there. The BLM currently has 4 maintenance-type LBAs under consideration for leasing in the Wyoming portion of the Powder River Basin (see Table 1). In addition to the proposed Antelope LBA tract, the North Rochelle, Jacobs Ranch and North Antelope/Rochelle mines have pending applications for coal tracts adjacent to their current operations. The Montana BLM has received two lease applications within the decertified Powder River Federal Coal Region.

NEPA requires that cumulative as well as site-specific impacts of proposed federal actions be considered as part of the decision-making process. According to the Council of Environmental Quality, *cumulative impact* is 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 nonfederal) or person undertakes such other actions. Cumulative actions can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). In this case, concerns center about cumulative impacts of coal leasing when considered with coal mining and other known activities which cause impacts in the Powder River Basin of Wyoming. The impacts specific to the Antelope LBA are addressed in the preceding sections of this EA. This section is intended to evaluate whether the impacts of issuing the Antelope lease become more significant when considered with other activity in the Powder River Basin.

Prior to the decertification of the Powder River Coal Region, there were approximately 7.797 billion tons of federal coal underlying 102,426 acres under lease in the Wyoming portion of the Powder River Basin. This represented about 1.07% of the area of the Wyoming portion of the basin, assuming it occupies approximately 15,000 square miles in northeastern Wyoming. Since decertification, 5 new leases containing approximately 1.203 billion tons of minable coal underlying 9,787.5 acres have been issued (see Table 1), 1 lease containing roughly 180 million tons of coal underlying approximately 3,300 acres has been terminated due to failure to meet diligence (Keeline), and several other smaller, administrative lease adjustments (for example, 3 lease modifications involving approximately 214 acres) have been

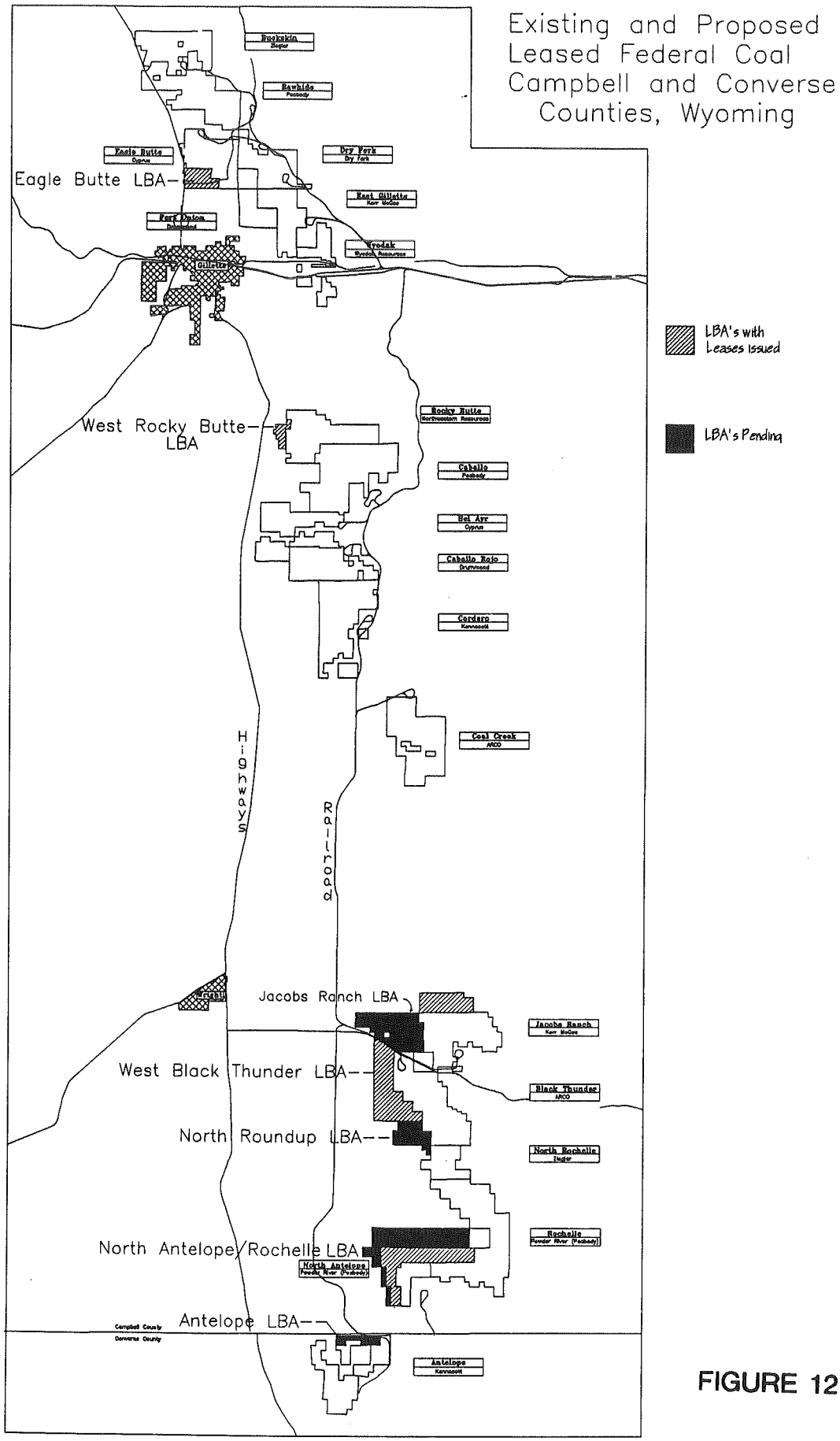

Existing and Proposed
Leased Federal Coal
Campbell and Converse
Counties, Wyoming
LBA's with Leases Issued
LBA's Pending
Eagle Butte LBA
West Rocky Butte LBA
Jacobs Ranch LBA
West Black Thunder LBA
North Roundup LBA
North Antelope/Rochelle LBA
Antelope LBA
Highways
Railroad
Gillette
Wright
Buckskin
Rawhide
Eagle Butte
Dry Fork
East Gillette
Fort Union
Wyodak
Rocky Butte
Caballo
Bel Ayr
Caballo Rojo
Cordero
Coal Creek
Jacobs Ranch
Black Thunder
North Rochelle
Rochelle
North Antelope
Antelope
Campbell County
Converse County

FIGURE 12

Table 16. Mine Sites Addressed in Previous Regional Analyses

MINE	OPERATOR	STATUS	1974 EIS	1979 EIS	1981 EIS	1984 EIS
Antelope	Antelope Coal Co.	(3)	XXX		XXX	XXX
Belle Ayr	AMAX Coal West, Inc.		XXX	XXX	XXX	XXX
Black Thunder	Thunder Basin Coal Co.	(1)	XXX	XXX	XXX	XXX
Buckskin	Zeigler Coal Co.			XXX	XXX	XXX
Caballo	Caballo Mining Co.			XXX	XXX	XXX
Caballo Rojo	Caballo Rojo, Inc.			XXX	XXX	XXX
Clovis Point/ East Gillette	Kerr-McGee	(2)		XXX	XXX	XXX
Coal Creek	Thunder Basin Coal Co.			XXX	XXX	XXX
Cordero	Cordero Mining		XXX	XXX	XXX	XXX
Dave Johnston	Pacificorp		XXX	XXX	XXX	XXX
Dry Fork	Dry Fork Coal				XXX	XXX
Eagle Butte	AMAX Coal West, Inc.	(1)	XXX	XXX	XXX	XXX
Fort Union	Fort Union Ltd.				XXX	XXX
Jacobs Ranch	Kerr-McGee	(1),(3)	XXX	XXX	XXX	XXX
Keeline		(5)			XXX	XXX
North Antelope	Powder River Coal Co.	(1),(3)	XXX	XXX	XXX	XXX
North Rochelle	Zeigler Coal Co.	(3)			XXX	XXX
Rawhide	Caballo Mining Co.		XXX	XXX	XXX	XXX
Rochelle	Powder River Coal Co.	(1),(3)	XXX	XXX	XXX	XXX
Wyodak	Wyodak Resources Development Corp.		XXX	XXX	XXX	XXX
Rocky Butte	Northwestern Resources Co.	(1),(4)			XXX	XXX
TOTALS: 21 (19 Mines, 1 Proposed Mine & 1 Terminated Lease)			11	15	20	20

(1) LBA application approved/lease issued
(2) Recently inactive, now active
(3) LBA application on file
(4) Proposed mine
(5) Lease terminated in 1992 due to failure to meet diligence requirements

approved. As a result, there are currently approximately 8.827 billion tons of federal coal underlying approximately 109,318 acres under lease in the Wyoming portion of the Powder River Basin. This represents about 1.14% of the surface of the Wyoming Powder River Basin. There are currently 4 pending LBAs containing approximately 1.18 billion additional tons of coal underlying about 10,076 acres in the Wyoming Powder River Basin. In all, the recently issued and pending LBAs contain approximately 2.385 billion tons of coal underlying approximately 19,900 acres. The 2.385 billion tons of coal represent approximately 11 years of reserves for the Wyoming Powder River Basin at the 1994 coal production rate of 217 million tons. The 19,900 acres in the issued and pending LBAs represents 2 tenths of one percent (0.2%) of the Powder River Basin, again based on an estimated size of 15,000 square miles for the basin in Wyoming. The 19,900 acres represent approximately 3.4% of the combined areas of Campbell and Converse counties (5,803,321 acres). For Converse County, federal coal leases currently account for about 0.66% of the

county. That number would increase to about 0.69% if the Antelope LBA as applied for (Alternative 1) is leased.

The following discussion of cumulative impacts includes a comparison of the actual coal activity occurring in the Wyoming portion of the Powder River Basin in 1990 with the activity predicted for 1990 in four previously prepared regional environmental impact statements on coal mining in the basin. The actual data for 1990 is used for this comparison rather than the most recent data because that is a year for which predictions were made in the regional EISs. Coal production reported for the Wyoming Powder River Basin in 1994 was 54.3 million tons greater than production reported for 1990.

4.6.1 Actual and Predicted Coal Activity in the Wyoming Powder River Coal Region

This cumulative impact analysis updates the cumulative analysis which is contained in each of four regional EISs prepared during the 1970s and early 1980s. The four analyses are:

- *Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming,* BLM, October 1974.
- *Final Environmental 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.

This update provides an assessment and analysis of cumulative environmental impacts based on current coal production and presently anticipated levels of regional development activity. The analysis reviews cumulative impacts identified in the above referenced EISs as compared to the actual development activity which has occurred. This cumulative analysis also considers data, monitoring results, and research done since the EISs were prepared, or in response to impacts identified in these EISs. These new data provide a further assessment of cumulative impacts resulting from the leased and pending lease-by-applications.

The Antelope lease-by-application is located in the Eastern Powder River Coal Basin, which includes Campbell and Converse counties, Wyoming. In the 1970s and early 1980s there was a great deal of interest and activity in mining existing leases and acquiring new federal coal leases. As a result, the four referenced regional EISs were prepared. Each of these regional EISs identified and discussed the regional, cumulative impacts resulting from coal development, coal related development, and other regional activities, based on reasonably foreseeable development scenarios at that time. All of the currently operating and proposed mines in the Eastern Powder River region, including those which have recently requested or been issued LBAs,

were specifically addressed in one or more of these EISs, as shown in Table 16. The Antelope Mine was addressed in the 1974, 1981 and 1983 EISs.

