

BLM LIBRARY



88011382

Special Projects Staff
Library

final

proposed coal leasing
**CARBON BASIN
AREA**

environmental statement



W 88611382
BLM Library
D-553A, Building 50
Denver Federal Center
P. O. Box 25047
Denver, CO 80225-0047

TD
195
.C58
C37
1979b

DEPARTMENT OF THE INTERIOR

FINAL

ENVIRONMENTAL STATEMENT

PROPOSED

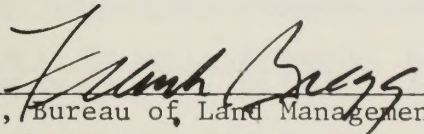
COAL LEASING

IN

CARBON BASIN AREA WYOMING

Prepared by the

DEPARTMENT OF THE INTERIOR



Director, Bureau of Land Management
Washington, D. C.

SUMMARY

Draft () Final (X) Environmental Statement

Department of the Interior, Bureau of Land Management

1. Type of Action: Administrative (X) Legislative ()

2. Brief Description of Action: The proposed Carbon Basin action is based on the management framework plan (MFP) application for leasing of federal coal. This environmental statement is developed as an analysis of impacts of potential coal development on a specific site included in the lease application and an associated right-of-way for one railroad spur, one telephone line, and one access road, and the relocation of a county road. The federal action(s) is the offering a competitive lease(s) for federal coal tract(s).

3. Summary of Environmental Impacts by 1990:

A. Air quality would be lowered in terms of all presently regulated pollutant standards. Visibility would also be reduced. Maximum predicted concentrations of carbon monoxide, nitrogen oxides, sulfur dioxide, and hydrocarbons would be less than 10% of the federal and state standards.

B. Parts of some geologic formations would be disturbed and would be exposed for study. Some fossils would be destroyed; others would be revealed.

C. The natural contour of 2,149 acres would be modified; most would be returned to the original contour.

D. Existing soil profiles on 2,149 acres would be destroyed; soil productivity would be lowered until reclamation were completed.

E. Water use would be increased in the region by 800 acre feet per year. Some sediment loads could be reduced from existing levels.

F. Vegetation on 2,480 acres would be disturbed, 331 acres would be used for housing support service facilities, and 2,149 acres would be utilized in the project development and reclaimed.

G. Wildlife habitat and some populations would be lost or disrupted on 1,175 acres during surface mine operations and on 956 acres for the life of the mine.

H. Some subsurface cultural resources could be destroyed.

I. The present visual quality would decrease as a result of mining, transportation facilities, transmission lines, mine structures, and urban expansion.

J. The quality of outdoor recreation would decrease; urban recreation facilities would not meet the needs of increased population.

K. Social support facilities would not keep pace with population increases. Small towns would lose their small town atmospheres. A total of 1,035 new jobs resulting directly from the proposed actions would reduce unemployment but would lead to a population increase. Increased construction wages and investment would increase personal income, retail sales, and property values, but the inflationary pressures would result in hardship to persons on fixed incomes. All transportation arteries including rail lines would experience heavier average daily traffic loading.

4. Alternatives Considered:

Four alternatives are assessed in Chapter 8 of this statement: No Action, Underground Mining Only, Surface Mining Only, and Split Lease Offer.

5. Comments on the Draft Environmental Statement were Requested from the Following: see Attachment A.

6. Date Draft Statement Made Available to EPA and to the Public: February 28, 1979.

7. Date Final Statement Made Available to EPA and to the Public: July 31, 1979.

Attachment A

COORDINATION IN THE REVIEW OF THE DRAFT ENVIRONMENTAL STATEMENT

Comments on the draft environmental statement were requested from the following agencies and state clearing houses. Respondents are marked with an asterisk (*).

Federal

*Advisory Council on Historic Preservation
Department of Agriculture
 *Soil Conservation Service
 Forest Service
Department of Commerce
Department of Energy
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
 *Bureau of Mines
 Bureau of Reclamation
 Fish and Wildlife Service
 *Heritage Conservation and Recreation Service
 *National Park Service
 *Office of Surface Mining
Department of Labor
 *Mining Safety and Health Administration
 Occupational Safety and Health Administration
Department of Transportation
*Environmental Protection Agency *Federal Energy Regulatory Commission
Interstate Commerce Commission Mountain Plains Federal Regional Council
Office of Economic Opportunity

State

The State of Wyoming Clearing House will coordinate comments from all interested agencies.

Local

Carbon County Commissioners
Carbon County Council of Governments
*Carbon County Planning Commission
*City of Rawlins
Town of Hanna
Town of Saratoga
Town of Encampment
Town of Sinclair
*Town of Medicine Bow

TABLE OF CONTENTS
FOR
CARBON BASIN ENVIRONMENTAL
STATEMENT

<u>Chapter 1</u>	<u>Page</u>
DESCRIPTION OF THE PROPOSED ACTION-----	1-1
INTRODUCTION-----	1-1
Proposed Action-----	1-1
History and Background-----	1-1
Relation of Carbon Basin to Civil Action No. 75-1749-----	1-5
Development of a Logical Mining Unit-----	1-5
Preleasing Inventories-----	1-5
AUTHORIZING ACTIONS-----	1-11
Federal-----	1-11
State-----	1-12
County-----	1-12
PROPOSED DEVELOPMENT-----	1-12
Coal Reserves-----	1-12
Estimated Mine Life-----	1-14
Mine and Reclamation Description-----	1-14
INTERRELATIONSHIPS-----	1-29
Hanna Area Management Framework Plan (MFP)-----	1-29
Relation of Carbon Basin to Southcentral Coal ES-----	1-29
 <u>Chapter 2</u>	
DESCRIPTION OF THE EXISTING ENVIRONMENT-----	2-1
Climate-----	2-1
Air Quality-----	2-1
Geology-----	2-1
Topography-----	2-3
Soils-----	2-3
Water Resources-----	2-11
Vegetation-----	2-17
Fish and Wildlife-----	2-21
Cultural Resources-----	2-22
Visual Resources-----	2-29
Recreation Resources-----	2-29
Agriculture-----	2-35
Land Use Plans, Controls, and Constraints-----	2-35
Socioeconomics-----	2-36
FUTURE ENVIRONMENT-----	2-47

Chapter 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION -----	3-1
ASSUMPTIONS AND GUIDELINES -----	3-1
Climate -----	3-1
Air Quality -----	3-3
Geology -----	3-11
Topography -----	3-12
Soils -----	3-12
Water Resources -----	3-15
Vegetation -----	3-21
Fish and Wildlife -----	3-21
Cultural Resources -----	3-25
Visual Resources -----	3-25
Recreation Resources -----	3-25
Agriculture -----	3-28
Socioeconomics -----	3-28

Chapter 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION -----	4-1
---	-----

Chapter 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED -----	5-1
---	-----

Chapter 6

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY -----	6-1
---	-----

Chapter 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES -----	7-1
---	-----

Chapter 8

ALTERNATIVES -----	8-1
NO-ACTION -----	8-1
UNDERGROUND MINING ONLY -----	8-1
SURFACE MINING ONLY -----	8-1
SPLIT LEASE OFFER -----	8-2

Chapter 9

CONSULTATION AND COORDINATION -----	9-1
INDEX TO PUBLIC COMMENTS -----	9-6
TESTIMONY PRESENTED AT PUBLIC HEARINGS -----	9-8
WRITTEN COMMENTS AND RESPONSES TO WRITTEN COMMENTS -----	9-14

References

REFERENCES -----	R-1
------------------	-----

Appendix

A - RESOURCE DATA -----	A-1
-------------------------	-----

CHAPTER 1

DESCRIPTION OF THE PROPOSED ACTION

INTRODUCTION

The Carbon Basin draft environmental statement (DES) was made available to the EPA and to the public on February 28, 1979. Public hearings were held to receive public testimony, and written comments were accepted through April 23, 1979 (Chapter 9). This final environmental statement was modified as a result of the comments received and from other data submitted.

Public comment has disclosed that there are at least two companies (namely, Commonwealth Edison and Belco Petroleum Corporation) interested in the coal resources in the Carbon Basin area. The interest could result in the decision to divide the area into two logical mining units (LMUs) and to offer each under competitive bid. This may be necessary to meet the regulations in 43 CFR 3475.5 which require that all coal reserves within a coal area be combined to complete logical mining unit(s) (LUMs).

Should the decision be made to lease, the lease document would stipulate that the lessee submit a mine and reclamation plan (M&RP) that would demonstrate that the established reclamation performance standards could be achieved and that the mining operation would achieve maximum economic recovery of the federal coal. It would further stipulate that the post mining use on public lands and other requirements as described in Chapter 4 of this document would be a requirement of the lease.

As discussed in the Proposed Development section of this chapter, Geological Survey (GS) will provide data on the total coal reserves in the Carbon Basin area. If that data indicates there is sufficient coal in the area to support two LMUs, the area may be divided into two lease tracts to be offered under competitive bid. Should this division be made, environmental assessment would be conducted at the time of submission of the M&RP for each tract.

Proposed Action

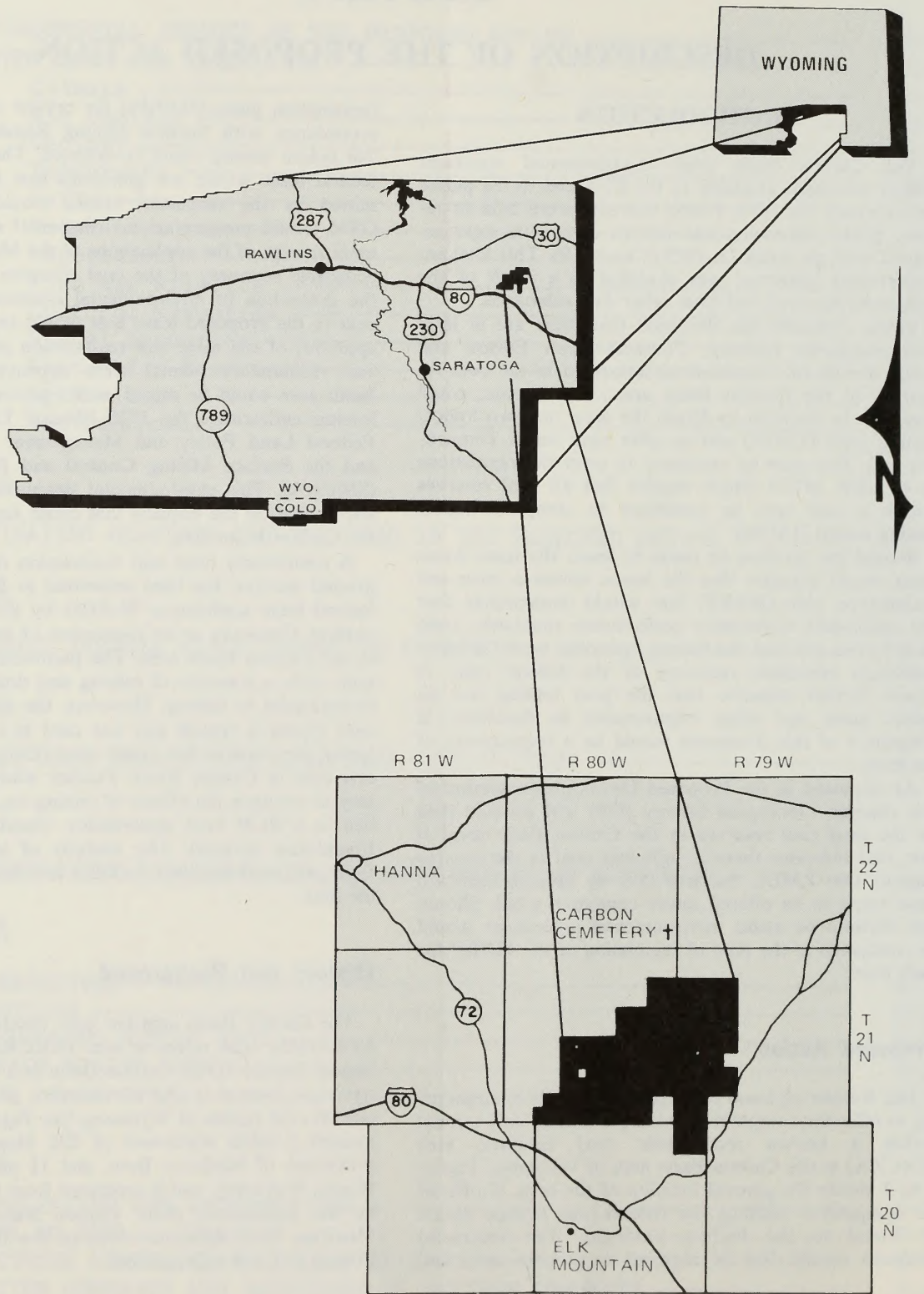
The Bureau of Land Management (BLM) is considering to offer for competitive bidding a federal coal tract(s) within a known recoverable coal resource area (KRCRA) in the Carbon Basin area of Wyoming. Figure CA1-1 shows the general location of the area. If offered for competitive bidding, the federal coal tract(s) would be leased to the highest bidder(s). The successful bidder(s) would then be required to prepare mine and

reclamation plans (M&RPs) for review and approval in accordance with Surface Mining Regulations 30 CFR 740 before mining could be initiated. The awarding of a federal lease would not guarantee that the M&RP submitted by the successful bidder would be approved. OSM would prepare an environmental assessment (EA) upon receipt of the applications of the M&RP. Maximum economic recovery of the coal resource consistent with the protection of environmental resources in and adjacent to the proposed lease area would be a condition for approval of the mine and reclamation plan. If the mine and reclamation plan(s) were approved, the Carbon Basin area could be mined under provisions of the following authorities: the 1920 Mineral Leasing Act, the Federal Land Policy and Management Act (FLPMA), and the Surface Mining Control and Reclamation Act (SMCRA). This environmental statement has been written to analyze the impacts that could result from mining the Carbon Basin area.

A preliminary mine and reclamation report (see Background section) has been submitted to BLM along with federal lease application W-50061 by the Edison Development Company as an expression of interest in mining in the Carbon Basin area. The preliminary report represents only a scenario of mining and does not indicate a commitment to leasing. However, the submitted preliminary report is typical and was used as a model for analyzing the impacts that could result from mining the federal coal in Carbon Basin. Further study will be necessary to evaluate the effects of mining on resources identified in a BLM coal unsuitability report (see Preleasing Inventories section). The analysis of impacts resulting from proposed ancillary facilities is based on best available data.

History and Background

The Carbon Basin area has been identified as a known recoverable coal resource area (KRCRA) by the Geological Survey (GS). Carbon Basin is a large geological structure located in the northeastern part of the south-central coal region of Wyoming (see Figure CA1-2). It is located 5 miles northwest of Elk Mountain, 13 miles southwest of Medicine Bow, and 12 miles southeast of Hanna, Wyoming, and is separated from the Hanna Basin by the Saddleback Hills. Carbon Basin is within the Medicine Bow Resource Area of the Rawlins District, Bureau of Land Management.



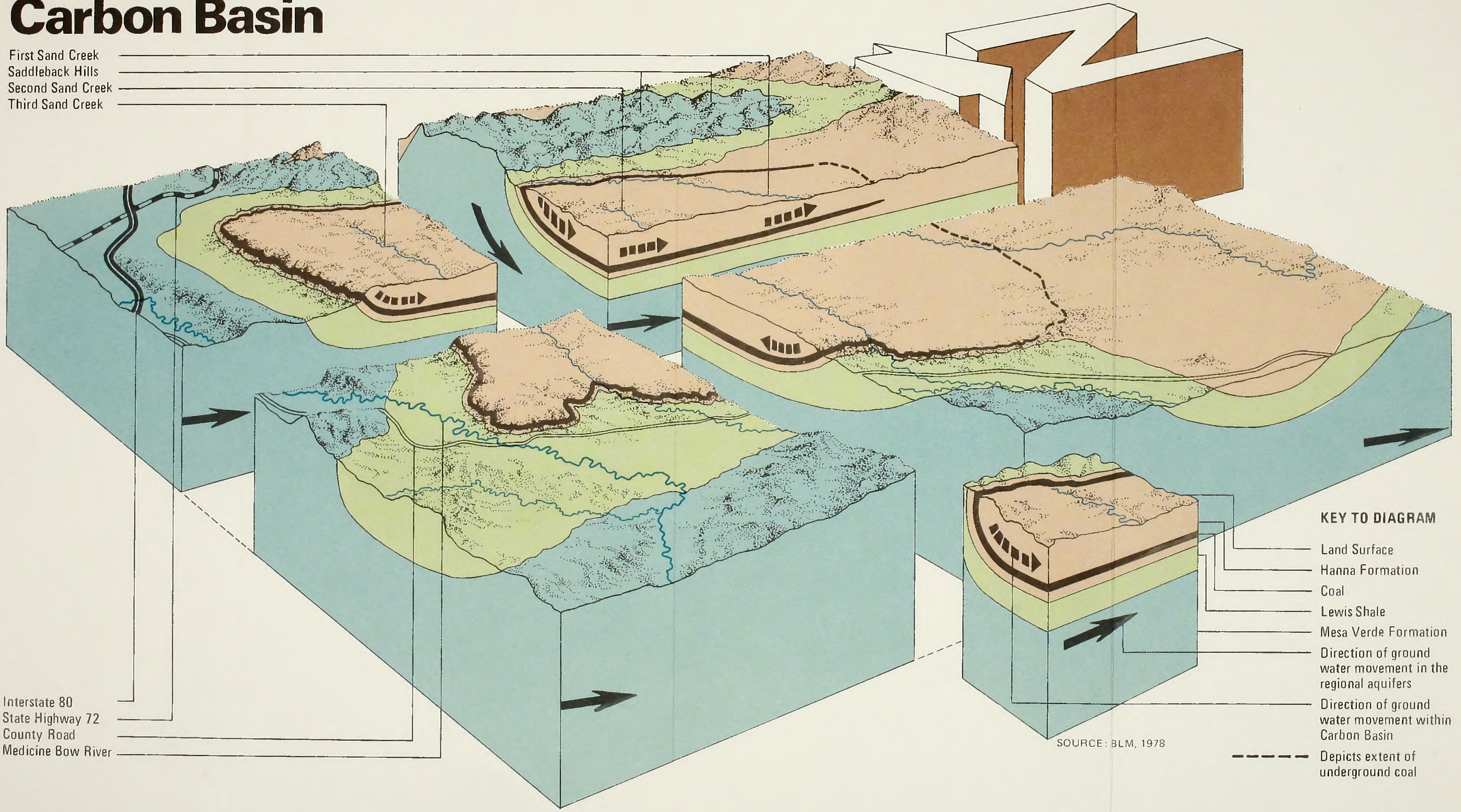
SOURCE: BLM, 1978

Figure CA1-1
GENERAL LOCATION MAP

Carbon Basin

First Sand Creek
Saddleback Hills
Second Sand Creek
Third Sand Creek

Interstate 80
State Highway 72
County Road
Medicine Bow River



KEY TO DIAGRAM

- Land Surface
- Hanna Formation
- Coal
- Lewis Shale
- Mesa Verde Formation
- Direction of ground water movement in the regional aquifers
- Direction of ground water movement within Carbon Basin
- Depicts extent of underground coal

SOURCE: BLM, 1978

Figure CA1-2
ISOMETRIC AQUIFER SYSTEM OF CARBON BASIN

DESCRIPTION OF THE PROPOSAL

An area within the KRCRA has been identified by the Bureau of Land Management as a possible coal development area pending further evaluation. The mining area or "proposed project area" contains 15,494 acres composed of private lands owned by Commonwealth Edison intermingled with federal and state lands (Table CA1-1) that would make a practical mining unit, as shown on Map CA1-1. The Belco Petroleum Company has private coal holdings located in the NE $\frac{1}{4}$ (160 acres) Section 28, T. 21 N., R. 80 W., which is located within the project area but which is excluded from the total acreage shown on Table CA1-1. The proposed project area is in T. 20 N., R. 80 W., T. 21 N., R. 79 W., and T. 21 N., R. 80 W., and all federal coal lies within the future coal study area of the Hanna MFP as shown on Map CA1-2.

An economic mining unit has been identified within the proposed project area by Edison Development Company. The unit roughly coincides with the area shown on Map CA1-1 as an area on which BLM will consider future leasing (proposed project area).

Federal lease application W-50061 was originally submitted to BLM on March 17, 1975, by the CF&I Steel Corporation. It covered 8,205.78 acres having federal coal but was later amended to cover 7,145.75 acres. The lease application was subsequently assigned to Nuclear Resources, Inc., on September 1, 1977. On September 28, 1977, the lease application was revised to change the name of the company from Nuclear Resources, Inc., to Edison Development Company.

As an expression of interest, the Edison Development Company submitted to BLM an environmental report in 1976. An additional environmental report was submitted in January 1978 (VTN Colorado) and updated mine and reclamation reports were submitted in May 1978 (Morrison-Knudsen), as discussed in the Proposed Action section.

Certain lands included in lease application W-50061 are being excluded from consideration of leasing for the following reasons (Map CA1-1):

1. Data are lacking to determine whether the quantity of coal present is economically feasible to mine.

2. Data are insufficient to determine economic feasibility or practicality of extending either underground or surface mining beyond the boundaries shown in the underground mining section of the mine and reclamation report. The remaining federal acreage to be considered for leasing is encompassed by the proposed project boundary as shown on Map CA1-1.

Adjacent and intermixed private coal holdings, shown on Map CA1-1 as other private holdings, have also been identified by representatives of Belco Petroleum Company. However, the company has submitted neither an application to mine nor information on quality or quantity of the coal reserves.

Relation of Carbon Basin to Civil Action 75-1749

Civil Action 75-1749 and its amendment ordered the Secretary of the Interior to meet certain criteria before

the Carbon Basin area could be leased for coal mining. The criteria were met on June 4, 1979; thus, the leasing program will now be administered through the Secretary's leasing program.