Each regional EIS predicted coal mining activity into the future and included estimates of future numbers of mines, production levels, and acreage disturbances. Coal-related developments, such as power plants, coal gasification, and other coal conversion industries were predicted. Other regional activities such as oil and gas, uranium, and any other known major development activities were also predicted. Then an analysis was developed to identify and evaluate impacts of all of these activities taken together.

Table 17 compares the coal-mining and other activities that had actually taken place in the region as of 1990 with the coal mining and other activities that were predicted for 1990 in the four regional EISs. The table includes the actual 1994 activity, after four new leases were issued. The cumulative impact analysis for each of the regional EISs is based on the predicted levels of activity shown in Table 17.

Table 17. Actual and Predicted Cumulative Regional Activity, Eastern Powder River Coal Region, Campbell and Converse Counties, Wyoming

Activity	1994 Actual Activity	1990 Actual Activity	1974 Predictions of 1990 Activity	1979 Predictions of 1990 Activity	1981 Predictions of 1990 Activity[1]	1984 Predictions of 1990 Activity[2]
No. of Producing Uranium Mines[3] (mining projects + in situ projects)	3[4]	1[4]	8	13	Not Available	14
No. of Power Plants	3	3	6	2	2	2
No. of Gasification Plants	0	0	2	1	1	0
Population	43,975[5]	40,498[6]	65,600	59,400	69,000	62,300
No. of Producing Coal Mines	19	18	14	15	38	37
Coal Production (millions of tons)	216.9[7]	162.6	150	174.3	303.2	292.1
Leased Federal Coal (millions of tons)	8,827	7,796.5	Not Available	Not Available	Not Available	Not Available
Acres of Leased Federal Coal	109,318	102,426	Not Available[8]	Not Available	Not Available	Not Available

[1] The 1981 EIS covered the entire Powder River Basin. Data for Campbell and Converse counties was extracted or calculated from data for Alternative 3C (the preferred alternative) for Wyoming and Montana.
[2] The 1984 EIS covered the entire Powder River Basin. It was not finalized and the actions proposed were never taken. Data for Campbell and Converse counties was calculated from the Baseline (No-Action) Alternative for Wyoming and Montana.
[3] The number of uranium mines is for the entire Wyoming Powder River Basin, not just Campbell and Converse counties.
[4] Source: "Wyoming Geo-Notes", Nos. 29 and 44 (published by the Wyoming State Geological Survey).
[5] Source: Campbell County Economic Development Corporation "Community Profile", 1/95; and personal communication, Converse County.
[6] Data from 1990 Census Results for Wyoming Counties/Municipalities.
[7] Source: "Annual Report of the State Inspector of Mines of Wyoming for the year ending 12/31/94.
[8] In 1974, 93,075 acres of coal were leased, 96,517 acres of coal were included in Preference Right Coal Lease Applications, and 157,861 acres of coal were included in competitive coal lease applications.

The actual level of development which occurred by 1990 is within the range of predictions made for that year in the referenced EISs (see Table 17). In retrospect, the predictions made in the 1979 EIS were the closest predictions to actual 1990 activity. This is explained by the fact that the 1981 and 1984 EISs assumed higher levels of new leasing and more development of new leases and pending preference right lease applications (PRLAs) than actually occurred. In reality, market conditions have not favored the development of new mines that was anticipated in the 1981 and 1984 regional EISs. No new mines (mines that were not addressed in the regional EISs) have opened or are planned. There are no remaining PRLAs in the Wyoming Powder River Basin; they have been relinquished since the regional EISs were prepared.

Many of the impacts of the development activities are related to the amounts of surface disturbance and new employment from the predicted coal-mining activity. Table 18 shows the 1990 predictions for each regional EIS as to acres disturbed, acres reclaimed, and employment. This table also illustrates surface disturbance, reclamation, and employment that actually had occurred or existed in 1990. As discussed previously, actual data from 1990 is used because predictions were made for that year in the regional EISs.

Table 18. Actual and Predicted Cumulative Surface Disturbance and Employment Related to Surface Coal Mining, Eastern Powder River Coal Region, Campbell and Converse Counties

	Actual 1990 Levels	1974 Predictions of 1990 Levels	1979 Predictions of 1990 Levels	1981 Predictions of 1990 Levels	1984 Predictions of 1990 Levels
Acres Disturbed	31,823	13,877	22,794	48,400[1]	32,400[1,2]
Acres Reclaimed	9,199	4,132	12,666	34,100[1]	22,800[1,2]
Coal Employment	2,862	5,200	3,899	11,900	11,500[2]

[1] This EIS covered entire Powder River Basin. The Wyoming portion is calculated from Montana and Wyoming total disturbance using reclamation acreage and the assumptions about mining and reclamation rates given in the EIS.
[2] Baseline "No Action" alternative used from EIS. The 1984 EIS was not finalized; thus the proposed actions were not taken.

Sources of 1990 data: 1990 Annual Mine Reports for Eastern Powder River Basin Mines, BLM Casper District Records, "Annual Report of Mines of Wyoming" through 12-31-90.

Cumulative surface disturbance as of 1990 was about 32,000 acres. This is within the range of predictions of the referenced EISs. Cumulative disturbance represents about one half of one percent of Campbell and Converse counties. The disturbed acreage is being reclaimed, about one third of the already disturbed areas had been contoured, topsoiled and reseeded as of 1990. The actual reclaimed acreage in 1990 was also within the range of predictions made for 1990 in the regional EISs.

4.6.2 Cumulative Impacts Related to Existing Surface Coal Mining in the Powder River Basin

There are currently three active mines located near the Converse-Campbell county line, the Antelope Mine, the North Antelope Mine, and the Rochelle Mine (see Figure 12). The North Antelope and Rochelle mines are in Campbell County, the Antelope Mine is in Converse County. The North Antelope and Rochelle mines recently acquired additional coal under the LBA regulations (see Table 1). One other active surface coal mine is located in Converse County, the Dave Johnston Mine, near the town of Glenrock.

The acreage disturbed by surface coal mining in the Powder River Basin was specifically analyzed in the referenced EISs, and no unique soils, vegetation, or habitat types were identified as being impacted. This conclusion can be extended to the LBAs, according to their site-specific EAs and EISs.

The success of revegetation (reclamation) depends on the ability of the plant communities being re-established to perpetuate themselves under the indigenous environmental conditions of an area, such as moisture distribution during the growing season, wind, temperature extremes, and drought. The reclaimed land must meet postmining land use objectives. As a rule, successful reclamation of land disturbed by coal mining depends on a combination of intensive reclamation practices and adequate, timely precipitation.

Successful establishment of vegetative cover, according to the requirements of OSM as administered by WDEQ/LQD, has been demonstrated at many mines in the Powder River Basin, including Dave Johnston, Black Thunder, Belle Ayr, Eagle Butte, Big Horn, Jacobs Ranch, Decker, and Rosebud. After a mined area has been reclaimed and reseeded with an approved permanent seed mixture, a portion of the required reclamation performance bond is held until postmining vegetation meets approved goals concerning species diversity, production, and cover. This bond is held a minimum of 10 years. According the WDEQ/LQD, one mine in the Wyoming portion of the basin has received final bond release on a portion of their reclaimed acreage to date.

Re-establishment of shrubs, particularly sagebrush, on reclaimed lands in the Powder River Basin of Wyoming has been a controversial issue in recent years. Reclaimed areas have been initially dominated by grasses. On the one hand, shrubs, particularly sagebrush, are an important component of habitat for some wildlife species, including sage grouse and pronghorn, and their absence can reduce the carrying capacity for those species on reclaimed land. On the other hand, reestablishment of sagebrush and other shrubs is a difficult and expensive process; the land returns to the surface owner after reclamation is completed and all bonds on the reclaimed land have been released; and shrubs such as sagebrush are not considered to be desirable by the ranching community on land reclaimed for use as grazing land. Sagebrush would naturally recolonize the reclaimed areas in time. Estimates of the amount of time that would be required for this to occur vary from 20

to 100 years. A proposed shrub density reclamation standard for the Wyoming Powder River Basin was recently developed by the WDEQ, with input from the mining industry, WGFD, and representatives of concerned environmental groups. OSM must now determine if the requirements of SMCRA will be met by the proposed standard.

Cumulative transportation impacts are related to coal production levels and are within the level of impacts identified in the referenced EISs. The maintenance-type LBAs, in general, would not significantly increase the transportation impacts already occurring, although they would, in general, extend the period of time that those impacts occur. The Antelope LBA itself would not extend the duration of mining at the Antelope Mine, although it would extend the period of coal production at the maximum rate. The specific and cumulative impacts of the proposed Rocky Butte Mine are addressed in the EIS prepared prior to issuance of that lease.

Cultural resource impacts are addressed specifically for each site identified and related to specific decisions to excavate, avoid, or research individual sites. Cultural sites are a nonrenewable resource subject to destruction through disturbance. However, as a result of mineral development and other surface-disturbing activities, an extensive inventory, cataloguing and excavation of cultural resources occurs as additional areas are disturbed.

Cumulative visual impacts are related to surface disturbance and activity. In the short term, mining activity dominates the landscape where mining is occurring. Most of the LBAs are adjacent to existing mining operations where the visual landscape is already affected by mining activities. In several cases, including Antelope, the LBAs include coal underlying acreage near public roads where mining operations will be more visible to the public. This is not a change from the existing situation because these same mines, including Antelope, have other leased coal properties near public roads. The major visual impact of some of the LBAs, not including the Antelope Mine LBA, would be to increase the time that the mines operate. In the case of the Antelope Mine, the LBA would not increase the life of the mine, but it would increase the area to be mined near the county road. After mining and reclamation are completed, the landscape character is variably changed. The change is greatest in areas where rough, steep-sided breaks, gullies or scoria knobs are replaced by gently rounded slopes.

The major recreational activities in the area of surface coal mining in the Wyoming Powder River Basin are hunting and off-road vehicle use. Much of the land in the basin in Wyoming is privately owned, and therefore not accessible for public use without the consent of the landowner. The disturbances related to coal mining increase the area that is unavailable for recreational uses such as hunting. The 1979 regional EIS predicted that cumulative regional mineral and municipal development would disturb approximately 62,645 acres by 1990, and indicated that this would reduce game populations, and thus hunting opportunities. That EIS also concluded that the loss of private land for hunting could be a more significant cumulative impact on recreational opportunities than the physical loss of land (habitat). The Antelope LBA includes some Thunder Basin National Grassland lands, as does the rest of the

existing Antelope Mine. Public access to these lands for hunting or other recreational purposes would be restricted during the life of the mine. The Antelope LBA tract is already within the Antelope Mine permit area, so access to the public land within the tract is already limited.

As indicated in Section 4.1.6, the BLM is responsible for managing habitat when making land use decisions. The previously prepared regional EISs identified that the cumulative impacts on wildlife during mining would include loss of habitat, and impediments to daily and seasonal movements such as road rights-of-way, fences, and railroad spurs. The EISs also predicted impacts from road kills and poaching.

The regional EISs also identified potential cumulative impacts to wildlife following surface coal mining and reclamation. The following excerpts from the 1979 and 1981 EISs summarize some of those impacts.

1979 Eastern Powder River Coal Final Environmental Statement:

> p. R4-26: "The effects of cumulative regional development on wildlife can be categorized by: (1) the loss of fish and wildlife habitat, (2) the resulting loss of fish and wildlife carrying capacity due to the loss of habitat, and (3) the loss of fish and wildlife populations and their progeny.
>
> p. R4-34: "A total of 1.4% of the regional sagebrush-grass habitat would be destroyed by 1990. Disturbance of this habitat type would have a detrimental effect on several species of wildlife. Sage grouse and pronghorn depend on sagebrush for the major portion of their food, especially in the fall and winter seasons. The loss of large areas of sagebrush through the mining process, and subsequent reclamation to grasses, would effectively prevent these two species from reestablishing populations in the mined areas until sagebrush reinvades from adjacent undisturbed land."
>
> p. R4-35: As habitat is destroyed, the area loses its carrying capacity, or ability to support fish and wildlife populations. All mineral development and related activity presently occurring or due to occur would cause a loss of carrying capacity in the region on 24,593 acres by 1980, 48,571 acres by 1985, and 62,645 acres by 1990. As stated above, reclamation would restore some habitat and thus some carrying capacity, but the number of species that would benefit would be few."

1981 Powder River Regional Coal Final EIS:

> p. 2: Leasing of all 19 tracts would have major affects (sic) on local populations of wildlife but minor affects (sic) on regional populations."
>
> p. 62: "On the short-term, antelope populations could be reduced by as much as 2,000 animals in Wyoming hunt areas 24 and 101 and 17..."
>
> p. 62: "In the long-term, antelope population would remain depressed 10 to 30 years after mining due to the long establishment time for sagebrush to invade reclaimed areas. Also, sharp-tailed grouse population would remain depressed from 10 to 20 years after mining until sufficient escape cover has regrown in reclaimed areas."

Wildlife monitoring data that have been collected since the preparation of the regional documents do not indicate that the actual cumulative impacts to wildlife have been more significant than those that were predicted in the regional EISs.

Cumulative impacts to pronghorn from leasing and mining the Antelope LBA are examined most appropriately in the context of currently projected mining disturbance within the Lance Creek herd unit. As a result of a relatively recent WGFD boundary change, the boundary between the Lance Creek Herd unit area and the Highlight Herd Unit area is now Highway 450. There are currently two other pending LBAs in the Lance Creek Herd unit area (North Roundup and North Antelope/Rochelle II) and two LBAs have been issued within this herd unit area (West Black Thunder and North Antelope/Rochelle I, see Table 1). Active mines within this unit include Antelope, North Antelope, Rochelle, North Rochelle and Black Thunder (see locations on Figure 12). There are no mine or rail facilities at the North Rochelle Mine, but they are mining coal and hauling it by truck. Within the existing leases at these five mines together, approximately 38 square miles, or about 0.9% of the total occupied habitat in the Lance Creek herd unit would be disturbed. The disturbed area could have a reduced carrying capacity for pronghorn following reclamation and bond release. Population density based on the 1992 post-hunting pronghorn population was five to six animals per square mile, but was reduced to about three animals per square mile in 1993, following the severe winter of 1992-1993.

The potential affected area for the Antelope LBA, as applied for, comprises about two-hundredths of one percent (0.02%) of the occupied habitat of the Lance Creek antelope herd unit. Addition of the Antelope LBA, as applied for, to the projected disturbance from the five existing mines in this herd unit does not significantly change the percentage of occupied pronghorn habitat that is within mine disturbance boundaries from the current value of about 0.9%. The Antelope LBA would disturb from 0.11% to 0.2% of the winter/yearlong Lance Creek antelope habitat, depending on the alternative that is chosen.

The four other LBAs sold or applied for to date are not in the Lance Creek herd unit. The West Rocky Butte and Jacobs Ranch I and II LBAs are in the Highlight herd unit, southeast of Gillette. Numerous existing coal leases also lie within the Highlight herd unit. These include seven operating mines (Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, part of Wyodak, and the recently reactivated East Gillette/Clovis Point Mine) as well as one proposed mine (Rocky Butte), that is currently in the permitting stage. Since decertification of the federal coal region, two federal leases covering approximately 2,172 acres have been issued within this herd unit. One previously existing federal lease within this herd unit, the Keeline lease covering approximately 3,300 acres, was terminated in 1992 due to failure to meet federal diligent development requirements. The cumulative impacts of coal mining on pronghorn in the Highlight herd unit area are analyzed in the West Rocky Butte EIS (BLM, June 1992).

A sale was held for the Eagle Butte LBA in April 1995. This LBA, located north of Gillette and adjacent to the Eagle Butte Mine (see Figure 12), would encompass an

area of about 1.4 square miles and is located in the North Black Hills pronghorn herd unit. The potential affected area in the Eagle Butte LBA comprises one-tenth of one percent of the occupied habitat of the North Black Hills antelope herd unit and less than half of one percent of the winter/yearlong habitat. The cumulative impacts of the Eagle Butte LBA on that herd unit, which includes five active mines [Eagle Butte (part), Rawhide (part), Wyodak (part), Dry Fork and Fort Union], are addressed in the Eagle Butte final EA (BLM, June, 1994).

Reclaimed acreage may experience reduced winter/yearlong use by pronghorn due to topographic moderation (which is permanent) and reductions in shrub density (not permanent). This may result in reduced carrying capacity for pronghorn on reclaimed lands; however, pronghorn habitat is not completely eliminated on reclaimed land. This is demonstrated by the fact that reclaimed lands are already used by pronghorn.

Likewise, cumulative impacts to the mule deer population of the Thunder Basin deer herd unit are not expected to be significantly increased by mining the Antelope LBA. Eleven active mines (part of Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Antelope, Rochelle, and Antelope), one developing mine (North Rochelle), one new mine now in the permit process (Rocky Butte), and two formerly proposed/now abandoned mine projects (Wymo Fuels and Keeline) are located within this deer herd unit. Combined, these mines would affect less than 4% of the occupied habitat within the Thunder Basin herd unit, based on information in the permit files and on a total occupied habitat area of 3,065 square miles. All of the recently issued or pending LBAs except one (Eagle Butte) are within this herd unit. Collectively, these LBAs represent approximately 10,785 acres, or 0.55% of the occupied herd unit area. The Antelope LBA tract is currently classified as yearlong deer habitat, and the affected area would comprise just over three hundredths of one percent of the occupied habitat of the Thunder Basin deer herd unit. This would not significantly change the percentage to be affected by currently permitted (or projected) mining operations.

No sage grouse leks have been found on the proposed lease, so there would not be a significant change in cumulative impacts to sage grouse resulting from this leasing action. Impacts to raptors and MBHFI (in this case, the mountain plover) must be mitigated, in accordance with plans approved by USFWS, so no cumulative impacts are expected to these species.

Cumulative impacts could also occur if habitat that is unique or present in the basin in limited extent is destroyed by mining and not replaced. The most unique and/or diverse wildlife habitats in the area of the Antelope Mine and LBA are the Antelope Creek valley and the mountain plover breeding habitat. The Antelope Creek valley would not be mined, and the mountain plover habitat would be restored.

As discussed previously, a new mine has been proposed for the recently issued West Rocky Butte lease combined with the Rocky Butte lease issued in 1982. An EIS was prepared prior to issuance of the West Rocky Butte lease (BLM, June 1992),

because issuance of the lease could result in a new mine start. Even with a new mine added to the current situation, total activity is within the reasonably foreseeable cumulative activity scenarios analyzed in the referenced EISs. However, this potential new mine would result in an additional impact to the water resources, a new source of suspended particulate matter in the air and also new employment, so a more detailed discussion of cumulative water, air quality, and socioeconomic impacts is included in this EA. The additional impacts of a new mine start to other resources, such as vegetation, soils, and transportation are included in the discussion of these topics in the paragraphs above.

4.6.3 Water Resources

Surface coal mining impacts local hydrology, including both the surface and groundwater systems. These impacts have been monitored over the years of mining activity. The potential and actual extent of these impacts have also been the subject of several regional studies. These new data are identified and assessed in this cumulative analysis.

4.6.3.1 Groundwater

The cumulative impact of surface coal mining on groundwater emerged as an area of concern during the scoping process and in comments received on the previous LBAs. The WDEQ/LQD is required by SMCRA and WDEQ/LQD Rules and Regulations to assess the potential for cumulative hydrologic impacts of current and anticipated mining on the ground and surface water systems each time a mine permit application or a mine permit revision is made. In 1987, the U.S. Geological Survey, in cooperation with the WDEQ/LQD and the OSM conducted a study of the hydrology of the eastern Powder River Basin, the purpose of which was to provide the hydrologic information needed to perform the required assessments. The resulting description of the cumulative effects of all current and anticipated mining (as of 1987) on the hydrologic system of the eastern Powder River Basin is presented in a document entitled "Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming", which is generally referred to as the CHIA (Martin, et. al; U.S. Geological Survey, 1988). The 1988 CHIA is the most comprehensive basinwide assessment of the potential hydrologic impacts of surface coal mining in the Wyoming Powder River Basin. The impacts of producing coal at the Antelope Mine were considered in this analysis.

During scoping for previous coal leasing EAs, concern was expressed over reliance on this existing CHIA for the eastern Powder River Basin in assessing the impacts to groundwater in this and previously prepared EAs, in light of the findings in OSM's 1992 Annual Evaluation Report on Wyoming's regulatory program. The scoping comments specifically identified groundwater impact analysis concerns related to two specific evaluation report findings: 1) that "assessments of the hydrologic impacts of minesites in the Powder River Basin are based on technical data that may not be site specific", and 2) that some CHIA documents in Wyoming are deficient in

that not all hydrologic impact projections were based on the most recent technical/baseline information.

With respect to the first concern, the lack of site-specific data is a surface water data concern in the evaluation report, not a groundwater data concern. The evaluation report noted that Wyoming agreed that the "USGS CHIA was site specific to the Belle Fourche River Basin and should not be extrapolated and used area wide" . (for surface water impacts).

With respect to the second finding, the evaluation report did not find that the CHIA's were inadequate, but cited areas where they could be improved. The evaluation report noted that WDEQ agreed that CHIA analyses must consider the most current information available for each mine in assessing cumulative impacts, and had suggested a procedure that would "include all the latest baseline information from the probable hydrologic consequences of all mines in the cumulative impact area." WDEQ/LQD has begun a computerized CHIA update. As a result of a cooperative agreement signed in 1993, BLM, OSM, the University of Wyoming and the State Engineer's Office are providing assistance to WDEQ/LQD in the CHIA update process, which is expected to take several years to complete.

Finally, in order for mining of the Antelope LBA tract to proceed, it must be permitted by WDEQ/LQD. As part of this process, the applicant must assess the probable hydrologic consequences of mining the LBA and the WDEQ/LQD must find that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside the permit area.

The cumulative hydrologic impacts associated with mining the Antelope Mine, including the Antelope LBA, will be re-evaluated by the WDEQ/LQD based on site-specific, current data before the tract is mined. Each time a mine permit application or a revision is made, the WDEQ/LQD assesses cumulative hydrologic impacts based on site-specific information and targeted to determining the cumulative impact of the applicant's mine or changes in the applicant's mining plan in combination with other mines or activities in the area.

The issues raised in the evaluation report do not change the assessment of impacts to groundwater described in this EA or the previous EAs. This environmental assessment describes anticipated impacts using the available information. In the case of groundwater impacts, this EA and the previous EAs and EISs rely on a comparison of the predictions in the CHIA with the monitoring information gathered since publication of the CHIA. As a result, the most current groundwater information is considered in this EA and has been considered in the previous EAs.