Development of a Logical Mining Unit

Coal management regulation 43 CFR 3475.5 requires the leasing unit to be a logical mining unit (LMU). Map CA1-1 shows surface ownership and coal status within the proposed project area. The difference in ownership is due to diversity of minerals and surface rights on individual sections. For example, in Section 22, T. 21 N., R. 80 W., the state has surface ownership and the federal government has mineral ownership. Map CA1-1 displays this overlap of ownership. Table CA1-1 shows the surface and coal ownership within the proposed project area. Because of this ownership pattern, private coal (owned or leased by Commonwealth Edison, Belco Petroleum Company, and others) would have to be developed along with the federal coal. This would be uneconomical to mine separately. Consequently, all reserves would have to be combined to complete logical mining unit(s).

Preleasing Inventories

The BLM is required to ensure that all Bureau-permitted projects give adequate consideration to the identification, evaluation, management, protection, and preservation of resources. BLM has contracted the Wyoming Game and Fish Department, the Fish and Wildlife Service, the Soil Conservation Service, and the State Historic Preservation Officer to conduct inventories that would accomplish this requirement. The following preliminary inventories, some of which are still in progress, have been conducted on the project area. Additional inventories will be required of the successful lessee prior to approval of the mine and reclamation plan should the lease be issued.

Fish and Wildlife

In 1974 the Wyoming Game and Fish Department conducted inventories on and adjacent to the area. The wildlife inventories identified whitetail prairie dog colonies, raptor nesting areas, big and small game species, birds and nongame mammals. The Fish and Wildlife Service conducted a comprehensive search for black-footed ferrets on the project area in August 1978, covering an estimated 2,744 acres of prairie dog colonies. The BLM and Fish and Wildlife Service biologists have located 15 golden eagle nests on and adjacent to the area, 3 of which were active in the spring of 1978. On May 15, 1978, a letter was written to the Fish and Wildlife Service to initiate formal coordination concerning these nests.

Table CA1-1

SURFACE AND COAL OWNERSHIP WITHIN PROJECT AREA

	Surface Acres	Coal Acres	Excluded Coal Acres
Federal*	5,626	6,146	1,000
State	640	0	0
Private	<u>9,228</u>	<u>8,348</u>	<u>0</u>
Total	15,494	14,494	1,000

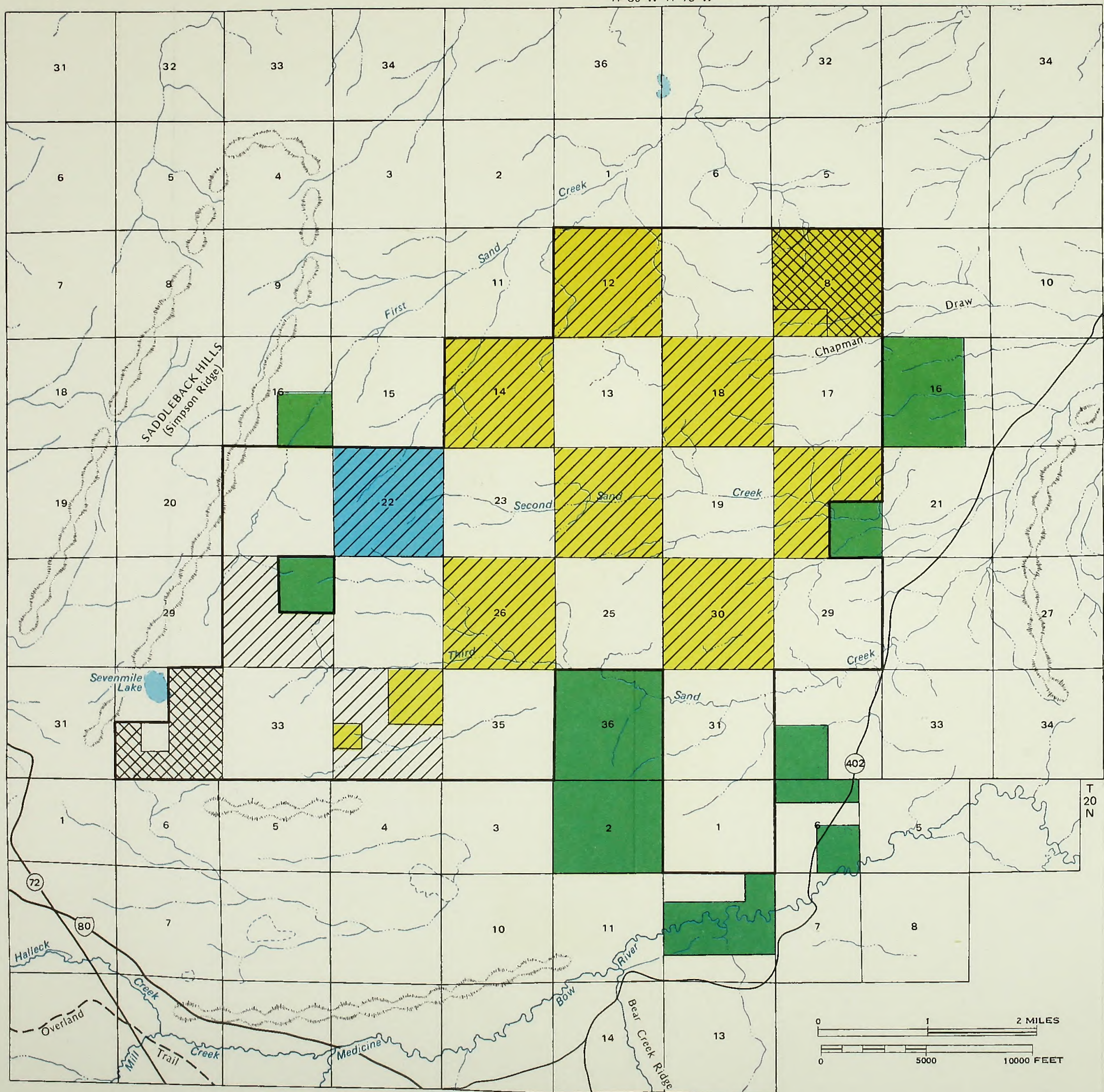
Source: BLM 1978

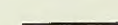



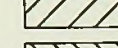
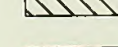

*Federal denotes public lands in relation to surface acres and Federal coal in relation to coal acres.

T 22 N
T 21 N

T 21 N

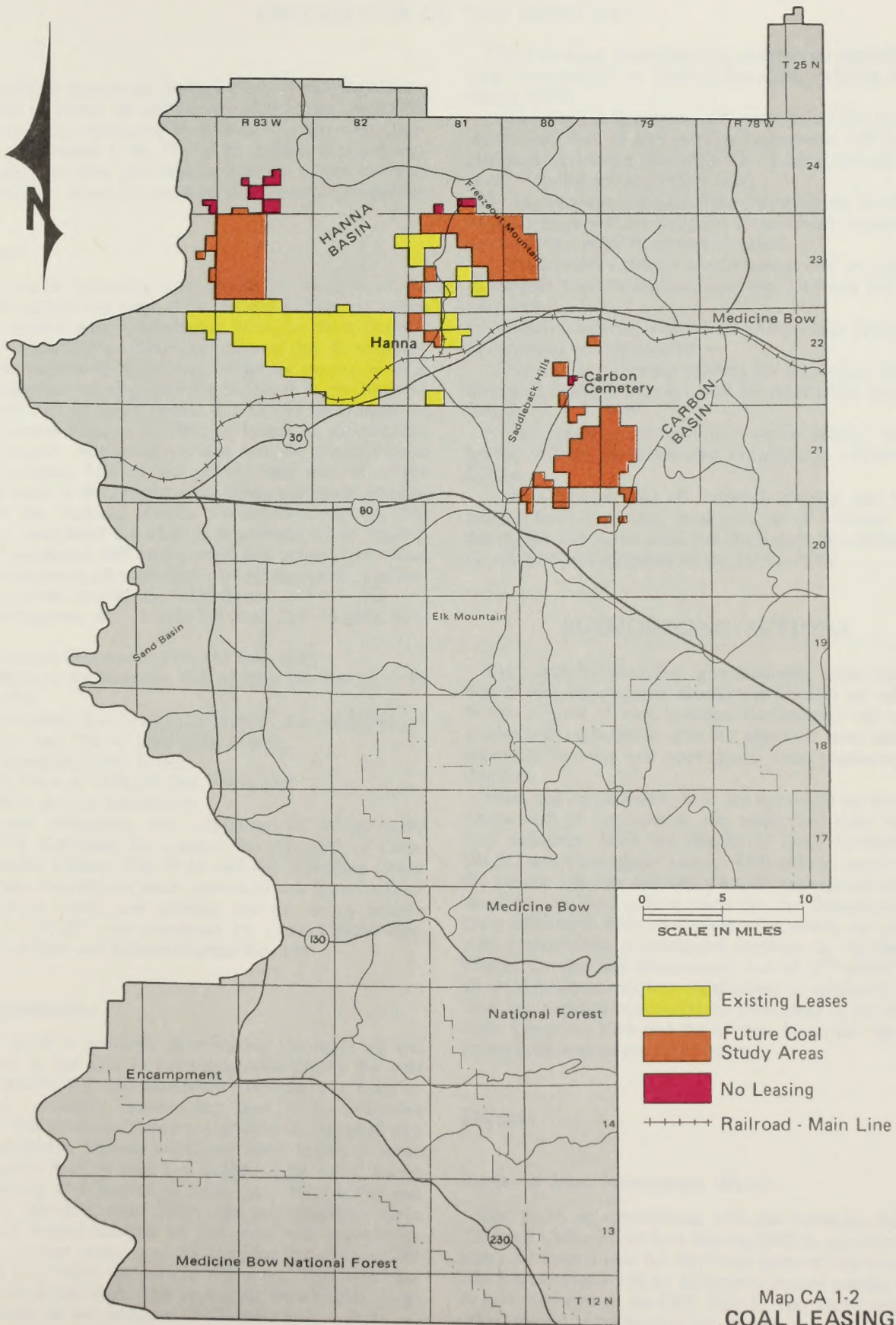
T 20 N



-  Lease (Project) Boundary
-  Federal Surface
-  State Surface
-  Private Surface and/or Private Coal
-  Federal Coal
-  Federal Coal Excluded From Leasing
-  Other Private Coal Properties Identified Through Public Review



Map CA 1-1
SURFACE AND COAL STATUS



SOURCE: BLM, 1978

DESCRIPTION OF THE PROPOSAL

Soils

The BLM contracted the Soil Conservation Service to conduct an Order III soil survey on the area. An Order II survey was conducted by Edison Development Company on Sections 1, 29, 31 and 35. Edison Development Company has also provided an analysis of the overburden material made for physical and chemical properties.

Cultural

A cultural inventory was conducted on 27% of the private surface and none of the federal surface in Carbon Basin project area. Consultation with the State Historic Preservation Officer (SHPO) confirmed that there are no known National Register sites within the project area. A determination for eligibility for inclusion in the National Register will be made by the SHPO and the Keeper of the National Register of Historic Places on all potential sites located. Additional surveys will be conducted on the remaining 73% of the private land and all of the public lands in the project area. Compliance with Section 106 of the National Historic Preservation Act of 1966 will be completed for all sites determined to be eligible. This compliance will be accomplished prior to any mine and reclamation plan or right-of-way approval. Applicable authorities include the following:

1. Antiquities Act of 1966 (34 Stat. 225; 16 USC 431-433);
2. Historic Site Act of 1935 (49 Stat. 666);
3. Historic Preservation Act of 1966 (80 Stat. 915; 16 USC 470);
4. National Environmental Policy Act (NEPA) of 1969 (33 Stat. 852; 42 USC 4321, et seq);
5. Executive Order 11593;
6. FLPMA of 1976 (90 Stat. 2743); and
7. State laws as appropriate.

Specific inventories were conducted on private lands by VTN Colorado, Inc., under the direction of Commonwealth Edison. The BLM and the Wyoming Game and Fish Department were consulted on threatened or endangered plants and animals and on raptor nesting sites; the SHPO was consulted on archeological sites, historical sites, and paleontological locations.

Coal Unsuitability

The BLM is presently investigating the lands on and adjacent to the area to determine unsuitability for coal development. All coal unsuitability criteria have been reviewed; unsuitable criteria that have to be evaluated against this proposed action are as follows: rights-of-way and easements; historic lands and sites; federally listed endangered species; bald and golden eagle nests; falcon cliff nesting sites; migratory birds; state resident fish and wildlife; alluvial valley floors and reclaimability. As a result of impact analysis on the mine and reclamation report, further study may be required by unsuitability criteria to protect the surface resources. This will be a condition of the lease. The applicable unsuitability criteria evaluations are discussed in Chapters 1, 2, 3, or 4.

The following constraints and restrictions applicable to coal development in Carbon Basin are included in the Hanna MFP:

1. The Carbon Cemetery (120 acres tract) and the area within 100 feet of the exterior boundaries will be excluded from leasing (see Map CA1-2 for a general location in relation to the project area).

2. Any projects considered for development in wildlife winter ranges will be designed to minimize impacts and to benefit the wildlife species involved.

3. The critical antelope winter habitat will be managed to support the existing antelope population in the planning unit.

4. Mineral leasing stipulations will include restoration of disturbed wildlife habitat.

5. Nesting and hunting habitats for all raptors that are identified through surveys will be maintained and protected.

6. All multiple use activities within critical wildlife habitat will be evaluated and regulated to protect that habitat.

7. The decision that all livestock grazing will be removed from the mine project area of Carbon Basin during the life of the mine for the benefit of wildlife will be included in the update of the Hanna MFP.

AUTHORIZING ACTIONS

This section identifies governmental authorizations which will be required should the lease(s) be offered. Within 3 years of lease issuance, the lessee(s) will submit a mine and reclamation plan for approval from the Secretary of Interior and appropriate state regulatory authorities.

Mine and reclamation plans are approved by the Secretary and, as appropriate, the authorized state regulatory authority. Both the Bureau of Land Management (BLM) and Geological Survey (GS) will be involved in the review process and will provide appropriate stipulations on the final action taken by the Department on plans submitted. Submitted plans must satisfy the regulatory requirements promulgated pursuant to the Surface Mining Control and Reclamation Act of 1977 (SMCRA); all lease requirements and stipulations; all applicable state laws and regulations; conditions prescribed in the Hanna Area Land Use Plan and the Carbon Basin ES. Specific authorizing actions are listed below:

Federal

Bureau of Land Management (BLM)

The BLM, in consultation with the Geologic Survey (GS) and Office of Surface Mining (OSM), may issue the leases for federal coal for the Department of the Interior. The leased area(s) will be designated logical mining units in accordance with 43 CFR 3475.5. The BLM will develop special requirements for management and protec-

DESCRIPTION OF THE PROPOSAL

tion of all resources other than coal and for the post-mining use of the affected public lands. These special requirements will be included in the federal coal leases and reclamation plans. BLM will review and concur when approving the mine and reclamation plan to insure the protection of resources not included in the lease.

BLM will also be responsible for granting various rights-of-ways for ancillary facilities.

Office of Surface Mining (OSM)

OSM and, as appropriate, the Wyoming Department of Environmental Quality (DEQ) have the responsibility to jointly review mine and reclamation plans and to issue a mining permit. Such permit issuance must be accomplished with the concurrence of the BLM and GS. OSM has oversight responsibility for the review of the M&RP on private surface and private mineral to insure that reclamation is compatible with that conducted on adjacent lands and meets the requirements of SMCRA.

Geological Survey (GS)

GS is responsible for development, production, and maximum economic coal resource recovery requirements included in the mining permit area.

Fish and Wildlife Service (FWS)

Fish and Wildlife Service will issue permits to relocate golden eagle nests in coordination with BLM.

State

Wyoming Department of Environmental Quality (DEQ)

DEQ and OSM will jointly review for compliance the mining and reclamation plans and permits that are authorized under a federal coal lease. GS would also be consulted for their concurrence on the mine and reclamation plan as they relate to recovery of the coal resource, and BLM will be consulted for the post-mining land use and stipulation related to the management and protection of resources not included in the lease.

The Land Quality Division will issue a permit and license to mine after approval of a mine and reclamation plan.

The Air Quality Division will review all applications for air contaminate data, controls, and monitoring. The Air Quality Division will issue permits to construct and operate facilities that could affect air quality.

The Water Quality Division will issue permits to construct waste water systems and issue National Pollutant Discharge Elimination System (NPDES) permits for discharging waste water.

The Solid Waste Division will issue construction fill permits and industrial waste facility permits for solid waste disposal during construction and operation.

In accordance with 30 CFR Part 700.4 of SMCRA, the state is responsible for the regulation of surface coal mining and reclamation operation on non-federal lands under an approved state program. Part 700.4 also provides for the Secretary to delegate to the state through a cooperative agreement certain authority relating to the regulation of surface coal mining and reclamation operations on federal lands in accordance with 30 CFR Part 745. The cooperative agreement between the State of Wyoming and the Department of Interior concerning cooperative proposed regulation of surface coal mining and reclamation operation on federal lands within the State of Wyoming was signed on October 26, 1978. The purpose of the agreement is to prevent duality of administration and enforcement of mining and reclamation requirements by providing for the application of specific state reclamation regulations on surface coal mining and reclamation operations on federal lands within the state.

Additional details of the responsibilities of the state are included in 30 CFR 745.13.

Wyoming State Engineer

Any storage, impoundment, or use of surface or ground water for mining and coal processing operations will require a permit from the State Engineer.

County

The Carbon County government will review and approve the site plan submitted by the applicant and issue building permits for mining structures. They will also review and approve a zone change from ranching, agriculture and mining (RAM) to industrial for the railroad right-of-way.

PROPOSED DEVELOPMENT

Coal Reserves

The Carbon Basin area is extensively underlain by numerous coal horizons at various depths. Coal lying between 150 and 170 feet of the surface would have to be surface mined for maximum economic recovery in this region. Coal lying at depths greater than 170 feet below the surface would have to be mined by underground mining methods.

Table CA1-2 shows the approximate coal reserves and coal groups in Carbon Basin. These coal reserves contain high quality, low sulfur coal in demand by power companies for use in power generation. Specific data and recommendations on the feasibility of mining the Blue and the Finch groups will be supplied to BLM by GS before a lease is offered.

An estimated 400 million tons of federal and private coal reserves have been identified within the Carbon Basin project area (Table CA1-2). Additional private

Table CA1-2

APPROXIMATE COAL RESERVES AND ANALYSIS DATA
FOR COAL GROUPS IN CARBON BASIN PROJECT AREA

Item	Coal Group		
	Johnson	Blue	Finch
Coal Thickness*, Feet (Maximum)	32	5	13
Coal Reserves, Million Tons	250	30	120
Moisture, Percent	9.06-12.50	**	8.41
Ash, Percent	9.19-10.98	**	6.51
Volatile matter, Percent	37.86-39.39	**	43.83
Fixed Carbon, Percent	42.10-42.68	**	41.25
Sulfur, Percent	0.57- 0.60	**	0.52
BTU/lb.	10,980-11,280	**	11,680

Source: Nuclear Resources, Carbon Basin Mine Report.

*Coal reserves are estimated from data presently available. Future drilling may provide information significantly altering the quantities presented.

**Analysis not available for the Blue group.

DESCRIPTION OF THE PROPOSAL

holdings have been identified by Belco Petroleum Company within and adjacent to the Carbon Basin project area. Information on the quality and quantity of the coal has not been supplied by the company. Further exploration is needed to obtain a more accurate estimate of the reserves on the proposed project area and on tracts outside the proposed project area identified on Map CA1-1 and in the Surface Mining Only alternative. Leasing of the area will be deferred until GS provides data on the amount of coal that can be economically recovered.

Estimated Mine Life

Since the total recoverable reserve of coal has not been established, a projected date for the end of mine life cannot be determined at this time. Mine life is expected to be beyond the 40 years stated in the preliminary mine and reclamation report submitted by Edison Development Company unless the underground mining alternative is selected (see Chapter 8, Underground Mining alternative).

The combining of the coal reserves of the Carbon Basin area would extend the mine life beyond 40 years at the 5 million ton per year production rate and the mining area would be divided into logical mining units (leasing units) with a life of less than 40 years each.

MINE AND RECLAMATION DESCRIPTION

Typical Operation of Surface Facilities

The preliminary mine and reclamation reports propose the development of both a surface and underground mine for the annual production of 5 million tons of coal. The proposed surface mine is designed to recover approximately 10 million tons of coal located on private lands. However, interpretation of the coal isopleth map, stratigraphic diagrams, and other associated maps furnished in the mine and reclamation report indicates that the surface mine could be expanded to economically mine adjacent federal coal on the project area by surface mining methods. This coal lies within 150 to 170 feet of the surface. Most of this coal is not economically recoverable by underground mining methods. The underground mine would be developed concurrently with the surface mine and would permit recovery of federal and private coal lying 150 to 900 feet below the surface. Three portals would be constructed to serve the main underground mine operation. An underground training mine is proposed to be worked in Section 1, T. 20 N., R. 80 W. Proposed mine and ancillary facilities would serve both the surface and underground mining operations.

Mine Facilities

The proposed mine facilities would be primarily for development of the underground mines but would also serve the needs of the surface operations. These facilities would be located on private lands as shown on Figure CA1-3: the main mine facilities and east portal would be located in Section 29, T. 21 N., R. 79 W.; the surface mine facilities and south portal would be located in Section 35, T. 21 N., R. 80 W.; the surface mine facilities and training mine would be located in Section 1, T. 20 N., R. 79 W.; and the west portal would be located in Section 32, T. 21 N., R. 80 W.

A ventilation shaft is located on private land in Section 13, T. 21 N., R. 80 W. The construction of this shaft would disturb approximately 10 acres of land. Access to the shaft area would be by existing secondary roads from the east portal, a distance of approximately 5 miles. A security fence with a locked gate would surround the shaft site.