Monitoring programs, which are required by WDEQ/LQD and administered by the mining companies, have been established in the Eastern Powder River Coal Basin. Each mine is required to monitor groundwater levels in the coal itself as well as in shallower aquifers in the area surrounding their operations. There are also

requirements for drilling monitoring wells in the backfill areas of the mines in order to record the water level recovery in these areas.

The Gillette Area Groundwater Monitoring Organization (GAGMO) is a voluntary group which was formed in 1980. The purpose of GAGMO is to assemble and report the hydrologic monitoring data being collected by the coal mining companies operating in the eastern Powder River Basin of Wyoming, from the Buckskin Mine north of Gillette to the Antelope Mine in northern Converse County. Members of GAGMO include most of the companies with operating or proposed mines in that area, the WDEQ, the Wyoming State Engineer's Office, the BLM, the U.S. Geological Survey, and the OSM, which joined in 1991. The Dave Johnston Mine, located near Glenrock, is not a member of GAGMO. The Cordero Mine resigned from GAGMO in December, 1992.

Each year, GAGMO contracts with an independent firm to publish the results of the monitoring for that year. In 1991, GAGMO published two reports, an annual report for 1990 and a ten-year report. The 10-year report, which was prepared by Hydro-Engineering of Casper, summarized the water monitoring data collected from 1980 to 1990 in the Wyoming Powder River Basin. According to the GAGMO 10-year report (Hydro-Engineering, 1991), 646 monitoring wells were operated at 21 coal mines in 1990. (The 21 sites included active and inactive mines and unmined leases. Data for the Cordero Mine are not included in the GAGMO 1993 annual report, but were included in the 10-year report and in annual reports prior to 1993.)

The following discussion of cumulative hydrologic impacts compares the CHIA predictions to actual monitoring collected by Antelope Coal Company and by GAGMO. The major groundwater issues discussed 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 effect of the use of water from the sub-coal Fort Union Formation by the mines. Most mines in the Powder River Basin have water-supply wells completed in the sub-coal Fort Union Formation.

- Changes in water quality as a result of mining.

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 spoil aquifer is the first major groundwater concern. The following discussion of recharge,

movement, and discharge of water in the spoil aquifer is excerpted from the Powder River Basin CHIA (Martin, et. al; U.S. Geological Survey, 1988, p. 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 Wasatch aquifer and 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.

Wells that have been drilled to monitor water levels in the backfill indicate that recharge is already occurring in the reclaimed areas of the mines. 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 89% of the backfill wells reported for that year. In the 1993 and 1994 reports, water was present in 92% of the backfill wells.

The cumulative size of the backfill area in the Powder River Basin would be increased by mining of the recently issued leases and the currently proposed lease tracts. However, since reclamation is done concurrently with mining, and the monitoring data demonstrate that recharge of the backfill is occurring, it is not anticipated that additional significant impacts would occur as a result of any of these leasing actions. In particular, a significant change in the cumulative impacts is not expected as a result of issuing the 617 acre Antelope LBA.

Clinker, or scoria, is baked and fused rock formed by prehistoric burning of the coal seams. The Wyodak-Anderson clinker is believed to be the major recharge source for the spoil aquifer, just as it is for the coal. Not all clinker is saturated, however. 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 mining. The Antelope LBA tract contains 3 small areas of clinker covering about 2.5% of the LBA tract (see Figure 4), and little saturated clinker is found in the Antelope Mine area, so there should be little cumulative effect on recharge.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mines. Most of the monitoring wells included in the GAGMO 10-year report (578 wells out of 646 total) are completed in the coal beds, in the overlying sediments, or in sand channels or interburden between the coal beds. These holes range from 9 feet to 420 feet in depth. The changes in water levels in the coal seams after 10 years of monitoring are shown in Figure 13, which was taken from the 1991 GAGMO 10-year report (Hydro-Engineering, 1991b). This map shows the area where actual drawdown in the coal seam has been greater than 5 feet in 10 years, in comparison with the predicted

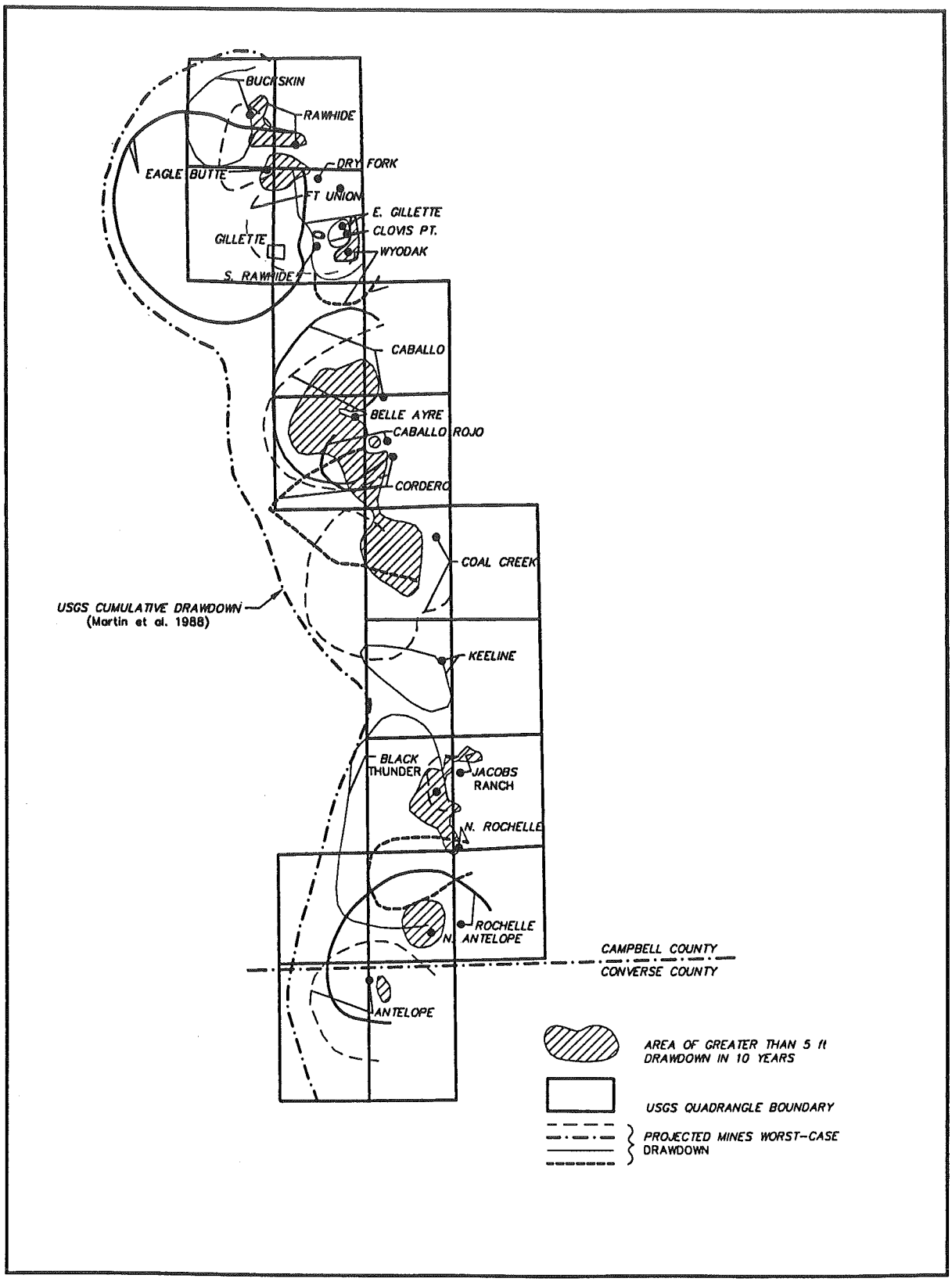


Figure 13. Comparison Between the 1990 Cumulative Drawdowns and the Mines' Worst-Case, and the USGS Predicted Cumulative Drawdowns (Modified from Hydro-Engineering, 1991)

worst-case 5-foot drawdown derived from groundwater modeling done by the mines. WDEQ/LQD policy is to have the mining companies determine the extent of the 5-foot drawdown contour.

In general, drawdown in the coal does not extend east of the mines because the mines are located on or near the coal outcrop line. The actual 10-year, 5-foot drawdown contours have not exceeded the predicted worst-case drawdown in any of the mines, and, in most cases, the drawdown contours are well within the mines' predicted worst case drawdown.

The actual 5-foot drawdown levels are also well within the cumulative drawdown predicted by the U.S. Geological Survey in the Powder River Basin CHIA (Martin, et. al; U.S. Geological Survey, 1988). This study predicted the approximate area of 5-foot or more water-level decline in the Wyodak coal aquifer which would result from "all anticipated coal mining." "All anticipated coal mining" as referred to in the CHIA includes 16 surface coal mines operating at the time the report was prepared and 6 additional mines proposed at that time. The proposed mines include 2 mines which are now producing, 1 mine which was inactive until recently but is currently producing, and the proposed Rocky Butte mine. The study assumes that water-supply wells completed in the coal may be affected as far away as 8 miles from mine pits, although the effects at that distance were assumed to be minimal.

Wells in the Wasatch Formation were considered to be impacted by drawdown only if they were within 2,000 feet of a mine pit (p. 29, Martin, et. al; U.S. Geological Survey, 1988). Drawdown extends farther in the coal than in the shallower aquifers because the coal is a confined aquifer that is aerially extensive. The area in which the shallower aquifers (Wasatch Formation, alluvium, and clinker) experience a 5-foot drawdown would be smaller than the area of drawdown in the coal because the shallower aquifers are generally discontinuous and of limited areal extent.

Based on the above assumptions, the CHIA indicates that about 3,000 wells in the area would be subject to impact by current and anticipated mining in Wyoming's Powder River Basin. Of these, about 1,200 wells are outside the actual mine areas (i.e., will not be removed by mining). About 1,000 of these supply water for domestic or livestock uses, and about 200 supply water for other uses. The remaining 1,800 wells are used by coal-mining companies: about 1,700 wells are monitor wells only, and the other 100 are used for water supply and/or dewatering at mine sites.

Of the 1,200 water-supply wells subject to impact, about 580 are completed in the Wasatch aquifer, about 100 in the Wyodak coal aquifer, and about 280 in strata below the coal. There is no completion data available for the remainder of these wells (about 240). They could be completed in any of the above aquifers.

Since the actual 10-year drawdown lies well within the cumulative drawdown predicted by Martin, et. al (U.S. Geological Survey, 1988), the cumulative impacts to water wells have not reached the levels described in that report.

The additional groundwater impacts that would be expected as a result of extending mining into the LBAs issued or proposed to date would be to extend the drawdown areas in the area surrounding the proposed new leases. In general, the LBAs would not bring mining operations closer to one another, so there would not be an increase in overlapping, or cumulative, drawdown area between mines. The actual drawdown contours for the mines with issued or proposed LBAs that would maintain their current operations are within the cumulative drawdown anticipated in the report by Martin, et. al (U.S. Geological Survey, 1988). As indicated in the previous discussion of backfill monitor wells, some recharge is already occurring in the majority of the backfill monitoring wells that have been drilled by the mines in the Wyoming Powder River Basin. Therefore additional significant impacts in water level drawdown for the maintenance leases, including the Antelope LBA, is not anticipated. The anticipated groundwater impacts for the proposed new start Rocky Butte mine are considered in the CHIA (Martin, et. al; U.S. Geological Survey, 1988). The addition of the West Rocky Butte tract could extend the drawdown area incrementally. An EIS which includes groundwater modeling was prepared to evaluate the impacts of leasing the West Rocky Butte tract (BLM, June 1992).

Potential water-level decline in the sub-coal Fort Union Formation is the third major groundwater issue. According to the Wyoming State Engineer's records, 14 mines hold permits for 42 wells which are between 400 feet and 10,000 feet deep. That number does not represent the actual number of wells potentially completed in the Tullock, because the zone of completion of these wells is not specified, and not all of the wells are currently producing (for example, 3 of the permits are held by an inactive mine, and 1 of the wells permitted by the Black Thunder Mine has not been used since 1984). The State Engineer's Office is currently tracking sub-coal Fort Union water use through various studies (personal communication, State Engineer's Office, 5/7/93). These studies are still in progress. One study, specific to the Gillette vicinity, includes both mine and residential use Fort Union wells in a study area that does not encompass the Antelope LBA.

Water-level declines in the Tullock have been documented in the Gillette area. According to Crist (U.S. Geological Survey, 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 sub-coal Fort Union wells occur within 1 mile of the pumped wells (M.A. Crist; U.S. Geological Survey, 1991; and p. 30, Martin, et. al; U.S. Geological Survey, 1988). The mine facilities in the Powder River Basin are separated by distances of 1 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 sub-coal Fort Union Formation. The OSM commissioned a cumulative impact study of the sub-coal Fort Union Formation to study the effects of mine facility wells on this aquifer unit (McIntosh, et. al; Office of Surface Mining, 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 this formation (M.A. Crist; U.S. Geological Survey, 1991). (Note: Gillette is using this water as a back-up source at this time.)

- Because large saturated thicknesses are available in this aquifer unit, generally 500 feet or more, a drawdown of 100 to 200 feet in the vicinity of a pumped well would not dewater the aquifer.

The mines adjacent to the 5 maintenance-type LBAs all have permits from the State Engineer for deeper wells. Extending the life of these mines would result in additional water being withdrawn from the Tullock. The additional water withdrawals would not be expected to extend the area of water level drawdown over a significantly larger area due to the discontinuous nature of the sands in the Tullock aquifer.

The only potential impact to Gillette's water supply as a result of the current and proposed LBAs adjacent to existing mines would be an indirect one related to the fact that leases would extend the duration of mining operations at the parent mines. Many of the mine employees in the eastern Powder River Basin live in or near Gillette and are city or county water users. Contact with the city (Fritzler, Gillette City Utilities, 1993) and Campbell County (McDill, Campbell County Engineer, 1992) indicate that the position of the city and county is that there is an adequate water supply for the city and county even with mine life extension due to the LBAs. The impact of the Antelope LBA on Gillette's water supply would be very minimal because few, if any, Antelope employees live in Gillette.

There would not be significant impact to the water supply of the city of Wright as a result of the 4 leased and 1 proposed LBAs. According to the State Engineer's Office, the only permitted wells drilled below 1,000 feet in a 100-square mile area surrounding Wright are 4 wells permitted to the city of Wright (State of Wyoming; Stockdale, State Engineer's Office, 1992). As discussed above, Crist (Martin, et. al; U.S. Geological Survey, 1988) indicated most of the water-level declines in the sub-coal Fort Union wells occur within 1 mile of the pumped wells. The Antelope LBA, about 22 miles southeast of Wright, would not contribute significantly to any cumulative impact on the water supply for that town.

The impacts of the new start mine at Rocky Butte on the Tullock aquifer were considered in the EIS prepared for the West Rocky Butte tract (BLM, 1992). The proposed Rocky Butte Mine is 40 miles north of the Antelope Mine.

The Tullock member of the Fort Union Formation is the lowermost unit in the formation, and it crops out at the surface east of the area being mined. Therefore any recharge to the Tullock member from the outcrop area is not affected by mining.

The fourth issue of concern with groundwater is the effect of mining on the 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 spoil 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 spoil aquifers than in water from either the Wasatch overburden or the coal aquifer (Martin, et. al; U.S. Geological Survey, 1988). This is expected because blasting and movement of the overburden materials exposes more surface area to water, increasing dissolution of soluble materials, particularly when the spoil materials were situated above the saturated zone in the premining environment. On the basis of studies done in North Dakota, it was estimated that at least one pore volume of water must leach the spoil before the dissolved-solids concentration in the water would be similar to the premining dissolved-solids concentration (Houghton, et. al; U.S. Geological Survey, 1987). One pore volume of water is the volume of water which would be required to fill the pore space or open space in the spoils following reclamation. The time required for one pore volume of water to pass through the spoil aquifer is greater than the time required for the postmining groundwater system to re-establish equilibrium. According to the CHIA, estimates of the time required to re-establish equilibrium range from tens to hundreds of years (p. 24, Martin, et. al; U.S. Geological Survey, 1988).

Chemical analyses of 336 samples collected between 1981 and 1986 from 45 wells completed in spoil aquifers at 10 mines indicated that the quality of water in the spoil will, in general, meet state standards for use for livestock when recharge occurs (Martin, et. al; U.S. Geological Survey, 1988). The major current use of water from the aquifers being replaced by the spoils (the Wasatch and Wyodak-Anderson coal aquifers) is for livestock because these aquifers are typically high in dissolved solids in their premining state (see Table 4, Martin, et. al, U.S. Geological Survey, 1988). According to the monitoring data published by GAGMO (Hydro-Engineering, 1991a, 1991b, 1992, 1993 and 1994), average TDS values in backfill wells have ranged from 400 to 25,000 mg/L. Of the backfill wells reported in the 1993 Annual GAGMO report (Hydro-Engineering, 1993), TDS in 71% were less than 5,000 mg/L, TDS in 25% were between 5,000 and 10,000 mg/L, and TDS in 4% were above 10,000 mg/L. In the 1994 report (Hydro-Engineering, 1994), TDS in 77% of the backfill wells were less than 5,000 mg/L, TDS in 21% were between 5,000 and 10,000 mg/L, and TDS in 4% were above 10,000 mg/L. This data supports the conclusion that water from the spoils would generally be acceptable for its current use, which is livestock, before and after equilibrium is established. The incremental effect on groundwater quality due to the all of the LBAs would be to increase the total volume of spoil, and, thus, the time for equilibrium to re-establish. The increase in leased federal acreage over the 1990 level, as a result of all the issued and pending LBAS and the termination of the Keeline lease, would be 8.6%. The amount of increase in spoil

volume would be roughly similar. The Antelope LBA would represent an increase of just over one-half of one percent in the spoil volume in the Wyoming portion of the basin.

4.6.3.2 Surface Water

There are two main issues relating to cumulative surface water impacts:

- Possible changes in runoff rates due to changes in precipitation infiltration rates.
- Possible changes in surface water quality.

Some studies indicate that infiltration rates are initially smaller on reclaimed lands than on premining lands. A weighted average reduction of 29% has been found, with this reduction declining over time until the postmining infiltration rates recover to premining levels (p. 106, Martin, et. al; U.S. Geological Survey, 1988). Since runoff and infiltration rates have an inverse relationship, a reduction in infiltration rates could cause an increase in runoff and, hence, streamflows. Assuming that the runoff from reclaimed areas is 29% greater than that from premining areas (based on this change in infiltration rates noted above), U.S. Geological Survey determined that major streams in the Powder River Basin would see runoff increases ranging from 0.4% for the Cheyenne River to 4.3% for Coal Creek. Antelope Creek would see an estimated 0.6% increase in runoff (p. 109, Martin, et. al; U.S. Geological Survey, 1988). Lands affected by mining the Antelope LBA would add a very minor amount to this increase.

Surface water quality should not be significantly affected by mining, based on studies conducted by the U.S. Geological Survey for the Belle Fourche River Basin (pp. 33-41, Bloyd, et. al; U.S. Geological Survey, 1986). Sediment yield should not increase in area streams, even with the added area disturbed due to the Antelope LBA. Although reclaimed soils may be more erosive for the first few years after reclamation, the larger sediment production would probably not be delivered to area streams due to sediment deposition as a result of flatter slopes on reclaimed lands and sediment trapping by mandated sedimentation ponds.

Impacts to alluvial valley floors (AVFs) can include several of the ground and surface water impacts listed above. Alluvial aquifers can be subject to water-table drawdown, channels subject to changes in flow patterns, and the interaction between surface water and groundwater can be altered. Impacts to designated AVFs are generally not permitted unless the AVF is insignificant to agriculture or unless the permit to affect the AVF was issued prior to the effective date of SMCRA. The WDEQ/LQD has determined that the potential AVF within and adjacent to the Antelope LBA is not significant to agriculture.

Recently, concern has been expressed over the presence of certain forms of selenium in overburden. The WDEQ and the mine operators are cooperating in a joint

effort to study this issue and to determine safe levels of selenium in overburden placed near the reclaimed surface, near reclaimed streams and impoundments, or in saturated spoils.

4.6.4 Air Quality

Blasting, coal crushing, moving equipment, and other activities associated with surface coal mining produce particles which can be released in the air. The larger these dust particles are, the closer to the source they will settle to the ground because they are heavier. The original federal health standard for dust, the total suspended particulates (TSP) standard, was based on measurement of the concentration of all dust particles in the air. The current federal health standard for dust, the PM_{10} standard, is based on measurement of the concentration of air-borne dust particles that are less than 10 micrometers in diameter. The newer standard was promulgated as a result of research indicating an increased health risk associated with inhalation of smaller dust particles, such as those produced by chemical activities like condensation, absorption, and adsorption. However, more recently some studies have indicated that airborne particulates may cause adverse health effects at particulate levels lower than the current standards (for example: Chestnut, et. al, 1991; and Schwartz, 1991/1992). The EPA is currently reviewing the appropriateness of the current standards in light of these studies concerning the potential adverse health effects.

Since most surface coal mining dust consists of relatively large particles, the more recent PM_{10} federal dust standard may have less impact on coal mining activities than did the older TSP standard. This is because monitoring at operating coal mines has indicated that, at the same distance from an active pit, the PM_{10} concentration is typically about one-third the TSP concentration. Current WDEQ air quality standards, which are under review by EPA, are shown on Table 9.

Tables 19 and 20 use the TSP standard in order to assess how well the previous regional impact assessments fit the current actual impacts. While it was not possible to predict with exact certainty which specific mines would be developed and what their sizes would be, the overall number and productivity of the mines in the Eastern Powder River Basin was projected with remarkable accuracy from 1979 to 1990.

Particulate emissions are controlled by the amount of regulation imposed as well as by coal production. It is reasonable that the actual emission rates would be less than the projected emission rates since regulations have become stricter during this time period. In particular, treatment of haul roads and stock piles, covering of conveyors, and more rapid revegetation of disturbed areas have become the norm rather than being used only in special cases.