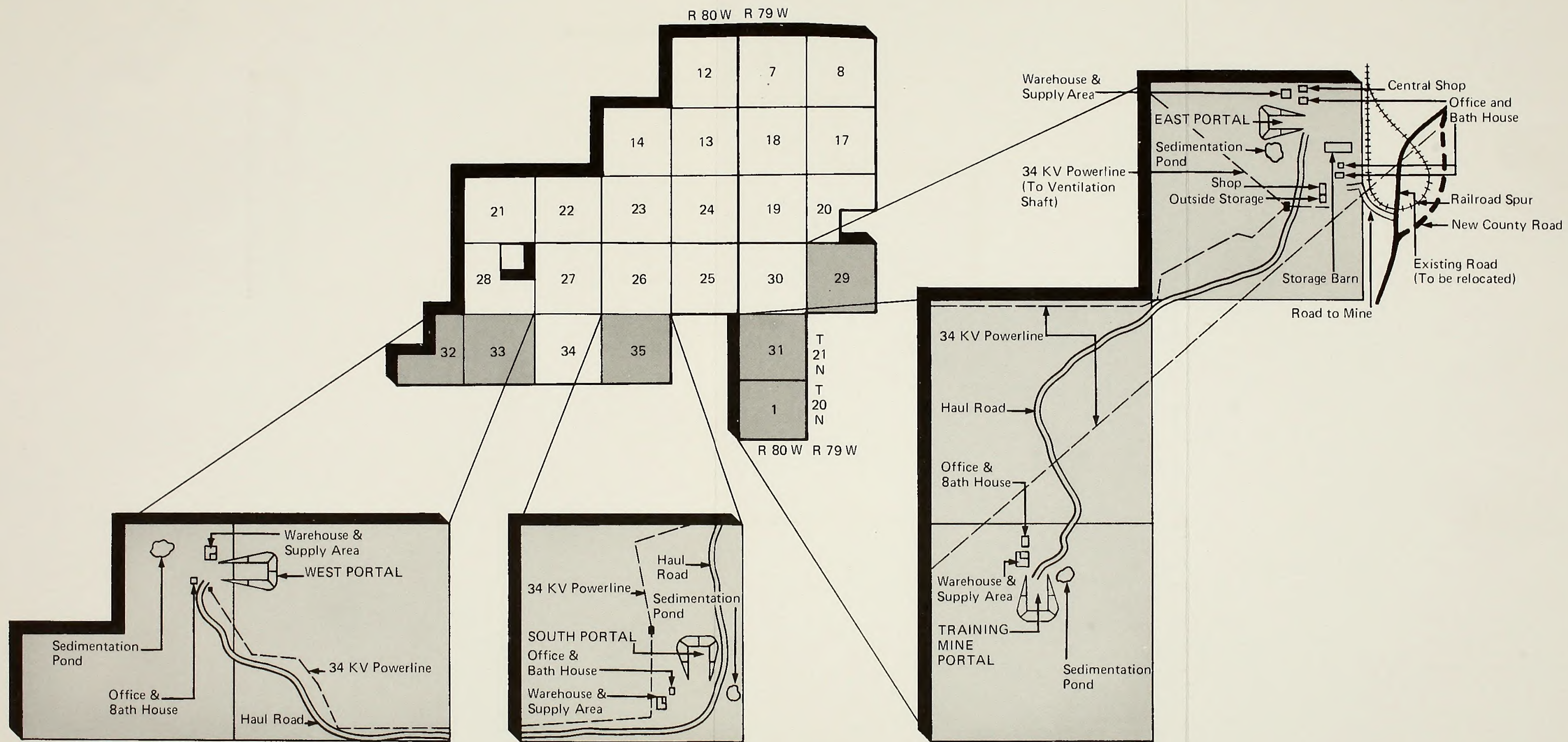
Electrical power would be provided by Carbon Power and Light, Incorporated, from the 34.5-kv transmission line which crosses the property. The main substation would be located near the main office. Portable substations would be located throughout the project area to serve the three portals of the main mine, the training mine portal, the ventilation shaft facilities, and the surface mining operations. Approximately 12 miles of line would be constructed; 10 miles would serve underground mining facilities and would remain for the life of the mine. Two miles of line would serve surface mining operations and would be removed upon completion of mining. All mine-related power lines would be constructed in accordance with standards established in the U.S. Department of Agriculture bulletin, REA 61-10, to reduce accidental electrocution of raptors.

Ancillary Facilities

A 13-mile railroad spur requiring a right-of-way (application W-57224) would be constructed by the Union Pacific Railroad Company. The spur would begin at the Union Pacific track in Section 15, T. 22 N., R. 78 W., and terminate in a loop track in Section 28, T. 21 N., R. 79 W., 6th P.M. (see Map CA1-2). Approximately 323 acres would be included in the railroad spur right-of-way: 97 acres of public and 226 acres of state and private land. A short-wave radio base station would be constructed at the office building to facilitate communication in and around the mining area. The proposed telephone line would extend from Elk Mountain to the east portal site for a distance of approximately 8 miles. As no right-of-way application is on file, the exact location of the line has not been determined, but it is estimated that approximately 10 acres (5 acres public, 5 acres private) would be disturbed.

Access Roads

A short section of access road would be constructed from the county road (Carbon County 402) along the



SOURCE: BLM, 1978

Figure CA1-3
SURFACE AND UNDERGROUND
FACILITY LOCATIONS

DESCRIPTION OF THE PROPOSAL

east side. The access road would be constructed along natural land surfaces where possible, avoiding unnecessary cuts and fills. Ditches and culverts would be used to control surface runoff. In accordance with the coal unsuitability criteria on rights-of-way and easements, the relocation of this portion of County Road 402 is acceptable. To secure the general plant and facilities area, fencing or a security station would be provided. The access road would occupy 2 acres of public land and no private land.

A portion of County Road 402 would have to be relocated to avoid the planned route of the railroad spur (Map CA1-3). The relocation of the road would disturb approximately 9 acres of public land. As the exact location of the proposed county road has not been determined, no right-of-way application is on file. When an application is received, an EA will be written on the proposed relocation.

Table CA1-4 summarizes the proposed ancillary facilities for the Carbon Basin Mine.

Surface Mining and Reclamation Operations

The typical operation description for the Carbon Basin project is confined to the areas shown on Figure CA1-4.

Topsoil Removal and Disposition

Topsoil would be removed in advance of the stripping operations and prior to the construction of waste dumps (see Figure CA1-4). The A, B, and C horizons of soils designated as suitable would be stripped and stockpiled. Topsoil stripping would be an ongoing process throughout the mine life. Topsoil stockpiles would be temporary and would be seeded with quick-growing grasses to control erosion.

Watercourse Diversions

All runoff water would be diverted above disturbed areas and returned to natural waterways below the mine. The reclamation program would reestablish the natural waterways as much as possible. Erosion in disturbed areas would be controlled prior to reestablishment of vegetation by building water bars (berms to impede the flow of water across an erodible surface). Any runoff from reclaimed mine areas which would not drain into the mine would be collected in settling ponds. Within the mine, itself, ground water, rain, and snowmelt would be collected at a low point and pumped to settling ponds. These ponds would be located as required by mining and reclaimed when no longer needed. Some of the water collected in the settling ponds might be used for dust control on haul and service roads and in working areas as needed to maintain air quality. If, in practice, it was found to be impossible or impractical to prevent discharges, applicable permits would be obtained, and the water would be monitored and treated, as necessary, before being released and monitored after being released.

Temporary diversion ditches would be built. The bottoms would be seeded with approved grasses where appropriate. Culverts or bridges would be installed where necessary. In no case would diversion ditches discharge directly upon topsoil storage areas, spoil piles, or other unconsolidated material. Surface water diversions would meet all state and federal standards.

Overburden Removal and Disposition

After topsoil material (A, B, C horizons) were removed and stockpiled together, overburden would be drilled and blasted. The broken material would be loaded by electric shovels onto rear-dump trucks for haulage to either disposal dumps or pit backfilling areas located behind the advancing coal face. Overburden disposal sites would be designed to meet state and federal standards. Any overburden having suitable characteristics for soil development and plant growing capabilities would be saved.

Coal Removal

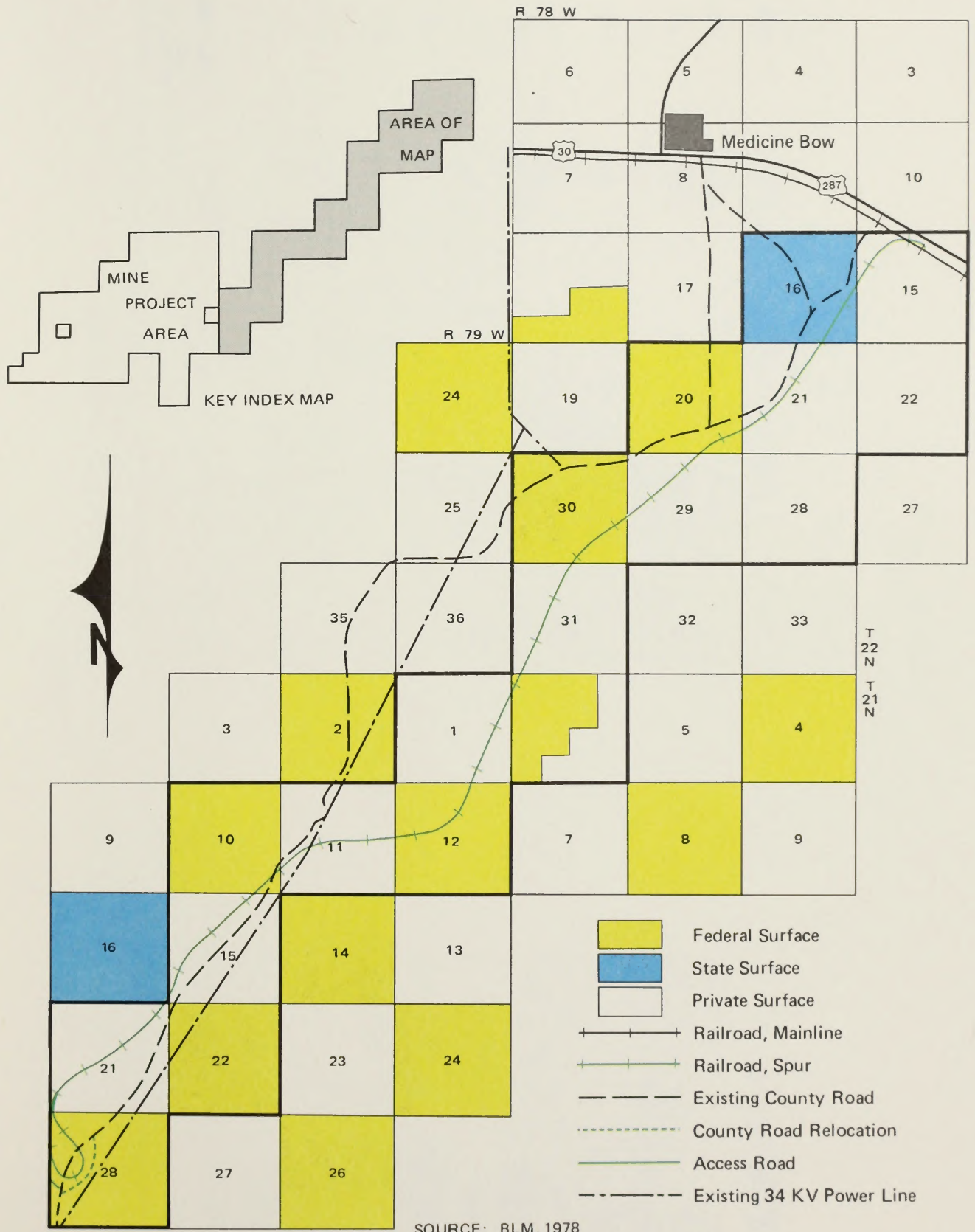
Exposed coal would be drilled and blasted. Broken coal would be loaded by front-end loaders onto trucks for haulage to the coal handling and load-out facilities located at the proposed railroad spur on the eastern side of the property. Coal production from the surface mine would total 10 million tons. Production rate would be approximately 1.0 million tons per year for 10 years. Surface disturbance would occur at the rate of approximately 140 acres a year; reclamation would be initiated at a rate of approximately 120 acres per year. Some areas disturbed by surface mining would be reshaped and utilized as mine facility sites.

Backfilling and Grading of Overburden

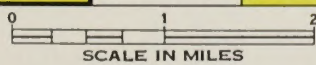
Overburden removed during initial surface mining would be dumped east and southeast of pit I (Figure CA1-4). Other overburden would be dumped into a small waste dump south of the outcrop line. As soon as sufficient room were available, backfilling of the mined out area would commence.

Since the access portal for mine I would be located in the exposed Johnson bed in the pit I highwall, backfilling is scheduled and planned for minimal interference to underground operations. As surface mining progressed southward into pits I and II, pit backfilling would follow, generally conforming to the original topography. At the completion of surface mining, the pits would be backfilled except where underground access portals were located.

Overburden would be removed by shovel and transported by trucks to the mined out area behind the advancing coal face. Bulldozers would be used for shaping the backfilled areas. Final grading of backfilled areas would be done prior to topsoil replacement and seeding. Prior to the replacement of the topsoil, the slopes of the waste dumps would be reduced to minimize erosion.



SOURCE: BLM, 1978



Map CA 1-3
GENERAL ACCESS AND UTILITIES

Table CAL-3

RELATION OF CARBON BASIN COAL DEVELOPMENT TO SOUTHCENTRAL COAL DEVELOPMENT

	Non-Coal	Existing Coal	Southcentral Proposed Coal	Subtotal	Proposed Carbon Basin	Total	% Increase Resulting From Carbon Basin
Final contour (acres disturbed)	2,375 ¹	10,286 ²	4,605 ²	17,266	1,416 ²	18,682	8.2
Mine Facilities ³ (acres disturbed)	0	61	349	410	209	619	51.0
Ancillary facilities ⁴ (acres disturbed)	0	23	400	423	500	923	118.2
Existing facilities relocation ⁵ (acres disturbed)	0	0	206	206	6	212	2.9
Acres reclaimed ⁶	1,900	8,550	2,497	12,947	833	13,780	6.4
Water Use ac-ft/yr (non-cumulative)	5,310	1,600	910	7,820	800	8,620	10.2
Number of mines	0	6	3	9	1	10	11.1
Tons of coal produced (millions)	0	158	46	204	31	235	15.2
Number of oil and gas wells	408	0	0	408	0	408	0.0
Population ⁷	19,797	9,888	1,360	31,045	2,640	33,685	8.5
Employment ⁷	8,737	4,365	612	13,714	1,323	15,037	9.6
Housing and support facilities ⁷ (acres disturbed)	2,184	1,091	153	3,428	331	3,759	9.7

Table CAI-3 (Cont'd.)

RELATION OF CARBON BASIN COAL DEVELOPMENT TO SOUTHCENTRAL COAL DEVELOPMENT

	Non-Coal	Existing Coal	Southcentral Proposed Coal	Subtotal	Proposed Carbon Basin	Total	% Increase Resulting From Carbon Basin
New power lines ⁸ (miles)	45	25	45	115	0	115	0.0
New railroad spur (miles)	0	3	8	11	13	24	118.2
New pipelines (all kinds) ⁸ (miles)	182	0	3	185	0	185	0.0
New access roads (miles)	0	0	9	9	1	10	11.1
New telephone lines (miles)	N.A.	0	4	4	8	12	---

1 Includes areas disturbed by oil and gas production, uranium, sand and gravel, prison construction, and the like.

2 Includes mine pit area, haul roads, topsoil and overburden storage areas.

3 Includes onsite surface facilities, railroad spur, access road, power lines, telephone lines and water storage areas inside project boundary.

4 Includes offsite access roads, haul road, railroad spur, power lines, telephone lines, pipelines, coal conveyor and water storage outside project boundary.

5 Includes power line, telephone line, Highway 789 relocation, and county road.

6 Areas on which topsoil has been replaced and shaped; seedbed prepared and seeded.

7 The estimates for "Non-Coal" and "Existing Coal" are derived by apportioning 1990 projections into coal and non-coal related economic activity. The apportionment is approximate and is shown for comparison with other categories. Coal employment figures shown include associated support employment.

8 Future estimates based on past occurrences.

DESCRIPTION OF THE PROPOSAL

Topsoil Replacement and Erosion Control Measures

Because of the sloping nature of some of the Carbon Basin project area, surface manipulations that prevent runoff would probably be an important part of the seedbed preparation. The tops of the spoil dumps would be shaped to form swales to prevent excessive runoff. Graded and shaped surfaces ready for topsoil replacement would be scarified to enhance water infiltration and to reduce compaction.

Approximately 2,049 acre-feet of suitable soils would be available for reclamation. This would provide an average of 12 inches or more of topsoil covering for the reclaimed areas at the end of mining. Soils required for revegetation would be taken out of stockpiles and spread over graded and shaped areas. Fertilizers and other soil amendments would be incorporated as needed.

Planting and Revegetation

The reclamation program of the coal mining operation would restore the affected public lands to a diverse, effective, and permanent vegetative cover of species native to the area or species that would support the planned post mining land use. A mining permit will not be approved unless the applicant's mine plan has demonstrated that reclamation to the post mining land use can be accomplished.

Implementation of the reclamation plan would include seedbed preparation, seeding and planting, and evaluation. Topsoil handling and seedbed preparation would conform to state and federal regulations and requirements.

An approved grass mixture would be seeded in the fall, and shrubs would be planted the following spring. All seeding and planting would be done during times of favorable soil moisture. Supplemental irrigation of all shrub plantings would be required, especially at the time of initial planting. Seeding and planting rates would be sufficient to assure establishment and self-generation of the desired vegetation. The revegetated lands would be fenced to eliminate grazing by range animals and pronghorn until an adequate cover of vegetation could be established and maintained.

Underground Mining

The coal reserves to be mined with underground mining methods would be recovered with continuous miners and longwall equipment. Present data indicate coal beds dip at approximately 11 to 16 degrees and extend to depths of 900 feet. Underground mining would produce approximately 95% of the total coal production.

During the initial phase of development, coal would be conveyed out of each of the three portals. Coal coming out of the east portal would go into a storage facility located in Section 29. Coal from the south and the west portals would be trucked to the storage facility located in Section 29. After completion of the initial development, all coal would be conveyed out the east portal

into the storage facility. Unit trains would be loaded from the storage facility. This would connect the mine site with the Union Pacific main line at Medicine Bow, Wyoming.

A combination of continuous and longwall mining would be used to recover the coal. Initial mining would be by the continuous method; longwall would be used where feasible as mining progressed.

A series of parallel underground openings called entries (separated by pillars of coal to provide support) would be developed from the portal. After the main entries were first developed, panel entries would be driven off one side of these main entries. These panel entries would be developed by advance mining methods in a consecutive manner in a direction away from the portals and on one side of the main entries. When these panels were mined out, mine development would progress on the other side of the main entries toward the portal. While retreating towards the portal, coal remaining in barriers between the main entries and room panels would be recovered. It is planned to use continuous mining equipment for mine development.

Longwall Mining

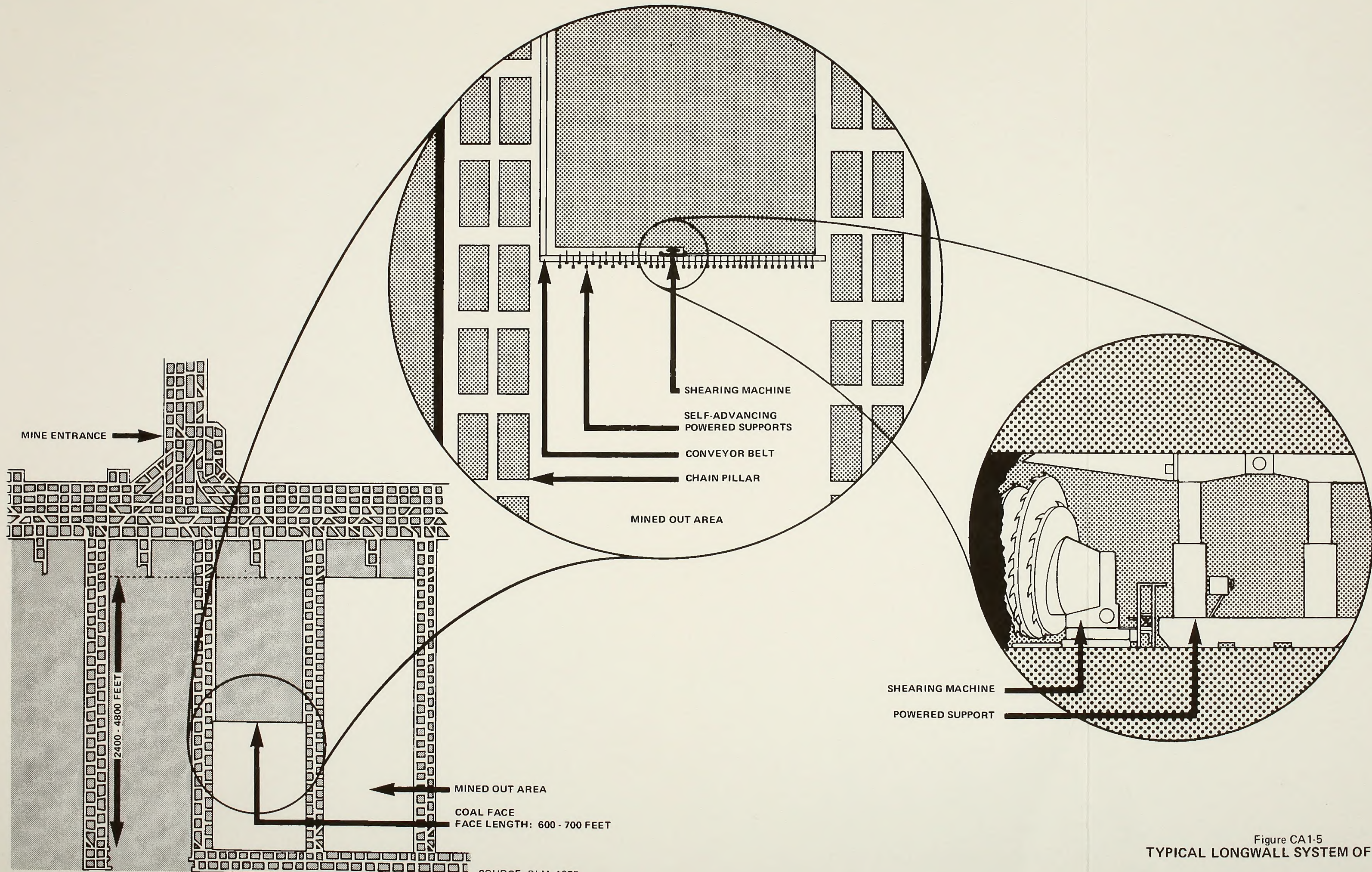
Longwall mining would be initiated by developing one or more entries 500 to 600 feet apart. Pillars left between gates would be mined by using longwall equipment and by retreat mining procedures. Most of the coal would be recovered by this longwall method of mining. The retreat system for longwall mining is commonly used in the United States since the entries do not have to be maintained behind the longwall face, thus simplifying roof support, ventilation, and the like.