Table 19. Particulate Concentration by Mine in the Eastern Powder River Basin as Projected for 1990 and as Measured for 1990 for the Annual Ambient Air Quality Standard

MINE NAME	PROJECTED 1990 ANNUAL AVG TSP CONCENTRATION[1] $\mu g/m^3$	MEASURED 1990 ANNUAL AVG TSP CONCENTRATION[2,3] $\mu g/m^3$
Antelope	20-40	29
Belle Ayr	20-40	40
Black Thunder	20-40	46
Buckskin	20-40	33
Caballo	20-40	33
Caballo Rojo	20-40	29
Clovis Point	20-40	Idle
Coal Creek	20-40	22
Cordero	20-40	43
Dave Johnston	20-40	28
Dry Fork	20-40	28
Eagle Butte	20-40	32
Fort Union	20-40	29
Jacobs Ranch	20-40	40
North Antelope/Rochelle	20-40	31
Rawhide	20-40	30
Wyodak	20-40	29
	Average	**33**

1 The technical report for the 1979 EIS with values for individual mines was not available at the writing of this draft, but the technical report for the 1984 EIS projected that mines south of Gillette would be between 30 and 40 $\mu g/m^3$ and those north of Gillette would span a greater range of between 20 and 40 $\mu g/m^3$

2 WDEQ

3 Average of all sites making measurements in 1990 with 40 or more observations.

Table 20. Particulate Emissions by Mine in the Eastern Powder River Basin as Projected for 1990 and as Estimated from Actual Mining Activities in 1990

MINE NAME	PROJECTED 1990 PARTICULATE EMISSION RATES (tons/year)[1]	ACTUAL 1990 PARTICULATE EMISSION RATES (tons/year)[2]
Antelope	NA[3]	228
Belle Ayr	4520	2127
Black Thunder	3744	1912
Buckskin	1276	531
Caballo	3651	1126
Caballo Rojo	NA	2701
Clovis Point	1492	Idle
Coal Creek	3432	1383
Cordero	9241	2477
Dave Johnston	961	NA
Dry Fork	NA	750
Eagle Butte	3096	1101
Fort Union	NA	278
Jacobs Ranch	3149	1869
North Antelope/Rochelle	2318	471
Rawhide	2218	1388
Wyodak	682	338
Total	**39780**	**18680**

[1] PEDCo, 1983.
[2] Tentative figures from various regional EIS's.
[3] NA = not available

As can be seen from the tables 19 and 20, ambient particulate concentrations across the region are usually well below both the past TSP air quality standard and the current PM_{10} air quality standard. Historically, cumulative air quality impacts have tended to occur when mine operations have been within about 10 miles of each other because most particles produced by mining processes are large particles which drop out of the air quickly. The trend over the past 10 years, and with most of the current and proposed maintenance tracts, is for mine operations to spread apart, increasing the distance between them, and thereby decreasing the potential for cumulative air quality impacts. This is not the case with the Antelope LBA, as it is located north of the existing Antelope leases in the direction of the nearest existing mine (North Antelope). The Antelope LBA is not located closer to the North Antelope Mine than the existing Antelope leases are, however, and modeling for both TSP and PM_{10} has indicated that the Antelope Mine is sufficiently far from the North Antelope that air quality effects between the two mines are not cumulative (ENSR, 1990).

Development of new mines, including Rocky Butte Mine, would reverse the historical trend of increasing distances between neighboring mining operations. Air-quality impacts presented in the EIS for the West Rocky Butte LBA include those expected for the life of the Rocky Butte Mine. Conclusions in that document were that air quality in the immediate vicinity of the proposed mine would decrease but still continue to meet state and federal standards (BLM, June 1992).

4.6.5 Socioeconomics

Four of the five recently-issued leases, like the Antelope LBA, are maintenance-type lease applications. As a result, it is not anticipated that issuance of these leases will result in additional socioeconomic impacts in the area. They would typically extend the period of employment for workers at these mines, and would therefore maintain income and employment over time in the area. They would not result in an increase in numbers of people employed in the area. The Rocky Butte LBA would result in a new mine start, adding approximately 250 to 300 new jobs to the area. The cumulative analysis in the Rocky Butte EIS assumed that construction on the Rocky Butte Mine would begin in 1993; however, construction has not begun as anticipated and is not expected to begin before 1998. The Rocky Butte EIS addressed potential effects in the Gillette area. The Antelope Mine is 60 miles south of Gillette, and most Antelope employees live in Douglas or Wright, so the analysis from the Rocky Butte EIS is not repeated in this EA.

Cumulative socioeconomic impacts on the town of Douglas are not anticipated as a result of leasing the Antelope LBA because the LBA tract would be used to extend the duration of maximum annual mine production. No new employees would be added as a result of leasing the Antelope LBA as a production maintenance tract. The following discussion of the town of Douglas is provided to demonstrate that the community could accommodate a small amount of growth without experiencing problems. Baseline data concerning socioeconomics of Douglas and Converse County are presented in Section 3.2.14 of this EA.

The population of Douglas declined from 6,030 in the 1980 Census to 5,076 in the 1990 Census, a drop of about 15.8%. The population of Converse County declined from 14,069 to 11,128 (20.9%) during this same period. These figures indicate that a small amount of growth in the mining industry might partially offset a population decline rather than causing net growth with its possible impacts on existing facilities and institutions.

As of 1992 there were 59 vacant housing units for sale or rent in Douglas, including 24 single-family dwellings, 30 mobile homes, and 5 multi-family units. This represents about 3% of the total housing units in Douglas (Douglas, Wyoming, 1992). These figures indicate that a small amount of population growth could be accommodated with existing facilities.

The total number of students in the Douglas school system rose from about 1,850 in 1977-78 to a peak of about 2,120 in 1982-83. The numbers have since declined to a present value of about 1,800. The buildings in the Douglas school system are relatively new, and on June 30, 1987 the County Treasurer paid the last of the bonded indebtedness notes. Currently the school district is debt free. The school district's assessed valuation dropped from a high in 1982-83 of over $260 million to about $140 million by 1989-90, due primarily to declines in the mineral industry. Despite this large decline in valuation, the district has met with only a 5-percent decline in operating funds because Converse County School District No. 1 has moved into Wyoming's "Foundation Program" which helps share education funds among the counties (Douglas, Wyoming, undated). These figures indicate that a small amount of growth in the mining industry, particularly if accompanied by an increase in assessed valuation, would not adversely impact the county and may help offset current declines.

The total 1989 mineral production valuation in Converse County on 1988 production was $142,451,704. The 1993 valuation on 1992 production was $189,602,445, an increase of about 33% over this time period. Most of this increase has been due to oil production valuation, offsetting declines gas and uranium. Coal valuation has remained relatively constant over this time period (State of Wyoming; Department of Commerce, Economic & Community Development Division, Energy Section, 1993).

In 1993, the total labor force of Converse County was 5,972 persons. Of these, 5,627 were employed and 345 were unemployed, showing an unemployment rate of 5.8%. This unemployment rate was above the state average of 5.4% in 1993 (State of Wyoming; Employment Resources Division, March 1994). Per capita income in Converse County in 1991 was $14,895, compared to a statewide average of $16,968. Per capita income in Campbell County, where coal mining is a major factor in employment, was $19,078 (State of Wyoming; Department of Administration and Information, Division of Economic Analysis, 14th Edition, December 1993). These figures indicate that some additional employment in the relatively high-paying coal mining industry could probably be accommodated by the existing labor force in Converse County.

Medical facilities in Converse County include a 44-bed hospital, a 60-bed nursing home, 4 doctors, and 3 dentists. Ambulance service is available (Douglas, Wyoming, 1992). The Converse County Memorial Hospital is conducting a physician recruitment program, seeking to hire 2 family practice physicians (Converse County Memorial Hospital Annual Report, 1991).

This information indicates that the town of Douglas and Converse County can handle a small influx of new people without experiencing problems associated with growth. With the Antelope LBA proposed as a maintenance-type tract, there should be little, if any, resultant cumulative socioeconomic impact on the Douglas area.

5.0 CONSULTATION AND COORDINATION

The following persons, firms, and agencies contributed data, analysis, review or guidance to this environmental assessment.

Bureau of Land Management	
Mike Karbs	Associate District Manager and Coal Steering Committee Coordinator
Nancy Doelger	Minerals Environmental Specialist and Team Leader
Charlie Gaskill	Casper District Coal Geologist
Brian Hennagin	Casper District Mining Engineer
Glen Nebeker	Casper District Planning/Environmental Coordinator
Mike Sestak	State Air Quality Specialist
Mike Brogan	Casper District Hydrologist
Chris Arthur	Platte River Resource Area Archaeologist
Willie Fitzgerald	Platte River Resource Area Wildlife Specialist
Randy Sorenson	Platte River Resource Area Realty Specialist
Joe Meyer	Casper District Soils Scientist
Gene Jonart	State Coal Coordinator
Roger Wickstrom	State Office Natural Resource Specialist
Laurie Bryant	State Paleontologist
U. S. Forest Service	
Malcolm R. Edwards	District Ranger
Dave Geer	Minerals Specialist
Joe Reddick	Lands and Minerals Staff
Tim Byer	Wildlife Biologist
Mike Winters	Special Uses/Oil and Gas
Jeff Tupula	Landscape Architect
Vicki Whitten-Dowse	Soil Scientist
Marc Wilcox	Hydrologist
Marnie McWilliams	Range Conservationist
Brad Humphrey	Archaeologist
Dennis Jaeger	Engineer
Office of Surface Mining Reclamation and Enforcement	
Floyd McMullen	Environmental Project Manager
Mel Granberg	Senior Project Manager
Roger Baker	Project Manager

U.S. Fish and Wildlife Service	
Art Anderson	Biologist
Antelope Coal Company	
William Oelklaus	Permitting/Solids/Vegetation/Cultural Resources
Ed Werner	Mining/Geology
Eric Sundberg	Hydrology
Kennecott Energy	
Bob Green	Governmental and Regulatory Affairs
Lyle Randen	Management
John Trummel	Coordination
Western Water Consultants, Inc. (Technical Consultants)	
Doyl Fritz	Report Preparation
Nick Tiffany	Hydrology
Mike Wolf	Geology
Craig Knight Boyd Jensen	CADD
Becky Desmond Heidi Peterson	Clerical

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APPENDIX A: COMMENT LETTERS ON THE DRAFT EA AND RESPONSES

1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

April 7, 1995

REPLY TO
ATTENTION OF
Wyoming Regulatory Office
2232 Dell Range Blvd., Suite 210
Cheyenne, Wyoming 82009

95 APR 12 PM 12:03

Ms. Nancy Doelger
Bureau of Land Management
Casper District Office
1701 E Street
Casper, Wyoming 82601

Dear Ms. Doelger:

This is in reference to your March 29, 1995 request for comments on the Draft Environmental Assessment for the Antelope Coal Lease Application.

The Corps of Engineers regulates the discharge of dredged and fill material into waters of the United States (including wetlands) as authorized primarily by section 404 of the Clean Water Act (33 U.S.C. 1344).

This office previously responded to your request for comments concerning the project proposal in a letter dated June 22, 1994. That correspondence indicated that we had confirmed a delineation of special aquatic sites and other waters of the U.S. for the mine. Clarification of that statement is needed. The draft EA indicates that our verification is not valid for any part of the expansion area. Antelope Coal will need to completely delineate the expansion area prior to filing for
a authorization under Section 404 of the Clean Water Act. You may want to require this action be completed before your final decision is made to ensure all impacts are addressed on your selected option. Note that regardless of the alternative selected, the applicant's proposal will likely meet the requirements of the Corps' Nationwide permit program, specifically Nationwide Permit 21.