The longwall system would consist of a combination of three basic components: the support system, the mining machine, and the haulage system. These components are shown in Figure CA1-5.

The support system would consist of interconnected hydraulic jacks with roof shields and floor bars, would be self-advancing, and would be capable of advancing the face conveyor.

Two types of mining machines (the planer and the shearer loader) are used in this country. It is probable that a shearer loader would be used. The shearer loader is a machine equipped with either a single or multiple drum cutter armed with cutter bits and mounted on a flexible armored conveyor. The shearer loader, and conveyor can be moved forward by hydraulic drum as coal is removed from the longwall panel.

The primary function of the face conveyor would be to haul coal; however, it should also be flexible enough to allow snaking the conveyor and would have sufficient strength to support the shearer loader which slides atop it. The longwall shearer would cut the coal from the face and discharge it onto the face conveyor which would discharge onto a stage loader to provide an even flow of coal onto the panel belt conveyor. At the head entry side of the longwall panel, the face conveyor would discharge onto an intermediate haul unit that would either piggyback or side dump onto a panel belt.



SOURCE: BLM, 1978

Figure CA1-5
TYPICAL LONGWALL SYSTEM OF MINING

DESCRIPTION OF THE PROPOSAL

Continuous miners would be used in all development work and in room and pillar sections in areas where faulting is known or suspected to occur and where long-wall mining is not applicable. A section would consist of a continuous miner, two shuttle cars, a roof bolter, and a rock duster. The continuous miners would cut the coal and simultaneously load it into a shuttle car. The shuttle cars would haul the coal to the belt line and dump it into a ratio feeder equipped with a breaker.

Subsidence

After coal extraction, the openings or mined-out panels would eventually close by gravitational forces. Convergence of the roof would gradually work towards the surface.

Predictable and planned subsidence is desirable since subsidence relieves stresses within the rock caused by coal removal. Overloading of underground structures are thus reduced, and a maximum recovery of the reserves is possible.

A baseline elevation survey of the project area would be performed before the mining operations would commence. Permanent survey stations would be established for the area and would be described in maps and aerial photographs with reference coordinates, elevations, and a geological summary. Engineering data, based on mine design and investigations on rock mechanics, would be used to predict and check the indications of the occurrence of subsidence. The data provided would be used to predict the magnitude and affects of subsidence and to prepare a reclamation plan for the affected areas.

The subsidence monitoring would consist of two major parts: setting up a rock mechanics study to evaluate the rock properties and establishing a grid system of fixed stations over the first areas to be mined. The stations would be located in reference to the underground mining operations. The location of the stations would be at given distances away from the underground workings and at given intervals over the underground workings. Such data as vertical and horizontal displacement of the surface stations, the depth of cover at each station, the mining height in the area, and the mine design in the area would be recorded. Measurements in this operating phase of the monitoring program would be made with conventional surveying equipment and would be periodically photographed by aerial methods.

INTERRELATIONSHIPS

Hanna Area Management Framework Plan (MFP)

The Hanna Area Management Framework Plan (MFP) contains land management decisions for that portion of the Medicine Bow Resource Area which lies within Carbon County. The planning within this unit was completed in 1977 in accordance with the standards of the Federal Land Policy and Management Act of 1975 and the Federal Coal Leasing Amendments Act of 1975.

The present land use decision for the public land in Carbon Basin is for wildlife habitat and livestock grazing management. However, livestock grazing will be excluded from the mine project area in the updated Hanna MFP. Recreation, especially hunting, has been identified as a secondary land use. An interim multiple use objective is to allow continued identification, leasing of the mine for the life, and development of coal in the planning unit (see Map CA1-3) to assist the nation in meeting its growing energy needs while providing adequate environmental safeguards and strict rehabilitation standards. The post-mining land use decision for public land is to return the planning unit to its original (present) land use of wildlife habitat, livestock grazing, and recreation management unless a higher use of the land is identified and procedures approved by BLM.

Relation of Carbon Basin to Southcentral ES

The possible development of coal in the Carbon Basin area is recognized in the Development of Coal Resources in the Southcentral Wyoming Environmental Statement. A discussion is included in the regional assessment section as part of the Hanna area of interest (Southcentral ES, Regional, Chapter 8, High Level Development). The Hanna area of interest, which includes Carbon Basin, is shown on the Southcentral ES, Regional, Map 1, Surface Ownership and Coal Action Areas. The analysis of the impacts resulting from development of all the areas of interest of which Carbon Basin is a part is included in the high level scenario (Southcentral ES, Regional, Chapter 8).

The Southcentral ES includes in its regional proposed action the coal mines now in operation and the three proposed coal mines on existing federal coal leases. As shown on Table CA1-3, the magnitude of developments in the Carbon Basin ES is in addition to the existing and proposed developments presented in Southcentral ES, Chapter 1.

CHAPTER 2

DESCRIPTION OF THE EXISTING ENVIRONMENT

CLIMATE

The climate of southcentral Wyoming is characterized by dry air masses, which are modified Pacific air masses moving eastward over the Rocky Mountains. Westerly winds provide most of the precipitation. In the summer, most of the precipitation in the area is a result of thunderstorms.

The proposed Carbon Basin project area is located about 6 miles northeast of the city of Elk Mountain and 12 miles southeast of Hanna in Carbon County. Temperatures at the site average about 45°F annually. Temperatures of 89°F or above occur in July. January is the coldest month with frequent daily minimum temperatures of 0°F or below (Becker 1964). The average frost-free season (32°F or above) at the Carbon Basin Mine site is estimated to be 113 days (National Oceanic and Atmospheric Administration 1974). Annual precipitation is low, averaging about 10 inches per year. Most of the precipitation is the result of spring and early summer thunderstorm activity, with most precipitation occurring in March, April and May (Southcentral ES, Regional, Chapter 2, Table R2-3). The mean annual lake evaporation is estimated to be about 36 to 42 inches. Winds are generally out of the southwest and west for much of the year with an average speed of 11 miles per hour (Figure CA2-1). Stable atmospheric conditions prevail about 80% of the time because of the cold temperatures and moderately strong winds. In this area, surface-based inversions are very frequent despite the high average wind speeds. They occur annually in the mornings 75% to 85% of the time. They occur most frequently in summer, least frequently in spring. During afternoons, they are uncommon except in winter where they are observed about one-third of the time (Southcentral ES, Regional, Chapter 2, Climate).

AIR QUALITY

Particulate air quality in undeveloped areas of southcentral Wyoming has an annual geometric mean ranging from 19 to 31 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) as recorded at five state and privately operated particulate sampling sites. The mean concentration at the five samplers is 25 $\mu\text{g}/\text{m}^3$ and the median is 24 $\mu\text{g}/\text{m}^3$.

Two samplers were operated by Rocky Mountain Energy in Carbon County from January through December of 1977. These samplers were located at the Adams Ranch (27 miles south of Creston Junction) and at the

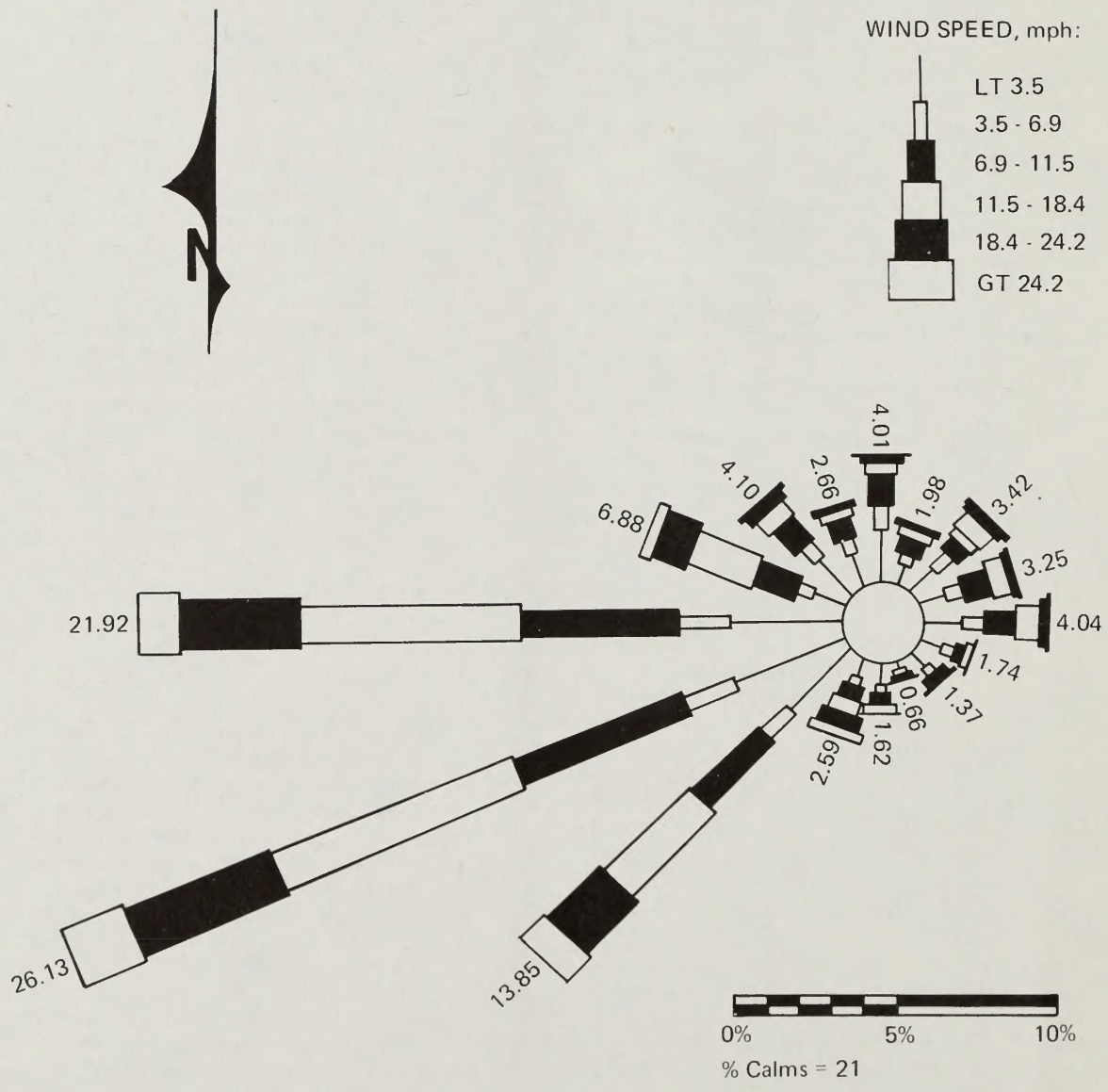
Curry Ranch (1 mile northwest of Medicine Bow). The sampler at the Adams Ranch recorded an annual geometric mean of 31 $\mu\text{g}/\text{m}^3$ and maximum 24-hour values of 136 $\mu\text{g}/\text{m}^3$ and 106 $\mu\text{g}/\text{m}^3$. The sampler at the Curry Ranch produced an annual geometric mean of 30 $\mu\text{g}/\text{m}^3$ and maximum 24-hour values of 86 $\mu\text{g}/\text{m}^3$ and 71 $\mu\text{g}/\text{m}^3$. These data being the most recent, the existing particulate air quality at the Carbon Basin is considered to be 31 $\mu\text{g}/\text{m}^3$.

There has been no intensive monitoring of gaseous pollutants in the ES area. The nearest sampling for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) was conducted for 3 months in 1976 at the Patrick Draw site (about 67 miles west of Rawlins). Though these data are not of sufficient duration to specifically quantify the presence of these pollutants in the ES area, they may be interpreted as an indicator of these pollutant levels at the site. The arithmetic mean concentrations recorded for SO_2 and NO_2 were 26 $\mu\text{g}/\text{m}^3$ and 19 $\mu\text{g}/\text{m}^3$ respectively (Wyoming Department of Environmental Quality 1977), both of which are well below the Wyoming state standard. Concentrations at the remote mine site are most likely somewhat lower than these recorded concentrations.

Visibility at the site ranges from less than 1 mile to greater than 60 miles throughout the year. Average visibility ranges from about 26 to 47 miles with greatest visibility occurring during spring and summer months.

GEOLOGY

The proposed project area is located about 6 miles northeast of the city of Elk Mountain (Southcentral ES, Regional, Appendix A, Map 1) and covers much of a small structural province known as Carbon Basin (Southcentral ES, Regional Appendix A, Map 4 and Figure CA1-2). The structural relation between Carbon Basin and Hanna Basin is illustrated on Map 4 in Appendix A which shows elevation contours on top of the buried Cloverly Formation (Lower Cretaceous or about 120 million years in age). The elevation of the top of the Cloverly Formation in Carbon Basin varies from 4,000 to 7,000 feet below sea level. The basin land surface is about 7,000 feet above sea level. The top of the Cloverly in Carbon Basin is 11,000 to 14,000 feet below the surface and is in the form of a small basin between the Simpson Ridge and the Big Medicine Bow anticline. Thus, 14,000 feet of post-Lower Cretaceous strata overlie the Cloverly Formation in Carbon Basin, the uppermost of which is the Hanna Formation which crops out



SOURCE: NATIONAL CLIMATIC CENTER, STAR PROGRAM FOR SELECTED U. S. CITIES, 1968. (RAWLINS, WYOMING)

Figure CA2-1
ANNUAL WIND ROSE FOR RAWLINS

DESCRIPTION OF THE ENVIRONMENT

over most of the proposed mining area. The Hanna Formation is composed of conglomerates, sandstones, clays-tones, shales, and many coal seams. The coal seams dip toward the center of the project area similar to the surface of the Cloverly Formation and are not interrupted by faulting to the extent that exists in the Hanna Basin.

On some private company geologic maps such as one of Carbon Basin released by Intrasearch (1976), the project area is mapped as the Dutton Creek Formation as opposed to the Hanna Formation (Appendix A, Map 4). The Dutton Creek Formation was named by Hyden and others (1965) to describe a 200-foot thick section of coarse conglomerates 12 miles southwest of Carbon Basin.

The section is now regarded as part of the Hanna Formation, and the name Dutton Creek Formation was abandoned by the Geological Survey in 1969 (Gill et al. 1970).

Coal

Coal reserves in the Carbon Basin are predominantly contained in the Hanna Formation of Paleocene-Eocene Age. Approximately 30 coal horizons have been identified. Of these horizons, one bed and two groups may have commercial potential (see Table CA1-2). They are described below.

Johnson Bed

The lower most bed in the Hanna Formation is the Johnson, which has a maximum thickness of 32 feet near the center of the project area. Along the western edge, the Johnson seam averages 22 feet in thickness and thins westward to 14 feet in thickness. The Johnson thins locally to 8 feet in thickness and increases to 10 to 14 feet in thickness along the eastern edge. The Johnson bed appears to be a single, continuous bed of coal over most of the area, but small splits may occur locally near the top and base of the seam. Inplace reserves in the Johnson bed—measured and inferred—are estimated by the company to be approximately 220 million tons. The Johnson bed is classified as subbituminous A and B.

Blue Group

The Blue group is identified as a coal zone overlying the Johnson bed. Locally, the Blue group contains seams in excess of 5 feet in thickness in the central, eastern, and southeastern portions of the area.

Finch Group

The Finch group is subdivided into upper and lower subgroups which overlay the Blue group. Maximum thicknesses are developed in the western and central portions of the project area. Locally, the Finch group consists of seams in excess of 13 feet in thickness.

Other Mineral Resources

Sand and Gravel

Reserves of sand and gravel suitable for concrete aggregate are unknown. There is a small deposit in the northeast corner of the project which is located on both federal and private lands. There are also numerous deposits along the Medicine Bow River south of the project area which could be utilized.

Scoria

Scoria (clinker) deposits for road and railroad spur construction have not been identified in or near the project area.

Paleontology

A preliminary survey of outcrops of the Hanna Formation within the project area was conducted by McGrew (1976). A general summary of the principal fossiliferous formations, ages, number of known fossil localities, and general fossil types in the proposed project area is presented in Table CA2-1.

TOPOGRAPHY

The average elevation of the proposed project area is about 7,200 feet above sea level, and the local relief is about 400 feet. The local relief consists of a northeast trending ridge that has been dissected by the Second Sand and Third Sand Creeks which drain the area to the east. These creeks are tributaries of the Medicine Bow River (Southcentral ES, Regional, Appendix A, Map 1). There is no relation between the surface topography and the geologic structure of Carbon Basin.

SOILS

Soil data for the Carbon Basin project area were taken from an Order III soil survey report (Map CA2-1) done by the Soil Conservation Service (SCS) for the Bureau of Land Management in the summer of 1977 (USDA, SCS 1978). Additional data over Sections 1, 29, 31, and 35 were correlated from the survey done by VTN Colorado, Inc., in the fall of 1977 (VTN 1978). The soils information by VTN over Sections 1, 29, 31, and 35 is an Order II survey. The VTN map (Map CA2-2) and soil associations were used for calculations of disturbance and available topsoil material for reclamation of surface mining. Topsoil, as presented in this document, refers to any soil material suitable as a plant growing medium for reclamation purposes. This could include the A, B, and C horizons of the soil profile. The soil survey of the Carbon Basin project area conforms to the latest accepted practices of the National Cooperative Soil Survey

Table CA2-1

SUMMARY OF FOSSIL LOCALITIES IN THE AREA OF THE
PROPOSED CARBON BASIN MINE

Formation	Period	Known Fossil Localities	Type of Fossils
Hanna	Upper Paleocene/ Lower Eocene	General	V, I, P
Lewis Shale	Upper Cretaceous	General	I

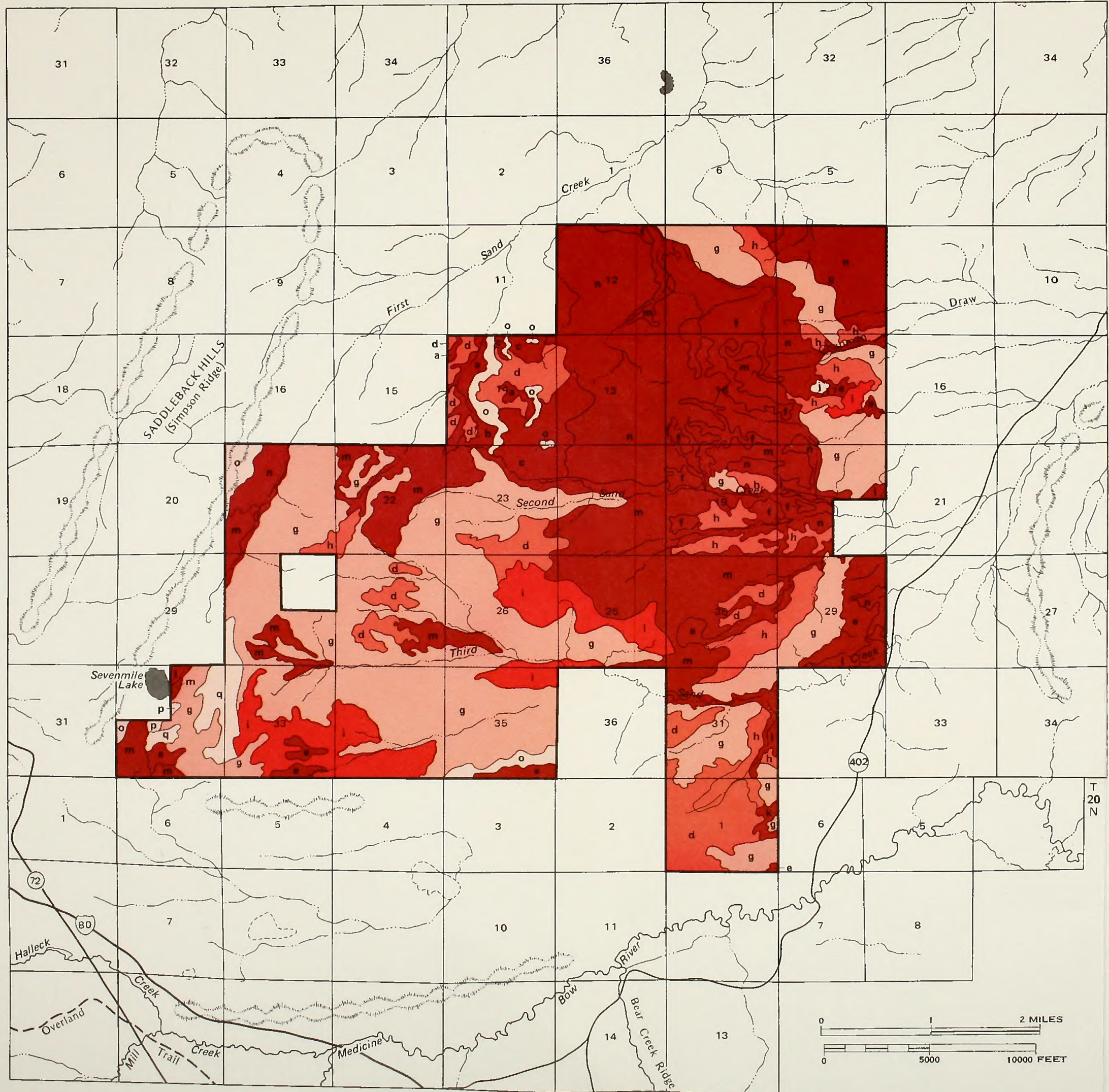
Source: McGrew, 1976.

General = Formation contains fossils throughout; specific localities are not identified.

V = Vertebrate

I = Invertebrate

P = Paleobotanical



- Deep (greater than 40 inches)
- Moderately Deep (20 to 40 inches)
- Shallow (10 to 20 inches)
- Very Shallow (less than 10 inches)
- Unsuitable (Playa, Rockland, Disturbed Lands)

- a. 38B - Rock River Sandy Loam, 2% to 6% slopes
- b. 38C - Rock River Sandy Loam, 6% to 12% slopes
- c. 78B - Ryan Park Sandy Loam, 2% to 6% slopes
- d. 90B - Blazon Loam, 5% to 15% slopes
- e. 210 - Ravalli-Forelle-15 Complex, 0% to 6% slopes
- f. 251 - Grieves-Blackhall Association, 2% to 20% slopes
- g. 252 - Shinbara-Blazon-Rock Outcrop Complex, 6% to 30% slopes
- h. 253 - Blazon-Satanka Association, 2% to 15% slopes
- i. 254 - Bullock-Blazon Complex, 0% to 6% slopes
- j. 255 - Playa
- k. 256 - McFadden-Rock River Complex, 0% to 20% slopes
- l. 257 - Havre-Glendive Soils, 0% to 6% slopes
- m. 258 - Rock River-Satanka Association, 0% to 12% slopes
- n. 260 - Ryan Park-Rock River Association, 2% to 20% slopes
- o. 401 - Torriorthents-Rock Outcrop Complex, 30% to 60% slopes
- p. C.F. - Cut and Fill
- q. M.D. - Mine Dump

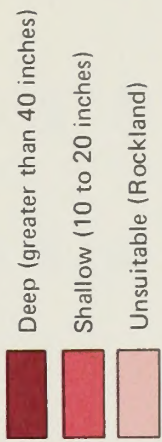
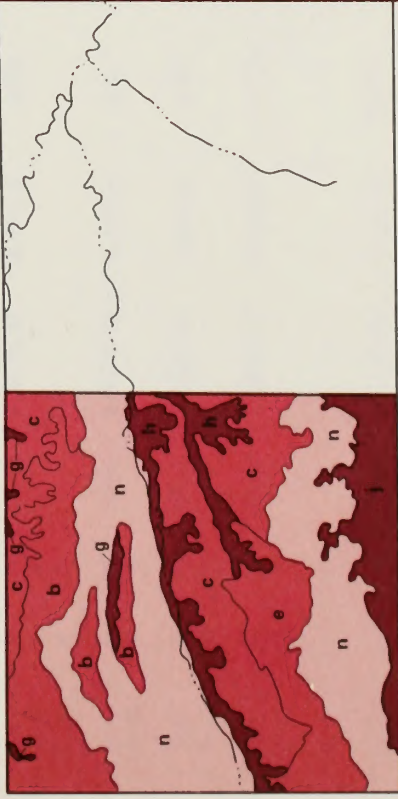
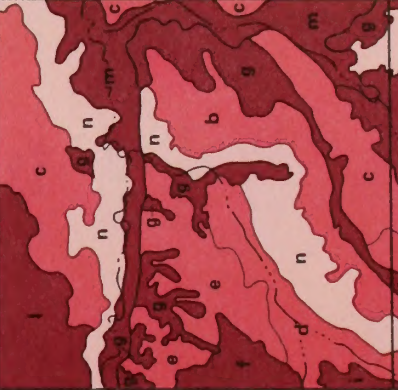
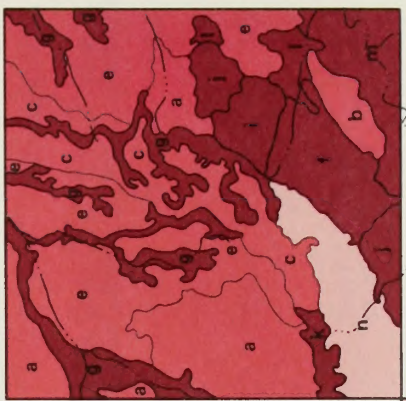


Map CA 2-1
ORDER III SOILS MAP

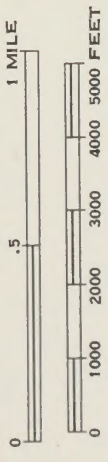


R 80 W R 79 N

12	7	8	
	13	18	17
14	23	24	19
21	22		25
	27	26	30
		33	34
			35
			T 21 N
			T 20 N



- a. 2-3 Blackhall-Blazon, 3% to 30% slopes
- b. 3 Blazon, 6% to 30% slopes
- c. 3-1 Blazon-Shinbara, 2% to 30% slopes
- d. 3-4 Blazon-Delphill, 6% to 30% slopes
- e. 3-10 Blazon-Satanka, 6% to 30% slopes
- f. 6 15, 0% to 30% slopes
- g. 6-7 15-Forelle, 0% to 30% slopes
- h. 7 Forelle, 0% to 30% slopes
- i. 8-2 Ryan Park-Blackhall, 3% to 30% slopes
- j. 8-5 Ryan Park-Grieves, 0% to 20% slopes
- k. 9 Rock River, 0% to 12% slopes
- l. 9-2 Rock River-Blackhall, 2% to 30% slopes
- m. 257 Havre-Glendive Soils, 0% to 6% slopes
- n. 401 Torriorthents-Rock Outcrop, 30% to 60% slopes



SOURCE : USDA SCS, 1978;
VTN, 1978; BLM, 1978

Map CA 2-2
ORDER II SOILS MAP

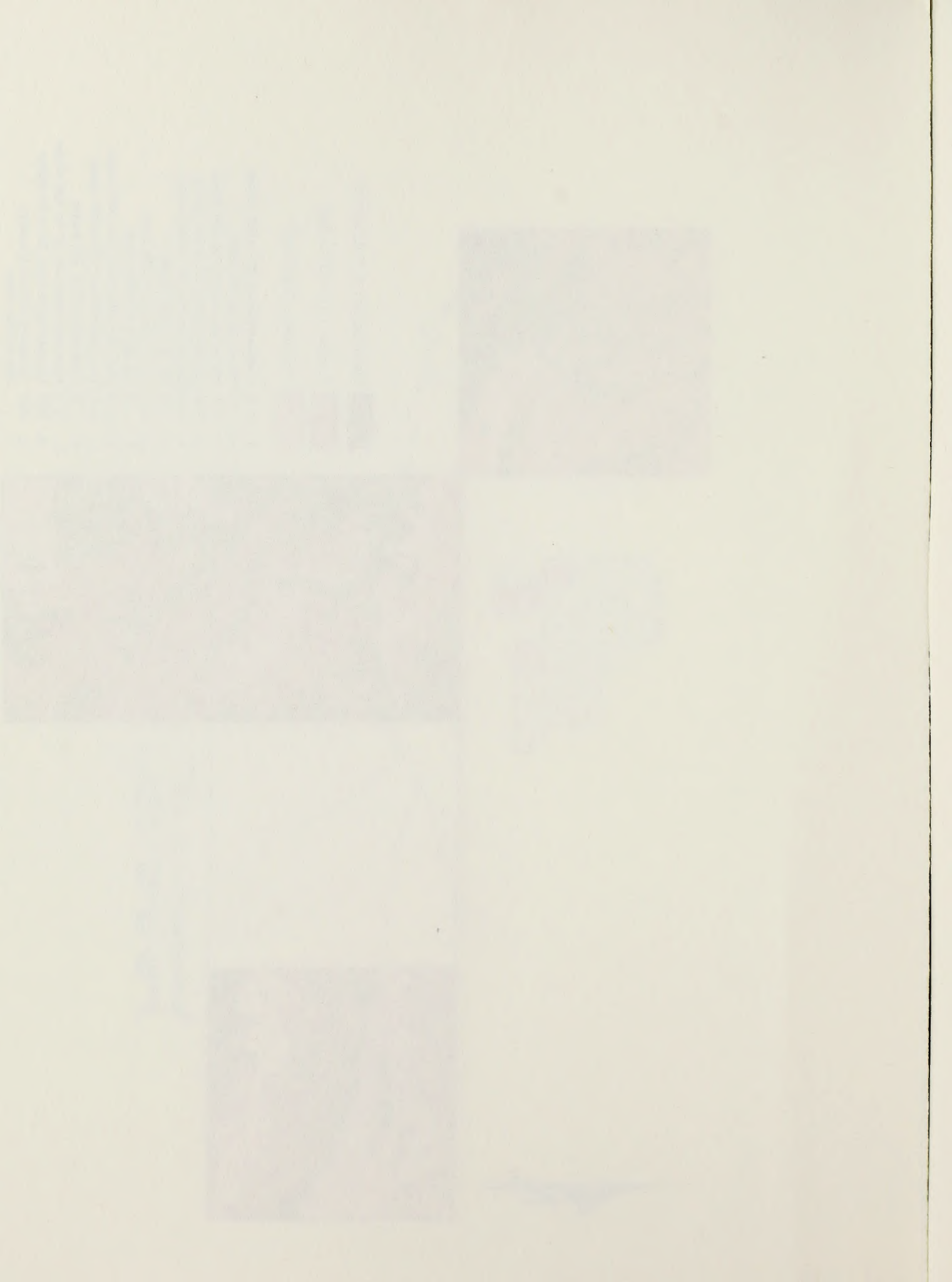


Table CA2-2

SOIL INTERPRETATION SUMMARY--CARBON BASIN

Soil Unit Symbol	% Slopes	Erosion Hazard Potential ¹ Water Wind	Rating	Ac	PSIAC ² Fe/SqMl/Yr	Ton/Ac/Yr	Suitability In. Avail.	Suitability for Final Cover ³ Mined Land	Range Site ⁴	Capability Group ⁴		Estimated Acres in Project Area	Vegetative Type ⁵	
										Dryland	Irrigated			Acres
38B	2-6	L	M	24-29	0.20-0.24	0.6-0.8	12-60	M-H	Loamy	VIe5	IIIe	126	0.8	4
38C	6-12	M	N	26-33	0.21-0.27	0.7-0.9	12-60	M-H	Loamy	VIe5	IVe	36	0.2	4
78B	2-6	L	H	24-31	0.20-0.25	0.06-0.08	26-60	H	Sandy	VIe2	IIIe	360	2.3	4
90B	5-15	H	M	31-41	0.25-0.36	0.8-1.2	0-6	L	Sh. Loamy	VIIe14		1,055	6.8	4
210	0-3 3-6	L M	M M	24-29	0.20-0.24	0.6-0.8	14-60	M-H	Saline Upland Loamy	VIIIs71 VIe2	VIIs71 IIIe2	398	2.6	14, 4
251	2-6 6-15 15-20	M M H	M H H	27-37	0.22-0.31	0.7-1.0	4-60	L-H	Sandy Sh. Sandy	VIe5 VIIe14		515	3.3	4
252	6-15 15-30	M H	M M	51-61	0.52-0.74	1.7-2.4	0-6	L	Sh. Loamy Very Shallow	VIIIs17 VIIe14		5,007	32.3	4
253	2-6 6-15	M M	M M	37-47	0.31-0.45	1.0-1.4	6-27	L-M	Sh. Loamy Loamy	VIIe14 VIe2		832	5.4	4
254	0-3 3-6	L M	M M	23-27	0.18-0.22	0.6-0.7	6-10	L	Impervious Clay Sh. Loamy	VIe1 VIIe14		917	5.9	4a
255	0-3	L	H									6	0.04	1
256	0-3 3-6 6-15	L M M	H H H	26-37	0.21-0.31	0.7-1.0	13-60	L-H	Sandy Loamy	VIe5		27	0.2	4

Table CA2-2 (Continued)

Soil Unit Symbol	Erosion Hazard Potential ¹		Rating	Ac Ft/SqMi/Yr	Ton/Ac/Yr	Suitability for Final Cover ³ for Mined Land	Range Site ⁴	Capability Group ⁴		Estimated Acres in Project Area		Vegetative Type ⁵	
	% Slopes	Water Wind						PSIAC ²	In. Avail.	Suitability	Dryland		Irrigated
257	0-3	L M	14-19	0.13-0.16	0.4-0.5	6-60	M-H	Lowland	VIe2	IIIe2	251	1.6	14, 4
258	0-3	L M	24-32	0.20-0.27	0.6-0.9	17-60	M-H	Lowland Loamy	VIe5 VIe2	IIIe5	2,634	17.0	4
260	2-6	L H	26-33	0.21-0.27	0.7-0.9	12-60	M-H	Sandy Loamy	VIe5 VIe2		2,890	18.6	4
401	30-60	H H	61-75	0.74-1.2	2.4-3.5	0	L	Very Shallow	VIIIIs		214	1.4	4, 4a
C.F.	Out and Fill			(Disturbed Land)							15	0.1	
M.D.	Mine Dump			(Disturbed Land)							225	1.4	

Source:

1. Erosion hazard classes or susceptibility of the soil to erosion when no cover is present from BLM 7317.1 and soil profile descriptions in USDA, SCS 978, 1977, 1976, and 1972. L--Low (Slight) M--Moderate H--High (Severe).
2. Estimate present erosion rates (Pacific Southwest Inter-Agency Committee 1968).
3. Estimated soil suitability for reclamation of mined land (BLM 7312); L--Low (Poor), M--Moderate (Fair), and H--High (Good).
4. Soil survey legend and interpretations and mapping unit descriptions SSA630 (January 1978).
5. Vegetative types adapted to and likely to occur on soil types (see Vegetation section).

DESCRIPTION OF THE ENVIRONMENT

Program using the new Soil Taxonomy, USDA, 1975. Mapping units are based upon soil types with similar properties. Separation is at family, association, complex, or series level. Additional units were not shown in each mapping unit if they were too small or too complex to delineate or if the soil survey was not detailed enough to describe them.

Some of the principal soils found on the Carbon Basin project area that would be disturbed by surface mining are in mapping units 252 (3-1, 3-10); 401 (401); and 90B (3-1, 3-10). (See Maps CA2-1 and CA2-2.) Soils of mapping unit 252 characteristically occur on moderately steep and steep residual uplands with sharp ridge crests and slope breaks. These loams to fine sandy loams have a high erosion potential, steep slopes, very shallow depths, and rock outcrops, making them poor sources of soil material for reclamation.

The soils of mapping unit 401 (401) occur as a complex of Torriorthents and rock outcrop on very steep, rough, and broken lands. The very shallow depth, very severe runoff, and erosion hazard make these soils unsuitable for reclamation.

The soils of mapping unit 90B (3-1, 3-10) characteristically occur on gently sloping to moderately steep residual uplands. These loams to sandy clay loams have a moderate to high erosion potential and shallow depths, making them poor to fair sources of soil material for reclamation.

The soils of mapping unit 210 (6-7) characteristically occur on gently sloping to moderately steep slopes on alluvial fans, terraces, and drainage ways. These loam to clay loam soils have a low to moderate erosion hazard potential and subsoil sodium in the Ravalli portion, making them fair to good sources of topsoil material.

The application of the coal unsuitability criteria to the narrow floodplain soils (257) in the First, Second and Third Sand Creek drainages within the project would identify these areas as not being alluvial valley floors or prime farmland. The buffer zone (1-3/4 miles and 1/4 mile) for the Medicine Bow River alluvial valley floor would cross over into the mine project. These areas would be entirely on private surface. These areas are acceptable pending further study designation except for a small portion in the SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 1, T. 20 N., R. 79 W., which is unsuitable.

A soil use interpretation summary for the mapping units (Map CA2-1) is shown in Table CA2-2.

Detailed soil use interpretations for and description of the mapping units are given in the Carbon Basin Appendix A.

WATER RESOURCES

Ground Water

The ground water system in Carbon Basin has been studied only superficially, and properties of the system are largely unknown. The coal-bearing formations of the basin are essentially separated from the broad regional

aquifers by a bowl-shaped layer of relative semipervious Lewis shale (see Figure CA1-2). The layer of shale is especially significant because it essentially eliminates any hydraulic connection between the coal-bearing formations and the alluvium along the Medicine Bow River. Where the river flows past the south side of the project area, the alluvium rests partly on the shale and partly on the Mesa Verde Formation, which underlies the shale.

The hydraulic gradient in the Mesa Verde is away from the river. If any water were lost from the river, it would flow under the shale. Small, insignificant amounts of water could be forced upward through the shale; however, the rate of movement through the shale would be very slow.

In the following analysis, the word basin is applied to those formations enclosed by the Lewis shale. Within the basin, ground water exists in three aquifer types: alluvial, water table (including some possible perched zones), and artesian (confined).

Along drainage channels of ephemeral streams there are narrow deposits of quaternary fluvial alluvium that contain water. Depth to bedrock varies from outcrop at the surface to nearly 25 feet. The level of the ground water in the alluvial fill fluctuates in direct response to surface flow, indicating hydraulic communication between the alluvial ground water table and surface water flow.

The coal beds are overlain with sandstones, clays, siltstones, and shales of the Hanna Formation. The sandstones immediately above the coal are generally saturated with water and form localized aquifers, which exist under both water table and artesian conditions. Where clays overlie the saturated sandstone in substantial thicknesses, artesian conditions exist. Where the aquifer approaches outcrops toward its recharge area, water table conditions exist.

The coal beds and adjacent sand and shale layers comprise a poorly productive multi-aquifer system. There is little interstitial permeability in coal, but water movement exists because of secondary permeability from cracks, joints, and cleats. Although the coal is a relatively poor aquifer, delivering only a few gallons per minute (gpm), it probably is the principal aquifer in the basin. Recharge to both the coal and the sandstone aquifers occurs principally around the southern and eastern rim of the basin. Water moves northeasterly from the recharge areas on a gradient of about 100 feet per mile and discharges through small springs and seeps. Very little if any water drains out of the basin. There is very limited connection between water in the coal and that in the sandstones above and below the coal.

The only ground water studies available for Carbon Basin are those conducted for development of the Carbon Basin Mine. These studies cover only the four sections where surface mining is proposed. The studies are based on five groupings of wells that penetrate to depths of 60 or 70 feet below the Johnson coal bed. The wells were constructed to measure static water levels at 33 feet above the coal bed, in the coal bed and at 66 feet below the coal. Water at each of these places is under artesian pressure, and the static water levels range from

DESCRIPTION OF THE ENVIRONMENT

67 to 372 feet above the top of the respective aquifer in which the water is encountered. No data were provided on the level at which water was encountered or on static water levels in sandstone layers more than 33 feet above the coal bed. However, it appears that most of the overburden is relatively dry and that wells will yield very little water.

Water moves through the aquifer very slowly, and large drawdowns are required to produce small amounts of water. At one well in Section 29, T. 21 N., R. 79 W., the artesian head in the coal was pumped off in 9 minutes. The drawdown for a yield of 3 gpm was 205 feet. Two adjacent observation wells, which bottom in sandstones above and below the coal, showed no response in the 39-minute pumping time. The transmissivity in the coal was computed to be less than 100 gallons per day per foot (gpd/ft); transmissivities as low as 0.1 gpd/ft were measured in the sandstones by slug testing the observation wells. The actual transmissivity for the multiple aquifer is probably somewhere in the range from 0.1 to 100 gpd/ft. The low transmissivity is probably representative of that in all sandstone and coal aquifers of the basin, but there may be some pockets that will produce larger quantities of water. The hydraulic gradient is toward the northeast from recharge areas around the southern and western rims of the basins. The gradient is 100 feet per mile.

No data are available regarding static water levels or artesian pressure in the sections proposed for underground mining. However, by extrapolating data from the studied area, it has been estimated that static water levels will generally be 100 to 200 feet below land surface. The artesian pressure head in the coal is probably a maximum of about 700 to 800 feet near the center of the basin. Such a head represents a pressure of 300 pounds per square inch (psi). This head would be dissipated quickly during pumping.

Surface Water

Most of the project area is drained by three ephemeral streams: First Sand, Second Sand, and Third Sand Creeks (see Map CA2-3). All three have deep arroyo type channels with flat sand beds and nearly vertical banks (Figure CA2-2). Second and Third Sand Creeks drain to the Medicine Bow River; First Sand Creek drains to Allen Lake, a closed basin at the northeast corner of Carbon Basin.

Mesilla Valley Engineers (1978) monitored the flow of Third Sand Creek during 1977. Flow was found in Third Sand Creek on March 7 and on April 13. This should not be construed to mean that the stream flowed continuously during the intervening period. Panborne (personal communication), a hydrologist who regularly visits a GS gaging station on Third Sand Creek, estimated that the stream flows on an average of 10 to 15 days per year. First and Second Sand Creeks probably flow about the same amount.

Peak flows of Third Sand Creek have been measured since 1965 at the county road crossing in Section 28, T.

21 N., R. 79 W., where the drainage area is 10.8 square miles. The maximum discharge is 1,560 cubic feet per second (cfs). This flow was confined to the channel. There is no record of any recent flood exceeding the capacity of the channel. Table CA2-3 shows the probability of a flood having a given discharge occurring in any given year. In terms of percentages, these figures mean that there is a 90% chance that the maximum discharge in any given year will exceed 100 cfs, a 50% chance that it will exceed 320 cfs, and a 10% chance that it will exceed 1,200 cfs. A fair estimate of flood discharges for other points in the project area can be estimated by multiplying the values for Third Sand Creek by a factor that is equal to the ratio raised to the 0.35 power of the drainage area at the point of interest to that at the Third Sand Creek or by using equations developed by Lowham (1976). Mean discharge for the three principal streams as estimated from procedures by Lowham (1976) are First Sand Creek—2 cfs, Second Sand Creek—1 cfs, and Third Sand Creek—1 cfs.