It should also be noted that Antelope is not
b authorized to be operating the remainder of the mining operation since they have not met the requirements of Nationwide Permit 21.

If you have any questions regarding this matter, please contact me at (307) 772-2300. Be sure to reference file number 199340126.

Sincerely,

Chandler J. Peter
Project Manager
Wyoming Regulatory Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

BUREAU OF LAND MANAGEMENT
CASPER DISTRICT OFFICE
95 MAY -4 AM 11:45

MAY 2 1995

Ref: 8WM-EA

Ms. Nancy Doelger
Bureau of Land Management
Casper District Office
1701 East E Street
Casper, Wyoming 82601

Re: Environmental Assessment for Antelope Coal Company coal lease application.

Dear Ms. Doelger:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Region VIII Office of the Environmental Protection Agency has the following comments concerning the subject project.

a The subject document indicates that the project would eliminate Horse Creek through the mined area and about five acres of associated valley bottom wetlands. The document also indicates that wetland mitigation would be developed after obtaining the lease. While this document is an Environmental Assessment (EA), it is not possible for us to concur with a Finding Of No Significant Impact (FONSI), should that be the decision, without the ability to review the wetland and stream mitigation plan to determine if they will be successful. Further wetland and stream mitigation details should be included in the EA prior to a FONSI.

b The EA also indicates that there would be major groundwater withdrawal during the life of the mine. There should be further discussion of how this withdrawal will affect springs within the cone of influence. Additional mitigation would need to be included should these springs be adversely affected.

c The distance from the mining disturbance boundary to date and the lease application area is over a mile. This area is undisturbed to date. It appears that this intervening area is planned to be mined at some time in the future. If this is so there should be some type of cumulative impact analysis which addresses this reasonably foreseeable action.

Printed on Recycled Paper

EPA appreciates the opportunity to review the subject document and all the effort which went into the preparation of it. If you have any questions, please contact Carl Heskett of my staff, at (303) 293-1557.

Sincerely,

Bill Geise

J. William Geise, Jr.
Acting Chief
Environmental Assessment Branch
Water Management Division

Peabody

PEABODY DEVELOPMENT COMPANY

BUREAU OF LAND MANAGEMENT
CASPER DISTRICT OFFICE

95 MAY 26 PM 12: 14

247 Russell Avenue
P.O. Box 706
Douglas, Wyoming 82633
(307) 358-6803
FAX: (307) 358-6805

May 24, 1995

Casper District Office - BLM
ATTN: Ms. Nancy Doelger
1701 East "E" Street
Casper, Wyoming 82601

RE: Antelope Coal Lease Application (WYW-128322)

Dear Ms. Doelger:

The Powder River Coal Company owns certain surface lands in T41N-R71W, Sections 23 and 26 directly north and adjacent to the Antelope Coal Company's Lease by Application WYW-128322 and alternate tract configurations #2 and #3. Based on the legal descriptions contained in the Draft Environmental Assessment, the surface lands owned by Powder River Coal Company would fall within the 1/2 mile buffer zone surrounding the Lease by Application WYW-128322 and the two alternate tract configurations.

While the Powder River Coal Company has contacted Antelope Coal Company regarding the probable need for some form of surface use or overstripping agreement, at the present time such an agreement is not in place nor has surface owner consent been obtained from Powder River Coal Company. This information is provided to you for consideration in reviewing the Antelope Coal Company Federal Coal Lease Application WYW-128322. Thank you.

Sincerely,
PEABODY DEVELOPMENT COMPANY

Victor E. Garber

Victor E. Garber
Manager of Land-West

VEG/lka

c: W. I. Burget (PRCC)
W. C. Jennings (PRCC)
L. H. Fox (PRCC)
J. L. Lautenschlager (PDC)
T. B. Petrosky (PDC)
R. M. Tew (PRCC)
N. H. Wilmsmeyer (PDC)
File

4

BUREAU OF LAND MANAGEMENT
CASPER DISTRICT OFFICE

95 JUN -5 AM 11:54

STATE OF WYOMING
OFFICE OF THE GOVERNOR

JIM GERINGER
GOVERNOR

STATE CAPITOL BUILDING
CHEYENNE, WY 82002

June 2, 1995

Nancy Doelger, Environmental Specialist
Bureau of Land Management
Casper District Office
1701 East "E" Street
Casper, Wyoming 82601

Dear Nancy:

On behalf of the State of Wyoming, Please be advised that we have reviewed the Draft Environmental Assessment for the Antelope Coal Lease Application and we support the proposed action. In accordance with our own comment period given to affected state agencies, I have attached two (2) comments for your review.

a I would like to commend you for the study done on this proposal. In addition, I would encourage you to look at the prospects of Alternative #2 in the assessment which increases the size of the lease by 206 acres. This proposal appears quite convincing to me as I read where an additional 13.6% of surface is disturbed while recovered coal resource is increased by 43% to 82 million tons. This would alleviate our great concern that smaller leases increase the possibility of by-passed coal. This by-passed coal will become worthless as the economies of scale are just not there to mine the resource. Your prediction of no new mine starts on this acreage confirms this fact.

Greater attention should be given to the economics of these proposals as it will prevent waste of our national natural resources.

Thank you for the opportunity to comment on the above assessment.

Sincerely,

Jim Magagna

Jim Magagna
Director of Federal Land Policy

JM:sdj
Enclosures

INTERNET GOVERNOR@WYDSPROD.STATE.WY.US • TELEPHONE (307) 777-7434 • FAX (307) 632-3909

5

THE STATE OF WYOMING

JIM GERINGER
GOVERNOR

Public Service Commission

700 W. 21ST STREET (307) 777-7427 CHEYENNE, WYOMING 82002
FAX (307) 777-5700
TTY (307) 777-7427

STEVE ELLENBECKER
CHAIRMAN
DOUG DOUGHTY
DEPUTY CHAIRMAN
BIL TUCKER
COMMISSIONER

STEPHEN G. OXLEY
ADMINISTRATOR
ALEX J. ELIOPULOS
CHIEF COUNSEL AND
COMMISSION SECRETARY

MEMORANDUM

TO: MS JULIE L. HAMILTON
POLICY ANALYST
GOVERNOR'S OFFICE

FROM: JON F. JACQUOT
ENGINEERING SUPERVISOR
PUBLIC SERVICE COMMISSION

DATE: MAY 10 1995

RE: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE ANTELOPE COAL LEASE APPLICATION, STATE IDENTIFIER NO. 94-013

Thank you for the opportunity to comment on the referenced matter. The Commission requests that no unreasonable restrictions be placed on the provision of utility service or on the construction of utility and pipeline facilities as a result of the development or implementation of the referenced plan.

a The Commission requests that, when coal leasing is being done, the costs of relocating any utility and pipeline facilities to accommodate coal production be borne by the lessee. If these costs are not borne by the lessee, those costs would fall unfairly on the rate payers of the affected utility or pipeline.

If you should have any questions regarding this matter, please let me know.

6

WYOMING GAME AND FISH DEPARTMENT

Jim Geringer, Governor
John Talbott, Acting Director

May 30, 1995

EIS 183
Bureau of Land Management
Wyoming State Office
Draft Environmental Assessment
Antelope Coal Lease
Application
SIN: 94-013
Converse County

JULIE L. HAMILTON
WYOMING STATE CLEARINGHOUSE
OFFICE OF THE GOVERNOR
STATE CAPITOL BUILDING
CHEYENNE, WY 82001

Dear Ms. Hamilton:

The staff of the Wyoming Game and Fish Department has reviewed the draft environmental assessment for the Antelope Coal Lease Application. We apologize for the lateness of these comments. Due to a clerical error, we were not aware the comment's were due earlier than May 30. We sincerely hope these comments can still be considered.

In 1992, Antelope Coal Company (ACC) filed a lease application to obtain federal coal reserves just north of the Antelope Mine. The lease would encompass 617.2 acres of federal coal. The EA is a decision document for both the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). The first decision is for the BLM to lease the coal. The second decision is for the USFS to permit surface access for lands of the Thunder Basin National Grasslands. Three alternatives to the proposed action are being considered. The first would be to lease a larger acreage (822.8 ac) through competitive sale to prevent potential bypass of coal. Another alternative would be to reduce the tract to 455.4 acres, with the potential to lease the additional acreage at a later date. The third alternative is no action.

The baseline wildlife information appears adequate. The Lease-by-Application is within the existing mine permit boundary

Headquarters: 5400 Bishop Boulevard, Cheyenne, WY 82006-0001
FAX (307) 777-4610

and comprehensive wildlife data has been collected there for several years. Big game seasonal ranges are correctly identified in the EA. Our comments follow:

1. RE: Cumulative Habitat Losses. On page 112, the amount of big game habitat loss as a result of this lease and other coal activities in the surrounding areas has been quantified at approximately 1% of occupied habitat in Campbell and Converse Counties. Why is Converse County included in the total area? Antelope Creek is the south boundary for the Highlight Antelope Herd and the entire lease is north of the Creek. Also, most other coal activities are within the Highlight Herd Unit. Political subdivisions such as counties are not appropriate ecological units for impact analysis. Impact analysis should be done on a watershed or herd unit basis.

a

Reclamation does not immediately replace habitat value (i.e. sagebrush), therefore cumulative losses of these habitats are much greater than indicated in the draft EA. BLM should consider the cumulative impact of mine reclamation as historic land uses (ranching, grazing) resume. Moderate to heavy grazing will limit the habitat effectiveness of typical reclamation because the shrub component will be a small fraction (less than 12 percent) of shrub abundance prior to mining (current LQD shrub standard). Sagebrush will be reduced to an even smaller percent. Since the capability of reclamation to sustain habitat value under prevailing land use is an impact of the proposed action, it should receive full treatment in the analysis. BLM should also consider the effects of cumulative habitat losses on species other than big game, especially those vulnerable to habitat fragmentation [40 C.F.R. 1502.16(a) and (b); 40 CFR 1508.8; and 40 CFR 1508.7].

b

2. RE: Recreation Mitigation. The proposed lease will reduce availability of public lands for recreation (p 112). BLM and USFS should require the company to secure other lands for public use to mitigate lost access over the next 15 to 20 years of mining and through the bonding period [40 CFR 1500.2; 40 CFR 1502.14(f); 40 CFR 1502.16(h); 40 CFR 1505.2(c); 40 CFR 1508.20; 40 CFR 1502.2(d); and Sec 101(b)(3) of P.L. 91-190]. Since the limitation of public recreation on public land is an impact of substantial concern, and since there are practicable methods and alternatives available to mitigate it, such mitigation

c

alternatives should be developed and rigorously explored by the analysis.

Thank you for the opportunity to comment.

Sincerely,

JOE WHITE
DEPUTY DIRECTOR

JW:TC:as
cc: Wildlife, Fish, HATS Divisions

7

United States Department of the Interior

FISH AND WILDLIFE SERVICE

TAKE PRIDE IN AMERICA

Fish and Wildlife Enhancement
4000 Morrie Avenue
Cheyenne, Wyoming 82001

IN REPLY REFER TO:

FWE-61411

June 30, 1995

MEMORANDUM

To: District Manager, Casper District Office, BLM, Casper, WY
Attn: Nancy Doelger

From: Field Supervisor, ES, Cheyenne, WY (ES-61411)

Subject: Draft Environmental Assessment - Antelope Coal Lease Application (WYW128322), Powder River Coal Region

This responds to your agency's request for comments on the Draft Environmental Assessment regarding the proposed leasing of the Antelope Coal Tract in the Powder River Coal Region south of Gillette.