The southern edge of the coal outcrop is near the brink of a hillside having no defined channels. The water that originates on this hillside ends up in a closed basin and forms an intermittent lake on an old terrace above the Medicine Bow River. The lake is one of several water sources for wildlife and livestock, but it lacks adequate vegetation for nesting habitat.

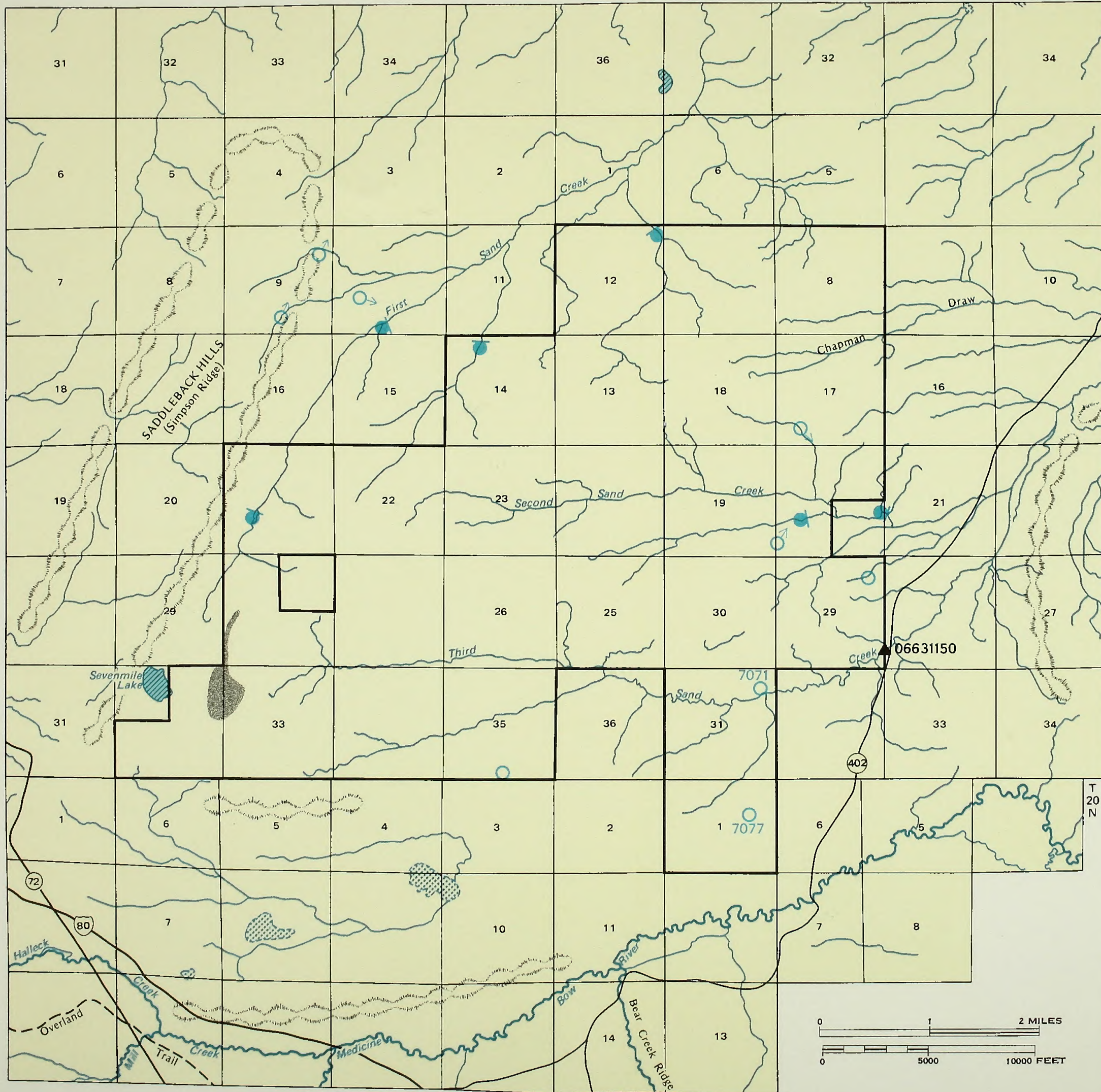
Several small springs, which are little more than seeps, exist in the basin. The springs are fed by aquifers that are small in areal extent and have little ability to transport water.








Quality

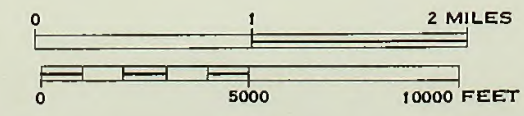
Ground water in the four sections proposed for surface mining was tested for 25 elements or ions by Mesilla Valley Engineers (1978). The total dissolved solids (TDS) concentrations ranged from 672 to 3,904 milligrams per liter (mg/l) in March; 1,160 to 2,936 mg/l in May; 1,124 to 8,084 mg/l in August; and 960 to 7,104 mg/l in December. Water having TDS concentrations of less than 1,000 mg/l is considered acceptable for human consumption.

Water from all wells had a strong hydrogen sulfide odor. Water is acceptable for livestock and wildlife but is borderline for human consumption.

Mesilla Valley Engineers (1978) tested waters from Third Sand Creek, Second Sand Creek, and Medicine Bow River for those constituents prescribed by Guideline 4, November 1976, Wyoming Department of Environmental Quality. The pH of waters in both Sand Creeks ranged from 7.93 to 8.35; TDS ranged from 788 mg/l on Third Sand Creek in April to 2,700 mg/l in Second Sand Creek in May. The waters were high in calcium, magnesium, and sulfate. The water is acceptable for wildlife, livestock, and irrigation. When the quality is best, during periods of snow melt, it is also acceptable for human consumption. No sediment analyses were made nor were any chemical analyses made for flows re-



-  Spring
-  Stock Pond
-  7071 Test Well (number is altitude of groundwater table)
-  Intermittent Stream
-  Perennial Stream
-  Stream Gaging Station (number is USGS identification)
-  Intermittent Lake
-  Playa
-  Old Surface Mine Area



Map CA 2-3
WATER RESOURCES

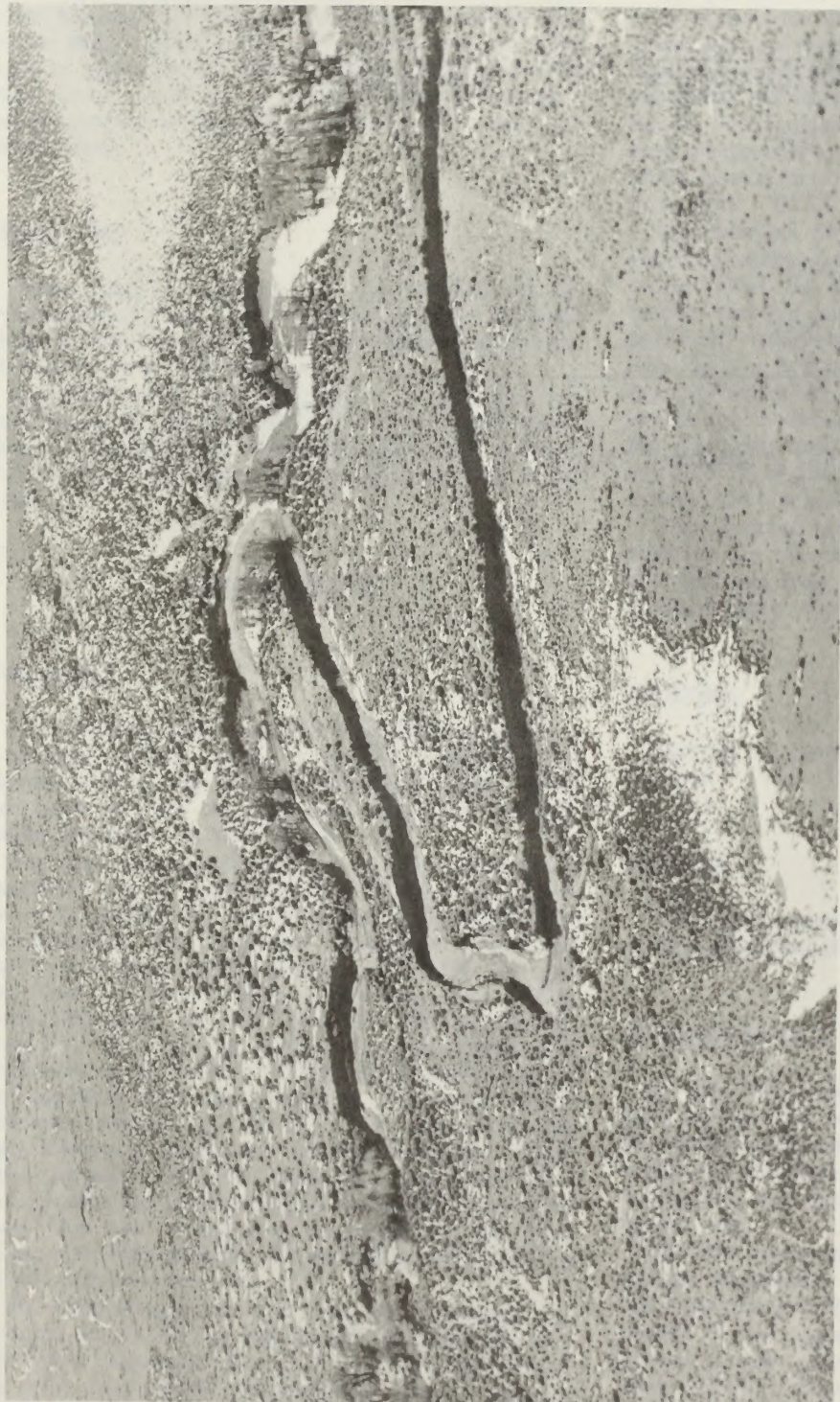


Figure CA2-2

STEEP ARROYO TYPE BANKS AND SAND BED ON THIRD SAND CREEK

FLOW IS FROM RIGHT TO LEFT

Table CA2-3

PROBABILITIES FOR DISCHARGES

<u>Discharge in cfs</u>	<u>Probability</u>
100	.9
320	.5
1,200	.1
2,000	.04

Source: Lowham, 1976

DESCRIPTION OF THE ENVIRONMENT

sulting from intense summer rains. These summer flows probably carry sediment loads of several thousand mg/l.

During the period April to August, the TDS content in the Medicine Bow River ranged from 76 mg/l in May at site MB2, upstream from the project area, to 3,092 mg/l in August at site MB3, downstream from Second Sand Creek. Each set of monthly samples showed a marked increase in dissolved solids between the two sampling points.

Water Use

Water rights for livestock reservoirs and irrigation diversions in the project area consist of rights for one well, seven livestock reservoirs, and two surface diversions. No other uses of water are known.

Numerous other water rights exist for diversions and wells along the Medicine Bow River. As stated above, there is essentially no hydraulic connection between Carbon Basin and waters in the Medicine Bow River valley.

VEGETATION

Terrestrial

The vegetative cover on the Carbon Basin project area is comprised of four vegetative types. The geographic locations, acreage, and percent distribution of the vegetative types and the disturbed area caused by previous mining are shown on Map CA2-4.

The sagebrush-grass type (Type 4) is the predominant vegetative type on the project area. It is located primarily on the shallow to moderate slopes of the hills and in the drainages. The vegetative composition within the type varies widely because the soils vary within the type site. This composition variance can range from a 90% shrub/10% grass and forb ratio to a 30% shrub/70% grass and forb ratio; the average is approximately 60% shrub/40% grass and forb. The dominant shrubs include big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus viscidiflorus*) and snowberry (*Symphoricarpos spp.*). Dominant grasses are western wheatgrass (*Agropyron smithii*), bluebunch wheatgrass (*Agropyron spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and bluegrass (*Poa spp.*). Vegetative production of this type ranges from approximately 600 pounds to 850 pounds of air dry vegetation per acre.

The birdfoot sagewort type (Type 4a) is generally located on the flat hilltops and upland flat swales. Because this type of vegetation has a low growth characteristic, the areas may appear as grasslands from a distance. Shrub composition is primarily birdfoot sagewort (*Artemisia pedatifida*), shadscale (*Atriplex confertifolia*), and winterfat (*Eurotia lanata*). The dominant grass species are western wheatgrass, Indian ricegrass, and bluegrasses. Vegetative production of this type ranges from

approximately 200 pounds to 350 pounds of air dry forage per acre.

The greasewood type (Type 14) is limited to the bottoms of the main drainages, primarily along Third Sand Creek and to a lesser extent on Second Sand Creek. The dominant shrub species are greasewood (*Sarcobatus vermiculatus*), big sagebrush, and snowberry (*Symphoricarpos albus*). The understory cover of grasses includes Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and various species of wheatgrasses (*Agropyron spp.*).

The mountain shrub type (Type 5) is limited in extent and is generally associated with rocky outcrops. It also occurs within the sagebrush-grass type as small isolated patches that are smaller in size than the minimum mapping unit. Although the areas are scattered and small in size, the type is important as wildlife habitat since it contains species preferred by wildlife. The dominant shrub species are mountain mahogany (*Cercocarpus montanus*), big sagebrush, snowberry, and rabbitbrush. The understory cover of grasses includes Indian ricegrass, wheatgrasses, and bluegrasses.

The disturbed area includes the acreage that was mined in the early 1900s. Vegetative cover on the mined and spoil pile areas is very sparse and consists primarily of native shrubs that have invaded onto the area.

Riparian

There is no riparian vegetation on the proposed project area.

Aquatic

There is no aquatic habitat on the project area because of the intermittent characteristics of the drainages.

Endangered and Threatened

In May 1977 Robert Dorn of the BLM conducted a plant species field examination in the project area. Neither Dorn's examination nor a search of past records revealed the existence of any plant species proposed for endangered and threatened status in the Carbon Basin project area.

The field examination was conducted in a manner that satisfies unsuitability criteria examinations. Due to the soil types that exist in the area, it was concluded that the chance of any threatened or endangered plants being present is near zero (BLM Memorandum, 4510 (932) dated 7/22/77). Therefore, the area is acceptable under unsuitability criteria for threatened or endangered species.

DESCRIPTION OF THE SYSTEM

The system is designed to provide a comprehensive overview of the current state of the organization. It includes a detailed analysis of the existing infrastructure, a comparison of current performance against industry benchmarks, and a series of recommendations for improvement. The system is intended to be a valuable tool for management decision-making and strategic planning.

The system is designed to provide a comprehensive overview of the current state of the organization. It includes a detailed analysis of the existing infrastructure, a comparison of current performance against industry benchmarks, and a series of recommendations for improvement. The system is intended to be a valuable tool for management decision-making and strategic planning.

CONCLUSION

The system is designed to provide a comprehensive overview of the current state of the organization. It includes a detailed analysis of the existing infrastructure, a comparison of current performance against industry benchmarks, and a series of recommendations for improvement. The system is intended to be a valuable tool for management decision-making and strategic planning.

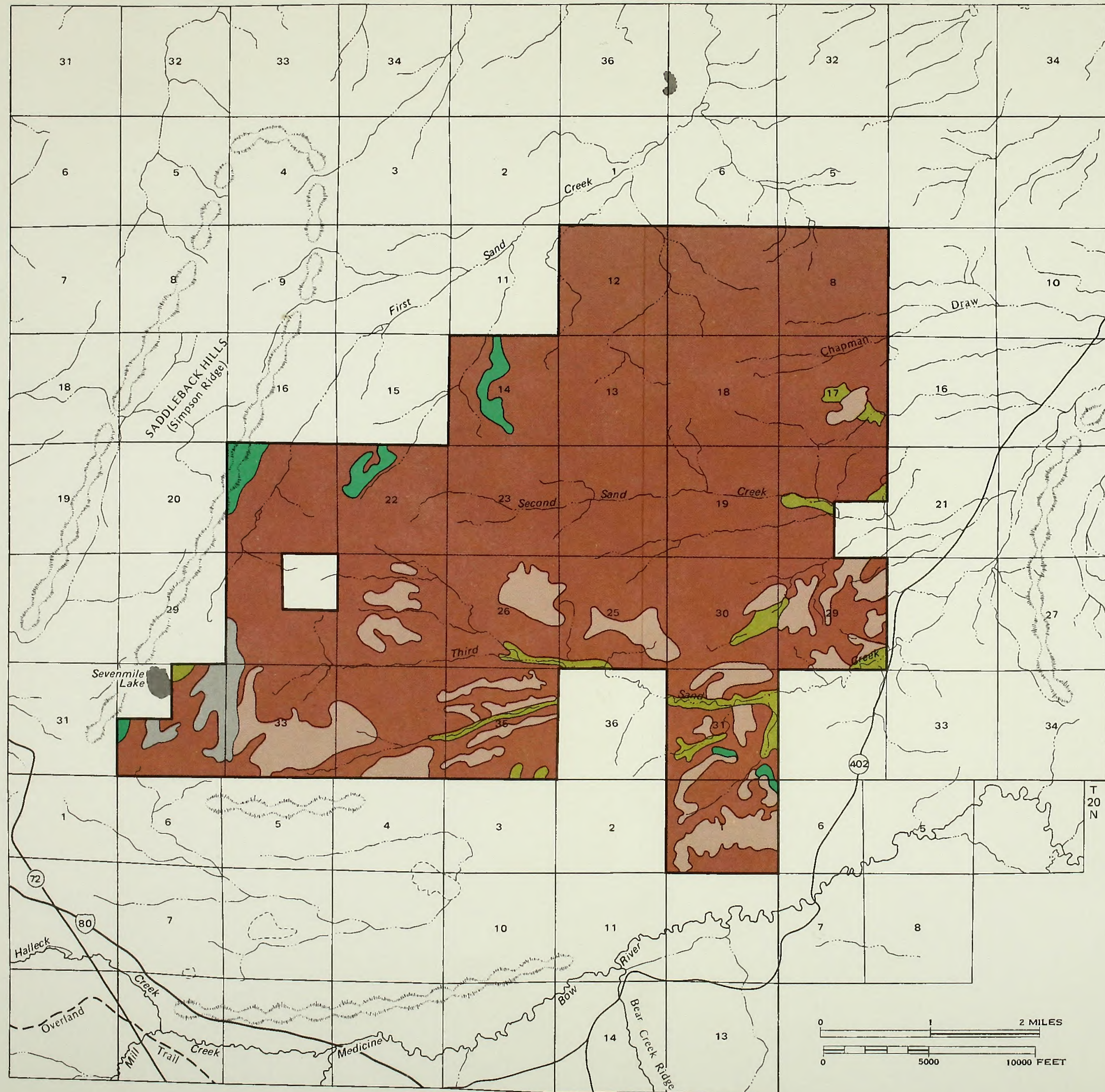
REFERENCES





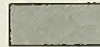
1. Smith, J. (2001). *Business Process Management: The Breakthrough to Sustained Growth*. Boston: Harvard Business School Press.

2. Johnson, M. (2002). *Strategic Management: A Case Study Approach*. Boston: Allyn and Bacon.

APPENDIX A: Data Tables

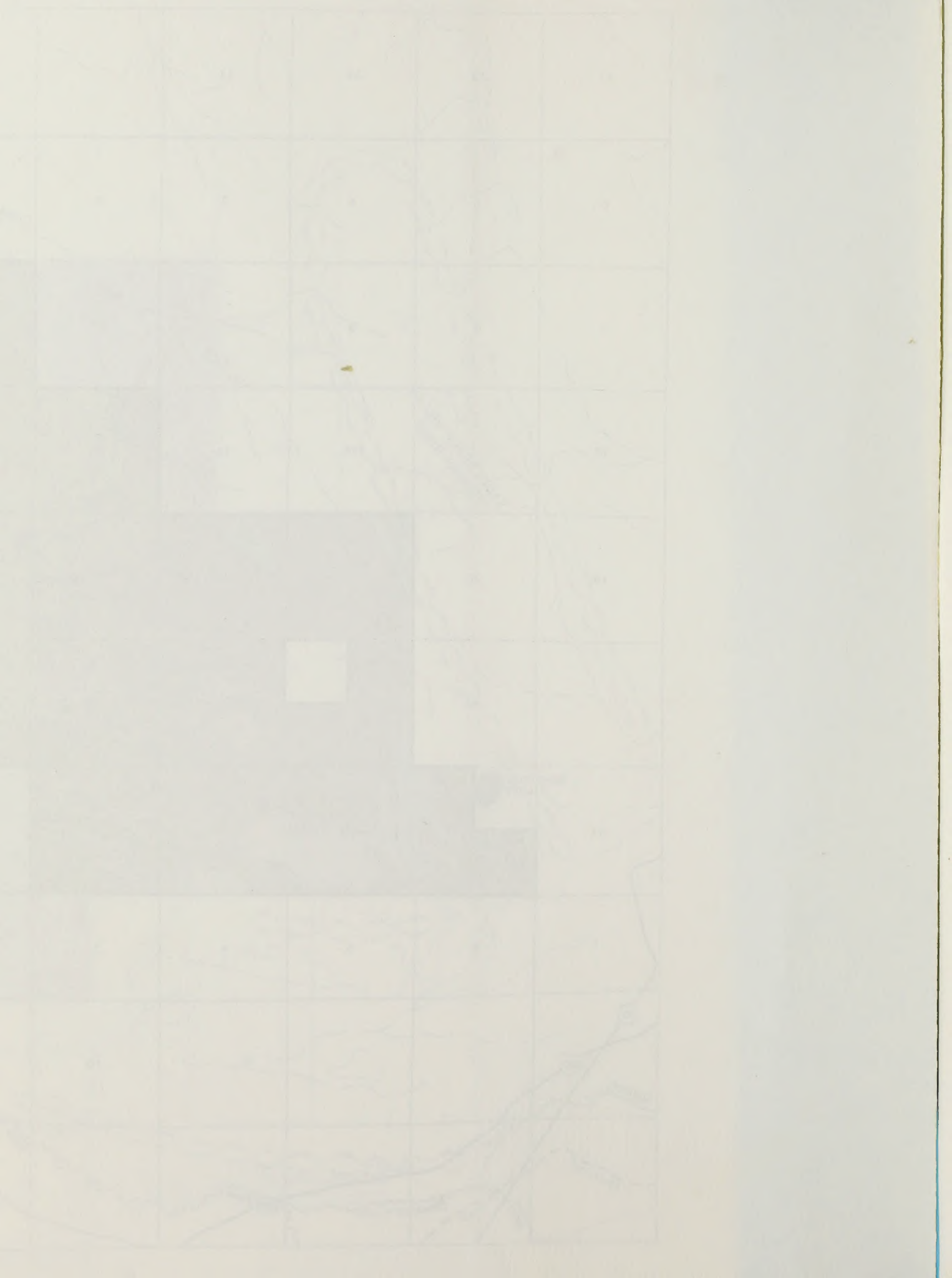
This appendix contains detailed data tables and charts that support the findings presented in the main report. It includes a breakdown of key performance indicators, a comparison of market trends, and a detailed analysis of the organization's financial performance over the past five years.