In reference to the unsuitability criteria application for criterions Numbers 9 and 11 through 14 for the subject lease, BLM, Forest Service, and U.S. Fish and Wildlife Service biologists conducted an onsite evaluation to determine the protection needs for important habitat that may be contained in the tract for ferruginous hawks, mountain plovers, and the threatened plant, Ute ladies'-tresses (Spiranthes diluvialis). Pertaining to the ferruginous
a hawk and mountain plover habitat contained in the subject coal tract, we recommend that the lease be conditioned to require replacement of important habitat for these species. Prior to mining of the area, the replacement plan should be coordinated with and approved prior by our respective agencies and the Forest Service. Since there is potential habitat for the Ute ladies'-tresses along Horse and Antelope Creeks, it was the recommendation of agency's
b biologists that the area be surveyed and, if the plant was present, the unsuitability criteria be applied to protect the species and its habitat.

We appreciate the opportunity to comment on this proposal. If we can assist further, please contact Art Anderson of my staff at the letterhead address or phone 772-2374.

Charles P. Davis

JUL - 5 '95
DM MN
ADM FL
PA SL
AO BRA
OPR NRA
LER PRA
RCP Lead Resp

cc: Director, WGFD, Cheyenne, WY
Area Manager, BLM, Casper, WY

Seven comments were received on the Draft Environmental Assessment for the Antelope Coal Lease Application. These comment letters and responses to those comments are included on the following pages. The responses were jointly prepared by the BLM and the US Forest Service. The Forest Service has addressed the comments that apply to use of the National Grassland Surface, and BLM has addressed the comments that apply to the decision to lease the coal

Response to Letter 1: Corps of Engineers

(a). Before any mining can occur on the LBA, the existing Antelope mining permit will have to be amended to include the LBA. This mining permit amendment must be approved by the Wyoming Department of Environmental Quality/Land Quality Division and the Assistant Secretary of the Interior, Land and Minerals Management. WDEQ/LQD will require wetland delineation verification and detailed wetland mitigation plans during the mining permit amendment process. Corps of Engineers concurrence, as well as BLM and US Forest Service concurrence, with the proposed mining permit amendment is required during the amendment approval process.

The Clean Water Act must be reauthorized by Congress in 1996, and the reauthorization process could result in substantial changes in wetlands delineation requirements. Since initial disturbance on the LBA tract will not occur until 1998, wetlands delineation and mitigation plans on the LBA tract can be completed during the mining permit amendment process, in accordance with any changes in wetlands delineation requirements that result from reauthorization of the Clean Air Act in 1996.

(b). The Antelope Mine submitted a Nationwide Permit No. 21 notification package which comprehensively described wetlands disturbances on the existing mine during the 1992-1997 period to the Army Corps of Engineers on June 29, 1995. The Corps of Engineers reviewed the package and responded with a concurrence letter dated July 19, 1995.

The mine has an April 28, 1993 concurrence letter from the Corps of Engineers verifying the wetlands delineations of the current permit area, which includes the LBA area. Additional review of the LBA area and designations of Other Waters of the U.S. will be completed during the mining permit amendment process.

Response to Letter 2: Environmental Protection Agency

(a) Please see response (a) to Letter 1 from the Army Corps of Engineers. As indicated in that response, detailed wetlands delineation and mitigation plans will be required during the mining permit amendment process, and the LBA tract cannot be mined until the mining permit amendment is approved. The mining permit approval process, which is administered by the Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD), includes a public notice process and a 60-day public comment period. The BLM is preparing a letter to WDEQ/LQD, requesting them to add your office to their mailing list for notification of permit actions. A copy of this letter will be sent to you.

(b) This EA was prepared to evaluate the impacts of adding the lease application area to the mine, it does not evaluate the impacts of the existing mine. The impacts and mitigation for the existing mine have been addressed in previous NEPA documents and the approved mining permit documents. This EA must evaluate if adding the LBA tract to the area to be mined will significantly increase the impacts that will be caused by the existing mine. In the case of springs within the area, the EA must evaluate if there will be a significant increase in the impacts to springs in the area as a result of mining and dewatering the LBA.

The draft EA on page 36 (final EA, page 37) indicates that the Wasatch Formation (the overburden) is not a regional aquifer due to its discontinuous lithology, the overburden contains little water in the Antelope Mine permit area, and there are no springs and seeps in the Wasatch Formation within the LBA tract. Seeps outside of the mine permit area are not generally affected by mining activities because of the discontinuous lithology. These seeps are generally associated with perched aquifers which are not in communication with the coal, or with other aquifers in the overburden.

There is discharge of groundwater from the Anderson Coal Seam into Antelope Creek upstream from the Antelope Mine (draft EA, pages 39-40; final EA, pages 40-41). The impacts to the flows in Antelope Creek as a result of mining the Anderson coal seam are analyzed in the existing approved Antelope Mine Permit, and summarized in the draft and final EAs (pages 84 and 86-87, respectively). As indicated in the EA, these impacts will not be significantly different as a result of mining the LBA.

(c) The area between the current mining disturbance boundary and the lease application area is part of the existing Antelope Mine permit area. Detailed mining plans for all disturbance within the existing mining permit area are

included in the existing approved mining permit documents. The impacts of mining and reclamation at the Antelope Mine were specifically analyzed in the draft (1981) and final (1982) Proposed Mining Plan and Reclamation EISs prepared by the Office of Surface Mining prior to approval of the mining permit. The cumulative impacts of the Antelope Mine were considered in several of the regional coal environmental impact statements referenced in the EA (see Sections 4.6 and 4.6.1, and Table 16 in the draft and final EAs). Cumulative hydrologic impacts of surface coal mining in the eastern Powder River Basin, including the Antelope Mine, were analyzed in U.S. Geological Survey Water-Resources Investigations Report 88-4046, also referred to as the CHIA (see discussion under Section 4.6.3.1 in the draft and final EAs). Cumulative air quality impacts of surface coal mining in the Powder River Basin, including the Antelope Mine, were included in a 1983 technical report on air quality environmental consequences prepared for BLM by PEDco Environmental, Inc. (see discussion in Section 4.6.4 of the draft and final EAs).

Response to Letter 3: Peabody Development Company

(a) The draft EA (page 12) and final EA (pages 12 and 48) both state that ACC does not currently have agreements with all surface owners along the north boundary of the LBA tract, and that such agreements would be necessary to allow recovery of the coal up to the lease boundaries.

Response to Letter 4: State of Wyoming, Office of the Governor

(a) The BLM recognizes that the 206 acres of federal coal that would be added under Alternative 2 in the draft and final EAs could be bypassed if not mined by the Antelope Mine. The BLM did not choose this as its preferred alternative for the following reasons:

1. There are several workable alternatives for adding this federal coal to the Antelope Mine; it could be added to the mine as part of an LBA in the future, or it could be added to the existing leases at the Antelope Mine via the coal lease modification process; and

2. The coal in that area would be mined near the end of the life of the mine, according to the current mining plan. As a result, its current value would be relatively low when the fair market value of the tract under Alternative 2 is calculated. This coal could have a higher fair market value if it is leased closer to the time that it would be mined.

Response to Letter 5: Wyoming Public Service Commission

(a) Utility and pipeline facilities will be relocated by the coal lessee except in areas where pre-existing easements and rights-of-way or other legal obligations state otherwise.

Response to Letter 6: Wyoming Game and Fish Department

(a) The 1979 regional EIS covered Campbell and Converse counties, and the Antelope EA uses that area as a basis of comparison for predicted versus actual impacts of surface coal mining. Also, the Antelope Mine and the Antelope LBA are located in Converse County.

Since the LBA tract and the Antelope Mine are located in the Lance Creek Herd Unit, the cumulative impacts of mining on pronghorn habitat in the Lance Creek Herd Unit are discussed several paragraphs later. More specific impacts of mining the Antelope LBA tract on pronghorn habitat in the Lance Creek Herd Unit are discussed in Section 4.1.6. of the draft and final EAs.

(b) The draft EA recognizes that habitat value is not immediately or completely replaced by reclamation. Specifically, the following is stated on page 114 of the draft EA (page 117 of the final EA): "Reclaimed acreage may experience reduced winter/yearlong use by pronghorn due to topographic moderation (which is permanent) and reductions in shrub density (not permanent). This may result in reduced carrying capacity for pronghorn on reclaimed lands; however pronghorn habitat is not completely eliminated on reclaimed land."

While post-mining vegetation will be different than pre-mining vegetation, the effect on the habitat and its use in the LBA tract should not be significant. This is based on the facts that: 1) the shrub component within this area is short (less than 1.5 feet tall), providing very little height advantage when covered with snow during the winter; 2) during periods of deep snow or major weather events, big game will not be in this area as it is neither crucial winter range nor sever winter relief range; and 3) therefore, although there is a difference in nutritional value between shrubs and residual dried grass, during the period that this area is used, habitat effectiveness should be changed very little. This area would be used much as a burned over area is used, drawing animals in early as the grasses green up and supplying forage until weather conditions move the animals to other areas. Surrounding sagebrush

shrub areas should provide adequate shrub densities to meet normal forage needs required in year long habitat.

(c) The EA acknowledges the following: the limitation of public recreation on public lands is a significant issue in the Powder River Basin; the surface coal mines in Campbell and Converse counties increase the area that is unavailable for recreation use; and leasing the Antelope LBA includes some Thunder Basin National Grassland lands which will generally not be available for public access during the life of the mine (draft EA, pages 111-112; final EA, pages 114-115). The action being evaluated in this case (the addition of the Antelope LBA to the Antelope Mine) does not represent a significant incremental or cumulative increase to the already existing limitations on recreational access.

Antelope Coal Company has allowed hunting on restricted inactive portions of the permit area in the past when hunting did not jeopardize the safety of mine operations staff, hunters, or the public. No hunting was allowed during the last hunting season, due to safety considerations. The mine has indicated that hunting on the permit area in the future will probably be sporadically allowed, based on the existing safety considerations.

Response to Letter 7: U.S. Fish and Wildlife Service

(a) Based on previous meetings with the federal and state agencies responsible for the coal leasing and permitting process, the BLM and the US Forest Service have concluded that the Wyoming Department of Environmental Quality, the Office of Surface Mining, and the U.S. Fish and Wildlife Service have the necessary authority and mission to establish appropriate mitigation measures for replacing important habitat for Threatened and Endangered Species and for Migratory Birds of High Federal Interest during the permitting process. We have not been advised of any cases where appropriate mitigation measures have not been required as a part of the permitting process. Since the established process is working, we do not feel it is necessary or appropriate to condition the lease, and thereby add an additional layer of compliance and oversight responsibility to the process.

(b) The BLM and Forest Service recommended to the Antelope Mine that a survey for Ute Lady's Tresses be conducted during the appropriate season in 1995. This survey was conducted on August 2, 1995, by Walter Fertig of The Nature Conservancy/Wyoming Natural Diversity Database. As reported in Section 3.2.4.1 of the EA, no populations of Spiranthes diluvialis were found at the LBA site, and that "it appears unlikely that suitable habitat is present for this species in the LBA area."

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