	4 Sagebrush, Grass 12,996 Acres 83.8%
	4a Birdfoot Sagewort 1,675 Acres 10.8%
	5 Mountain Shrub 233 Acres 1.5%
	14 Greasewood 388 Acres 2.5%
	D Disturbed Area 216 Acres 1.4%



Map CA 2-4
VEGETATION DISTRIBUTION



DESCRIPTION OF THE ENVIRONMENT

Reclamation

Reclamation activity on coal mines in the Hanna Basin area is fairly recent. The Open Cut Law of 1969 and the Environmental Quality Act of 1973 were among the first laws establishing regulations for reclamation in Wyoming. The reclamation activity has generally been by trial and error and has not been very successful. This lack of successful reclamation is due in part to poor reclamation practices, the short time frames involved in reclamation activity, and the absence of any previous good reclamation efforts in the area to guide new efforts. Examples of poor reclamation practices are the failure to separate and bury unsuitable overburden (carbonaceous shale, parting material) material beneath suitable overburden material, replacement of insufficient topsoil amounts, lack of contouring, lack of shrub replacement (started in Hanna Basin, fall 1976), lack of fencing to control grazing by livestock and wildlife, and lack of mulching. Other important variables are the severe climatic conditions, low precipitation, low humidity, 80 to 100 day growing season, and sustained high winds. Since 1975, the coal companies' reclamation efforts have been improving and have been conducted under regulations existing prior to the new SMCRA regulations. Past reclamation efforts have resulted in areas in various stages of revegetative development, but to date DEQ has not released from bonding any area in the Hanna Basin area as being completely reclaimed. An estimated 3,653 acres are in the process of being reclaimed through initial seeding on five of the six existing mines in the Hanna Basin area.

FISH AND WILDLIFE

Habitat Types

Primary vegetative habitat types found on the project area and the major species of wildlife that occur in these various types are listed below. A partial listing of wildlife species that could occur on the project site can be obtained from the Rawlins District Office of the BLM.

Aquatic

There is no aquatic habitat located on the project area adequate to support fish life. All streams in the area are intermittent or ephemeral. Allen Lake, an ephemeral lake, furnishes water only for terrestrial wildlife and only for intermittent periods during the year. There are also seven livestock reservoirs on the project area that are used by wildlife, but these reservoirs also do not hold water year-round.

Terrestrial

Sagebrush (12,966 acres). This vegetative type supports a great variety of wildlife species including pronghorn antelope, mule deer, desert cottontail, whitetail jackrabbit, coyote, whitetail prairie dog, Richardson's ground squirrel, deer mouse, Great Basin pocket mouse, sage

grouse, Brewer's sparrow, sage sparrow, vesper sparrow, sage thrasher, green-tailed towhee, and horned lark.

Birdfoot Sagewort (1,675 acres). This vegetative type will generally support the same species of wildlife as supported by the big sagebrush type. The major wildlife species found in this type are listed above in the section on sagebrush.

Greasewood (388 acres). This vegetative habitat will generally support the following major species of wildlife: pronghorn, mule deer, desert cottontail, whitetail jackrabbit, coyote, whitetail prairie dog, Richardson's ground squirrel, least chipmunk, deer mouse, sage sparrow, sage thrasher, sage grouse, Brewer's sparrow, vesper sparrow, and horned lark.

Mountain Shrub (233 acres). The mountain shrub type is known to support the following major species of wildlife: mule deer, mountain cottontail, deer mouse, least chipmunk, coyote, Brewer's sparrow, green-tailed towhee, mountain bluebird, and loggerhead shrike.

Disturbed Area (216 acres). This old mined area is being used by many species of wildlife only as travel area and will not support wildlife.

General. The project area is used as both nesting and hunting habitat for several species of raptors. The most commonly observed raptors are Swainson's hawk, marsh hawk, red-tailed hawk, American kestrel, and golden eagle.

Wildlife

Birds

Nongame. The major small nongame birds species found on the project area are listed under various habitat types at the beginning of this section. There are at least 43 species of small songbirds that could occur on the proposed project area. At the present time, best estimates of density of small birds indicate that there are about 21 breeding pairs of birds per 100 acres when averaged over these vegetative types (personal communication, Max Schroeder, FWS, March 1978). The raptor population on and adjacent to the project area was inventoried by BLM and Fish and Wildlife Service biologists in April and May 1978 in a manner that satisfies unsuitability criteria concerning golden eagle nests. This inventory indicated that the area is acceptable for coal mining pending further study (Chapter 1, Proposed Action, Preleasing Inventories, Coal Unsuitability) of the golden eagle nest locations. In addition, unsuitability criteria concerning bald and golden eagle roost and concentration areas were applied to available data. The area is acceptable for coal mining pending further studies.

The general raptor inventory completed in 1978 also identified prairie falcon nests on and in the vicinity of the proposed mine. This inventory also indicated that through unsuitability criteria the area was acceptable pending further studies.

Round-wing or buteo hawk nests were also inventoried according to unsuitability criteria for migratory birds.

DESCRIPTION OF THE ENVIRONMENT

The area was determined to be acceptable pending further studies of these nest sites (see Map CA2-5).

The railroad spur right-of-way as shown on Map CA1-3 (Application W-57224) running from the main line to Medicine Bow was also surveyed for raptors. No nests or potential nesting sites were found.

A formal request for coordination with the Fish and Wildlife Service covering the golden eagle nests on the project area was initiated by letter dated May 15, 1978.

Game. The entire project area of 15,494 acres is classified by the Wyoming Game and Fish Department as year-round sage grouse habitat. Two strutting grounds or leks are located in the eastern portion of the area and one lek is located immediately adjacent to the site to the northwest (see Map CA2-6). The entire east half of the area contains critical sage grouse nesting areas that are associated with the strutting grounds. Critical nesting habitat is that area located within a 2-mile radius of the strutting ground where the bulk of the nesting takes place (Wallestad 1975). The majority of this project area is used as critical winter range by sage grouse. The Wyoming Game and Fish Department lists this area as some of the best sage grouse habitat and one of the best hunting areas in the state.

Sevenmile Lake and East Allen Lake, both small intermittent lakes adjacent to the project area, are utilized by waterfowl (mallards, redheads, scaups, pintails, and sandpipers) as a resting area during spring migrations. There is no riparian vegetation that could be used as nesting habitat.

Mammals

Nongame. According to sightings and a search of current literature (Burt and Grossenheider 3rd ed. 1976), there are at least 21 species of small nongame rodents that could occur on the project area and the railroad spur right-of-way during some portion of the year. Some of the more common species are deer mouse, least chipmunk, Richardson's ground squirrel, and whitetail jackrabbit. Numerous whitetail prairie dogs are present on an estimated 2,744 acres of active colonies on the site based upon a 1978 survey by the Fish and Wildlife Service (see Map CA2-6). A listing of small nongame mammals that could occur on the area can be obtained from the Rawlins District Office of the BLM.

Game. The pronghorn habitat on 15,292 acres of the project area is classified as winter/year-round range with the exception of about 3,200 acres which has been determined to be critical winter/year-round habitat. There are about 250 pronghorns that winter on the site, and a significant amount of fawning and rearing of young takes place on the area. Pronghorns occur throughout the project area for much of the year but tend to concentrate along County Road 402 from Spade Flats to the crossing of the Medicine Bow River in winter (see Map CA2-7).

The project area supports a year-round resident population of mule deer totaling about 50 head. All of the deer range is classed as winter/year-round range; none is listed as critical deer range. These deer tend to congregate along Simpson Ridge to the west and in the rocky

hills at the head of Third Sand Creek for much of the year. During the winter, they usually are found near Kyle Junction or along Third Sand Creek (see Map CA2-7).

The desert cottontail rabbit is a very common small game mammal on the project area. The Wyoming Game and Fish Department estimates that there are about five rabbits per acre in the vegetative types found on the project area.

Reptiles and Amphibians

Reptile and amphibian numbers appear to be low on the project area. Some of the more common species that could be expected to occur on the site are northern sideblotched lizard, northern shorthorned lizard, and the western rattlesnake. There is little riparian vegetation and very little free water on the area which would provide habitat for any kind of amphibian.

A Feral (Wild) Horses

Feral horses do not occur on the project area (see Southcentral ES, Regional, Appendix A, Map 9).

Endangered and/or Threatened

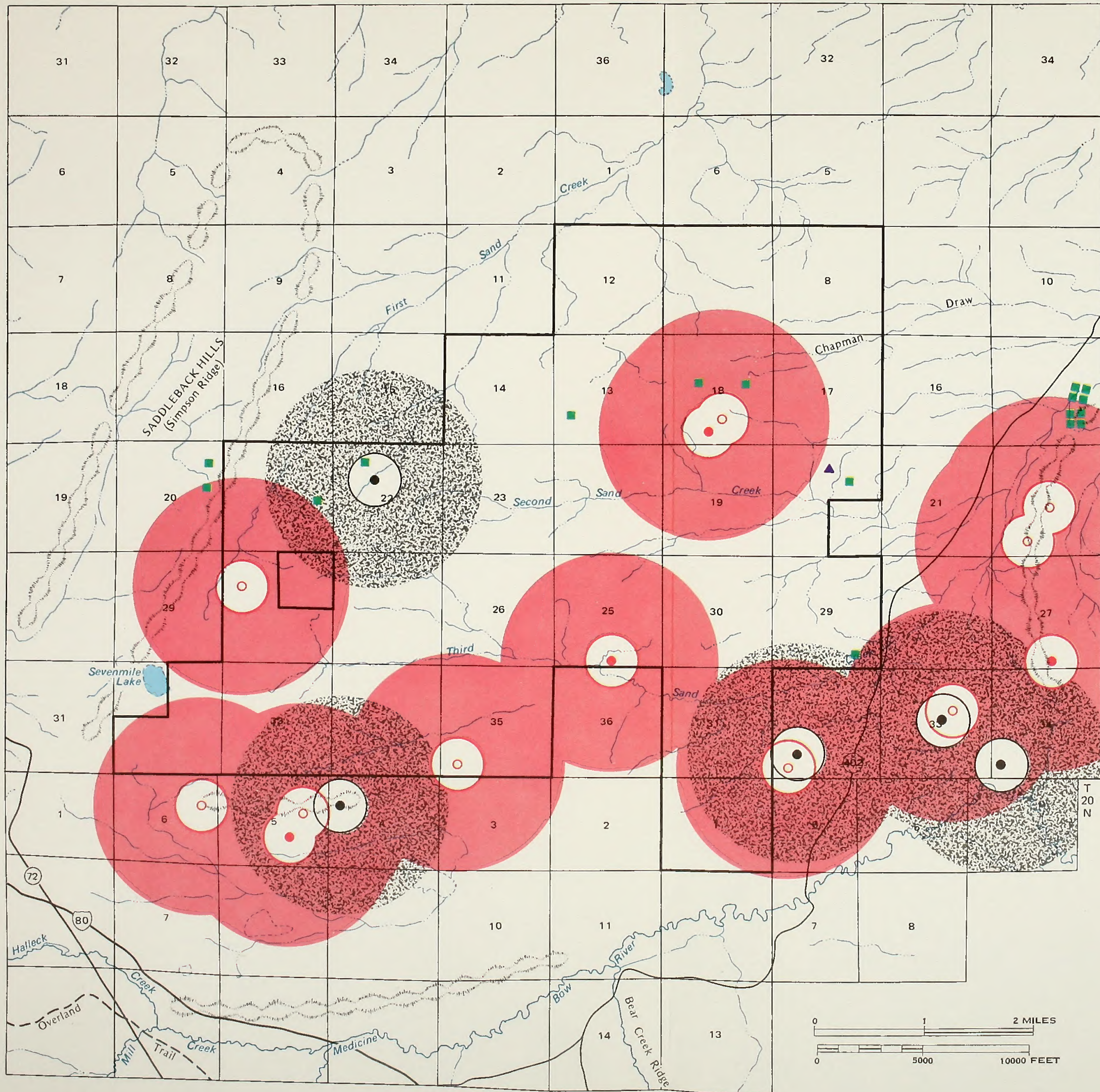
Habitat for the black-footed ferret exists on the site in the presence of large numbers of whitetail prairie dog colonies (see Map CA2-6). Several of these colonies on private surface occur in Section 29, T. 21 N., R. 79 W., and in Section 1, T. 20 N., R. 79 W., which are proposed to be surface mined.

There have been several historical sightings of ferrets in an area about 16 miles southwest of the proposed mine site (Southcentral ES, Regional, Appendix A, Map 8B). A letter requesting formal consultation with the Fish and Wildlife Service concerning the possibility of black-footed ferrets occurring on the project area was sent on September 26, 1978. The biological opinion returned by the FWS stated that ferrets are not likely to occur on the proposed mine site.

At the present time, there are no other known federally listed endangered or threatened species found on the project area. Therefore the area is acceptable for mining under unsuitability criteria for threatened and endangered species.

CULTURAL RESOURCES

No sites in the Carbon Basin project area are currently listed on the Wyoming Historic Preservation Plan or on the National Register of Historic Places.

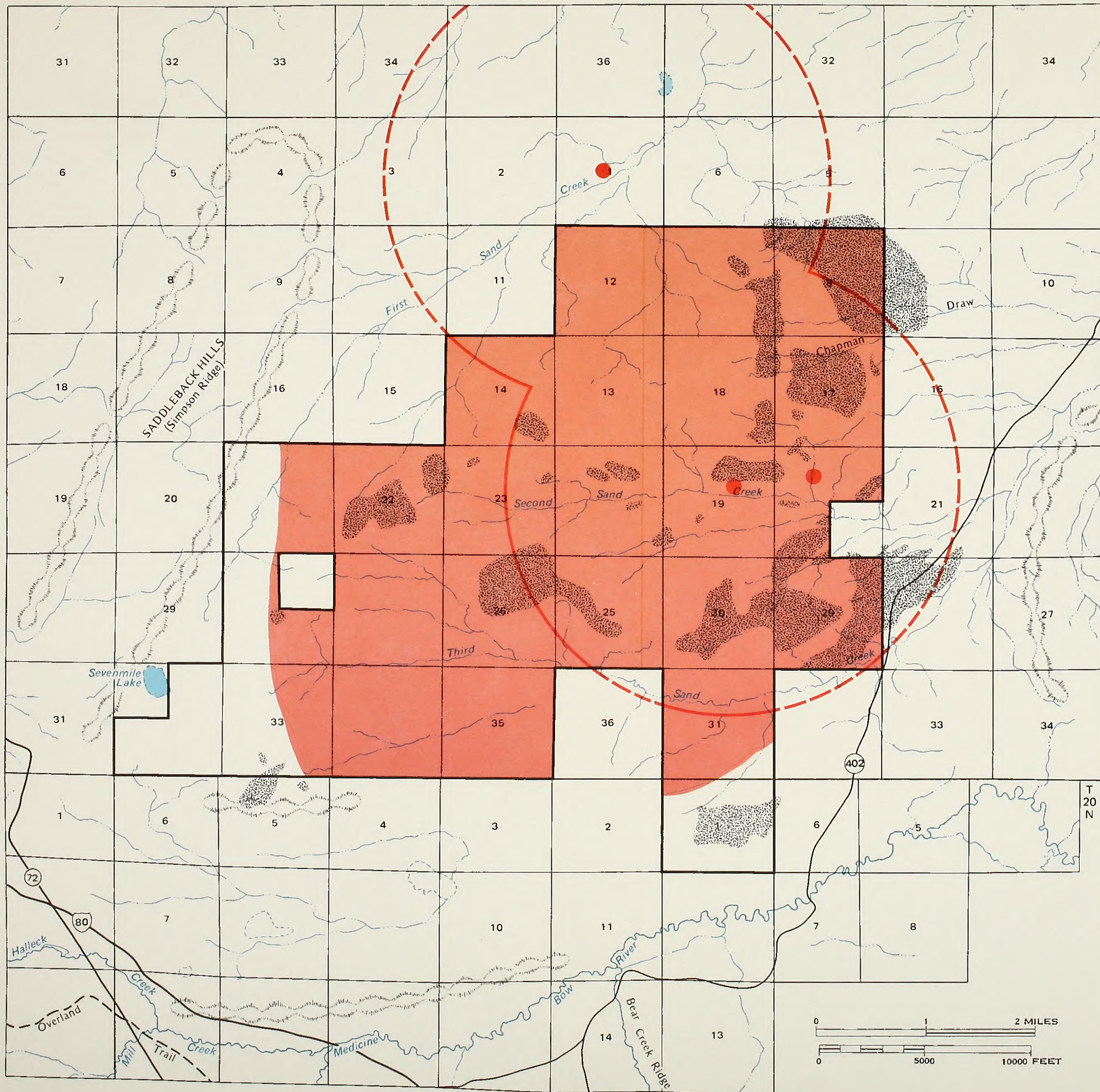


- Golden Eagle**
 - Active Nest
 - Inactive Nest
 - Unsuitable for Mining
 - Buffer Zone – Acceptable for Mining Pending Further Study
- Prairie Falcon**
 - Active Nest
 - Unsuitable for Mining
 - Buffer Zone – Acceptable for Mining Pending Further Study
- Other Raptors**
 - Buteo Hawk Nest
 - ▲ Great Horned Owl Nest

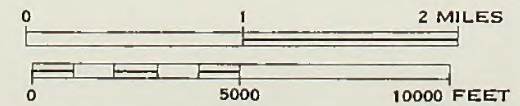
Map CA 2-5
RAPTOR NEST AND HABITAT

SOURCE: BLM, 1978

R 80 W R 79 W

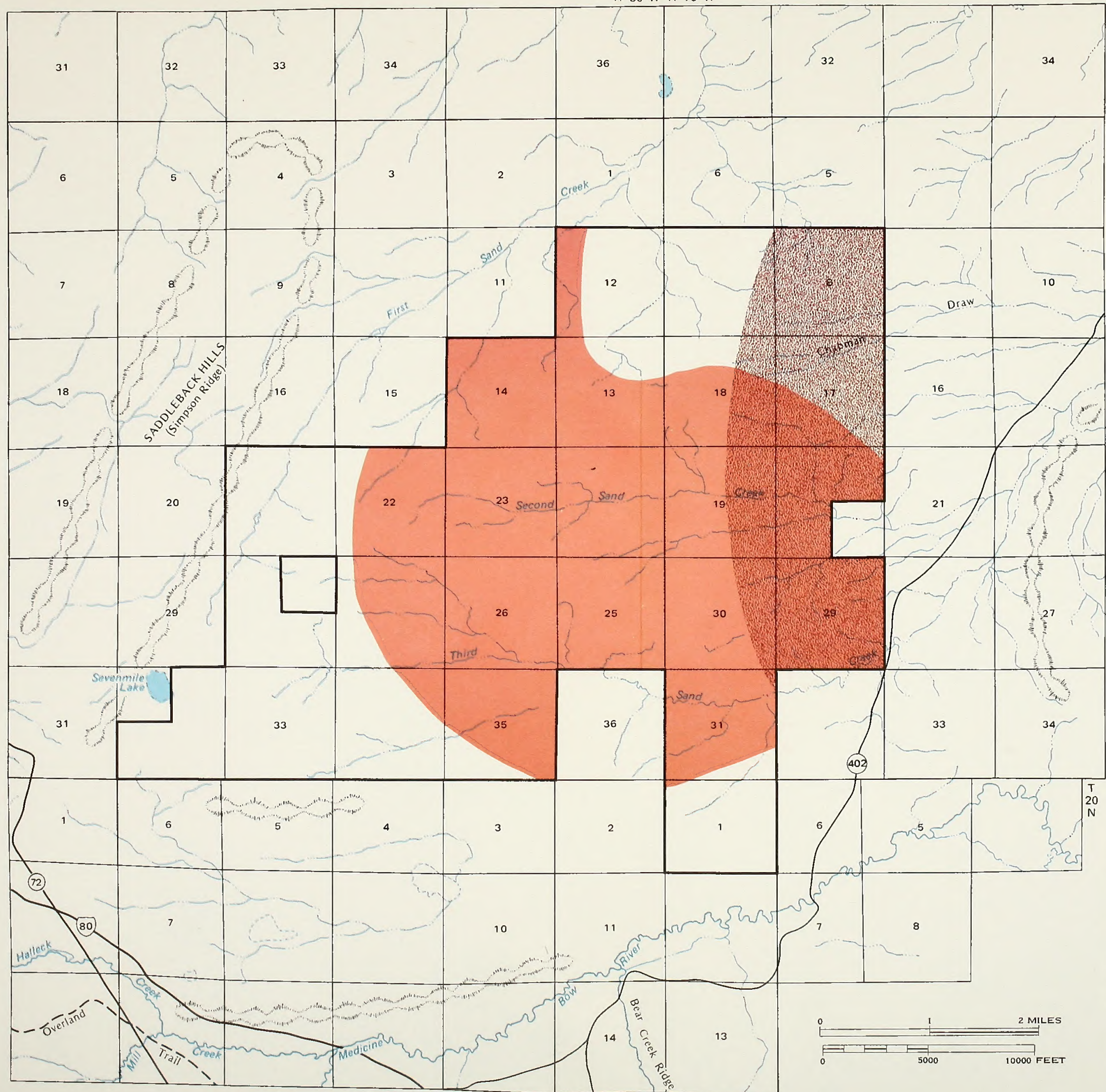


- Sage Grouse Strutting Grounds
 - ⊖ Sage Grouse Critical Nesting Area
 - Sage Grouse Critical Winter Area
 - Whitetail Prairie Dog Colony
- The entire area is year-round habitat for Sage Grouse





SOURCE: BLM, 1978

Map CA 2-6
BIRD AND SMALL MAMMAL
DISTRIBUTION

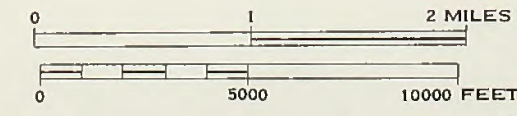


T 22 N
T 21 N



 Pronghorn Antelope
Critical Winter Area
 Mule Deer Winter Area
 The entire area is year-round range
for Pronghorn Antelope and Mule Deer

T 21 N
T 20 N



Map CA 2-7
BIG GAME DISTRIBUTION

DESCRIPTION OF THE ENVIRONMENT

Archeological

Approximately 27% of private land and none of the federal surface in the Carbon Basin project area was surveyed for cultural resources by Western Wyoming College (Metcalf 1977). See Table CA2-4 for a listing of site types found. No sites were located within the project area during this survey; however, one site was located immediately outside the project boundaries. Four sites were recorded during a 100% Class III survey along the proposed railroad spur done by the University of Wyoming (Zeimens 1977). The sites located in Sections 10, 11, 15, and 28 of T. 21 N., R. 29 W., consist largely of bison bone associated with deflated and intact hearths. For the most part, the sites are disturbed, but in all cases there is a likelihood of buried material. For this reason, all four sites should be tested to determine significance. Prior to the approval of the mine and reclamation plan, the remaining unsurveyed portions of the project area will have to be surveyed by the lessee.

In 1979 during a preliminary field inspection of federal lands in the Carbon Basin area for a geological survey coal evaluation drilling program, BLM archeologists discovered two archeological sites. These sites are of the level of significance to warrant examination of the entire unsurveyed portion of the project area. A site located in Section 8, T. 21 N., R. 79 W., consists of a sparse lithic scatter located a short distance from what appears to be two sheep herders' cairns. No dateable material was located. The cultural material was located on top of a high bluff. There seemed to be little deposition as bedrock outcrops were frequently exposed. The site will be mapped and intensively collected but it probably lacks the significance to require testing.

The second site is located in Section 18, T. 21 N., R. 79 W., and consists of a rock shelter associated with lithic material including tools, waste flakes and pottery. To the southeast, a lithic scatter is located on a low terrace just above an intermittent drainage. The lithic scatter and shelter appears to be slightly disturbed by vandals; although, there is no evidence of digging. The site appears to be significant and will require testing.

The potential for subsurface sites also exists within the entire project area, particularly in areas of windblown or alluvial deposits. An intense survey will have to be performed. If significant sites are found, testing may be required in accordance with 106 National Register compliance.

Historical

No historical resources have been located within the Carbon Basin project area according to the State Historic Preservation Officer.

VISUAL RESOURCES

A visual resources classification was conducted by the BLM on and adjacent to the project area using BLM

visual resource inventory and evaluation procedures as explained in BLM Manual 6300. Map CA2-8 illustrates the classification zones.

The visual management classes that have been identified within the project area are Class III—15,292 acres and Class V—216 acres.

The characteristic landscape (Figure CA2-3) of the project area is also typical of adjacent land. The land consists of rolling terrain covered with low growing sagebrush, mountain shrub, greasewood, and rock outcrops. The principal drainage features in the area are the Sand Creeks, which are ephemeral streams with little scenic value.

The project area is crossed by seasonal, unimproved dirt roads and fences. These intrusions can be seen throughout the project area, but they do not reduce the value of the management class. A good view of the project area can be seen from two locations along the county road which passes just east of the project area. The road is of importance to the visual sensitivity. The project area cannot be viewed from Interstate 80 or State Highway 72.

RECREATION RESOURCES

Visitor Use Data

Table CA2-5 depicts the estimated visitor use by activity in the proposed project area.

Hunting

During the summer, hunting is limited to ground squirrels and prairie dogs. In mid-September, the hunting season begins to draw hunters to the field. This area has good sage grouse and antelope populations for hunting purposes but deer hunting is very limited.

Rabbit hunters travel to the area to pursue cottontails, normally after the big game and bird hunting seasons are over. This season lasts from early fall until the end of February.

In recent years the value of coyote hides has increased from approximately \$35 for a prime hide in 1975 and 1976 to \$65 in 1977. This has encouraged people to travel to the area in winter to pursue coyote.

Off-Road Vehicles

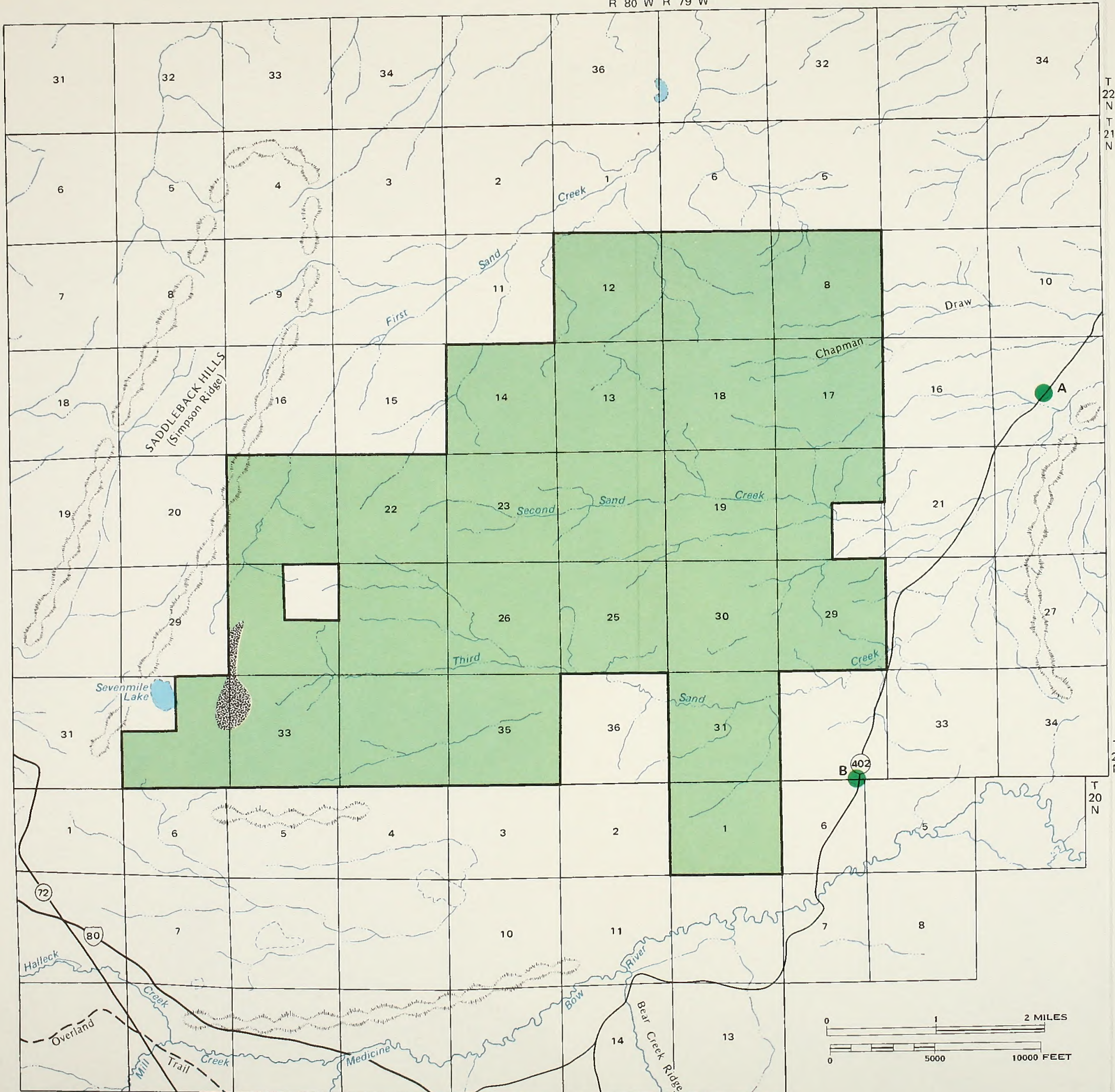
There are several mineral exploration and ranching associated roads located in the project area. These roads are used extensively by persons with four-wheel drive vehicles during the hunting season.

Table CA2-4

CULTURAL RESOURCES

Site Number	Within Project	Outside Project	Along Proposed Rail Spur	Campsite	Stone Ring	Chipped Stone	Isolated Artifact	Bone/Shell	Cultural Period
1		1							
2		2		2					
3	3				3				
4	4					4			
5	5					5			
6	6						6		
7	7						7		
8	8						8		
9		9							LP
10			10					10	
11			11						
12			12						12
13			13						13

Source: Metcalf, 1977

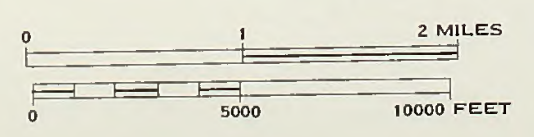


T 22 N
T 21 N
T 20 N

R 80 W
R 79 W



- Critical Viewpoints
- Class III
- Class V



Map CA 2-8
VISUAL RESOURCES

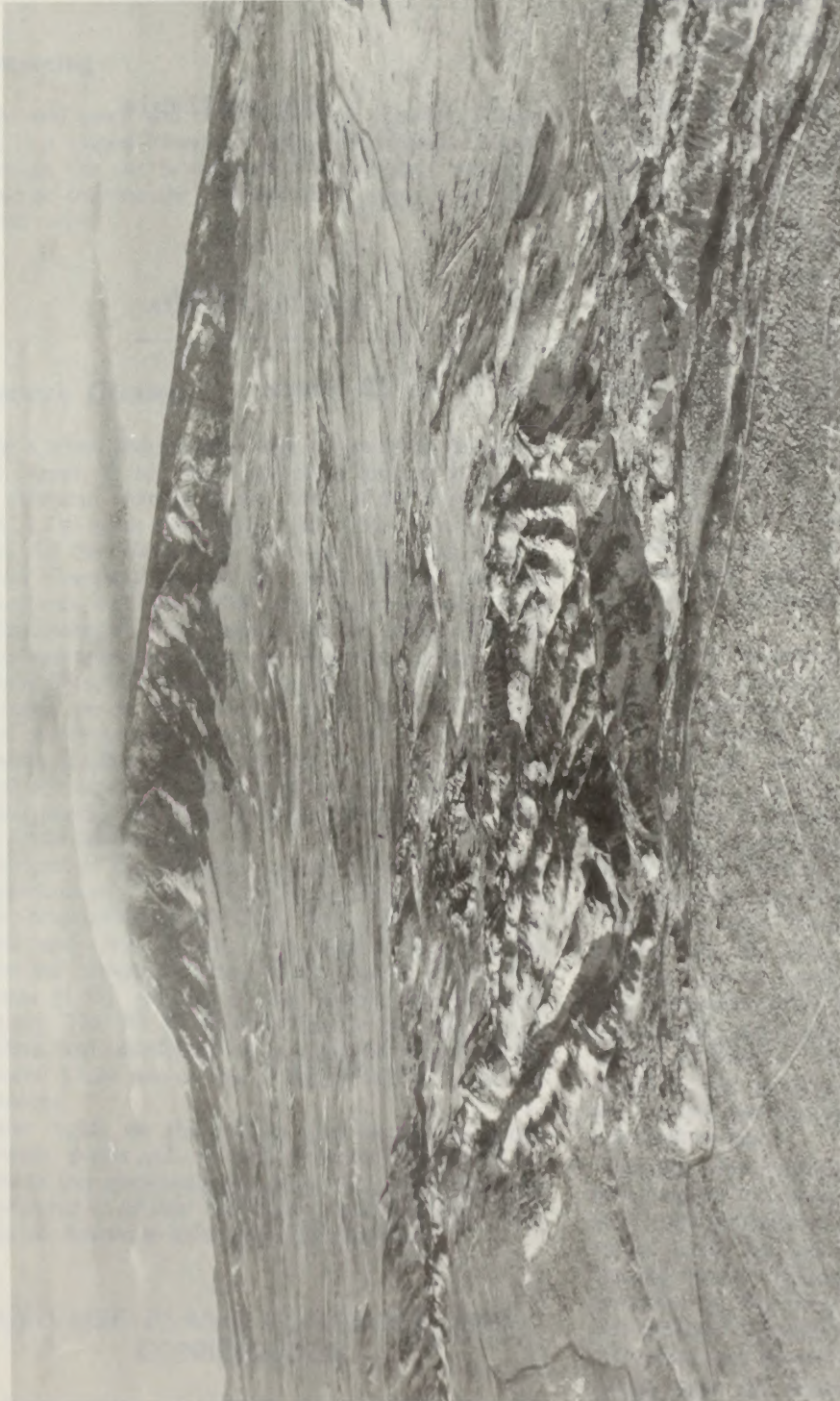


Figure CA2-3

CLASS V AREA (FOREGROUND) NEAR THE SOUTHWEST CORNER OF THE PROJECT;

ELK MOUNTAIN IN THE BACKGROUND

Table CA2-5

ESTIMATED VISITOR DAYS BY ACTIVITY IN THE CARBON BASIN AREA

<u>Activity</u>	<u>Visitor Days</u>
Hunting (big game)	60
Hunting (small game)	not available
Sightseeing	5
Off-road vehicle	<u>10</u>
Total	75(+)

Note: Visitor day considered to be 12 hours.

DESCRIPTION OF THE ENVIRONMENT

Wilderness Values

There are no areas in or near the proposed project area with identified wilderness values which meet the criteria set in Section 603 of the Federal Land Policy and Management Act of 1976.

Sightseeing

The old town site of Carbon and cemetery (Figure CA1-1) is visited frequently during the summer months. Although the site is not within the project boundary, people do traverse the proposed mine going to and from the old town.

AGRICULTURE

Livestock Grazing

The Carbon Basin project area is located in the southwest corner of the North Anschutz grazing allotment. The allotment contains 48,841 acres (17,049 acres public lands; 1,730 acres state lands; and 30,062 acres private lands). All the private lands are owned by Edison Development Company (except the NE $\frac{1}{4}$ Section 26). The project area involves 15,494 acres (approximately 32%) of this allotment. The planned surface mining area involves approximately 4% of the allotment acreage, located along the south allotment boundary.

Grazing use on the allotment in the past has been by cattle, involving two operators. The use by one ranch operation involves public lands only and is limited to 455 animal unit months (AUMs) of grazing during a 3 month summer period. The other grazing potential on the allotment totals 7,866 AUMs.

That part of the allotment covered by the project area of approximately 1,551 AUMs is distributed as follows; public lands—656 AUMs, state lands—64 AUMs, and private lands—831 AUMs. In contrast to past use, the present use pattern provides for the grazing of the project area (1,551 AUMs) by the Edison Development Company. The 455 AUM allocation for the other ranch operation was transferred to an adjacent portion of the allotment. There was no loss of federal AUMs in the use adjustment.

Water rights on the project area consist of seven stockwater ponds and one well. Inventory data show locations of five stockwater ponds on the project area and two adjacent to or near the project area boundary. Two springs are known to exist on the project area.

LAND USE PLANS, CONTROLS, AND CONSTRAINTS

A large number of separate governmental agencies (federal, state and county) exercise certain types of land

and resource use controls in Carbon County. The Carbon Basin project area includes public, state, and private lands. The federal sector includes the Bureau of Land Management (public lands and mineral estate under certain private lands). Development, management, use, and control of use on these public lands has been delegated to this agency.

Controls are effected through issuance or nonissuance of a variety of leases, permits, or licenses. Each authorization to use public lands contains provisions to control that use. Controls exercised by the federal government for the subsurface estate are governed by the statutes authorizing the disposition and use of that estate. Foremost among these statutes is the authority for leasing coal deposits and authority to require, as a condition of such leases, an operation-management plan and a reclamation-restoration plan. Management policy has been extended in greater detail by the National Environmental Policy Act of 1969, the Federal Land Policy and Management Act of 1976 and the Surface Mining Control and Reclamation Act of 1977. In certain situations, there is a joint or multiagency sharing of particular management and control functions and responsibilities, such as the cooperative agreement between the Department of the Interior and the State of Wyoming that allows the state to administer reclamation operations of an approved mine and reclamation plan on federal leases in Wyoming. The subsurface estate vested in private or state ownership would normally be governed by applicable State of Wyoming statutes.

A number of state agencies have development and administrative authority over State of Wyoming owned lands. Additionally, under State of Wyoming statutes, the state is authorized to perform and administer certain surface land use, planning and development activities on state, county, municipal, and privately-owned properties. Two pieces of legislation passed by the 1975 Wyoming Legislature which could have a significant effect on land use are: The Wyoming State Land Use Planning Act and The Industrial Development Information and Siting Act. The Land Use Planning Act requires completion of county land use plans by 1978, and these plans could conflict with or modify some of the energy proposals. The Industrial Siting Act requires furnishing extensive information and a state permit before certain facilities can be constructed. This act would affect developments which include gasification or electric generation proposals. Control does not apply to public properties except as provided by law.

Except where controls have specifically been delegated by statute to counties or municipalities, Wyoming retains total jurisdiction over state owned and privately owned lands. Use and control of state owned lands (including mineral leasing, rights-of-way, and the like) is governed by Wyoming law. The Carbon Basin project area includes 640 acres of state lands.

Control over mineral uses is vested in the State of Wyoming under the Wyoming Environmental Quality Act of 1973. This act also authorized the state to control air quality, water quality, and solid waste management.

DESCRIPTION OF THE ENVIRONMENT

Where a county or city lacks a specific authority, provisions of the Wyoming Joint Powers Act are available to enable joint exercise of power, privilege, or authority. This legislation enables two or more agencies to jointly plan, create, finance, and operate (control) water, sewage, or solid waste facilities; fire protection agency facilities; transportation systems facilities; and public school facilities.

Carbon County has developed and adopted comprehensive plans. Additionally, they have passed zoning ordinances throughout their boundaries to control land use. The land in the Carbon Basin project area is zoned for ranching, agriculture, and mining.

Cities have authority to effect a master plan, zoning, and other regulatory controls. Cities do not have statutory authority to effect controls over mineral extraction or production within their corporate limits. Furthermore, the Wyoming Environmental Quality Act of 1973 would preempt cities; authority to regulate and control air, water, solid waste, and land quality standards except where specifically delegated to a municipality.

In summary, all of the respective jurisdictions (federal, state, and county) have sufficient authority to impose effective land and resource use controls.

SOCIOECONOMICS

Demographics

Population

In 1977, the total population of Carbon County was estimated as 18,137. The population in Rawlins was 10,500, the population in Saratoga was 2,000, and the population in Hanna was 1,300 (Table CA2-6).

Employment

Total Carbon County employment was 8,067 in 1977 (Table CA2-7). The 1977 unemployment rate for Carbon County was 3%.

Income

The total 1977 personal income (in constant 1977 dollars) in Carbon County was \$147.1 million. The major contributors to this income were mining (28.4%), business services (19.7%), consumers' services (13.5%), and construction (13.5%). Per capita personal income was \$6,348 in 1975. Average weekly wages (Table CA2-8) have been the highest in the mining and manufacturing sectors of the economy.

Infrastructure

Private Sector

Total taxable sales in Carbon County were \$67.5 million in 1977. Wholesale trade (\$7.9 million), retail trade (\$46.7 million), and services (\$12.9 million) make up this total. Taxable sales are centered in Rawlins (77% of the county total), which serves as a local trade center for much of Carbon County.

Local Government

Current (1977) assessed values, mill levies, and bonded indebtedness for the region are shown on Table CA2-9. The bond ceiling, which is the maximum amount of debt that a jurisdiction may incur, is based on the assessed value for the current year. Communities may not issue general revenue bonds for greater than 4% of assessed valuation and sewer bonds for an additional 4%. There is no bond ceiling for water bonds. Counties are limited to 2% of assessed value, and school districts are limited to 10%.

Housing

There were 6,160 housing units in Carbon County in 1976; 16% were mobile homes. In 1977 there were 3,428 housing units in Rawlins. Of these 20% were mobile homes (Table CA2-10).

Education

The 1977 school enrollment for District 1 (Rawlins, Sinclair, Baggs, Bairoil) was 2,668. Building capacity in District 1 is 3,368. The 1977 school enrollment for District 2 (Saratoga, Encampment, Hanna, Elk Mountain, Medicine Bow, Shirley Basin, McFadden) was 1,658. Building capacity in District 2 is 2,430 (Table CA2-11). The expenditures per average daily membership (ADM) in District 1 was \$1,695 for 1976. In District 2, the expenditures per ADM was \$2,554; the statewide average expenditures per ADM was \$1,721 (Wyoming Department of Education 1977).

Health Care

In 1977 there were 2,015 people for each physician in Carbon County. The established standard is 1,000 population per physician. The standard for dentists is 1,600 population per dentist and for registered nurses it is 285 population per nurse. In Carbon County there were 2,591 people for each dentist and 263 people for each registered nurse (Wyoming Department of Health and Social Services 1976, 1978).

Table CA2-6

POPULATION TRENDS IN CARBON COUNTY
(1940-1977)

County City	Y E A R						
	1940	1950	1960	1970	1973	1975	1977
Carbon County	12,644	15,742	14,937	13,354	15,430	16,745	18,137
Rawlins**	5,531	7,415	8,968	7,855	8,685	9,592	10,500
Sinclair**	604	775	621	445	480	526	560
Hanna**	1,127	1,326	625	460	543	642	1,300
Elmo**	134	213	91	53	58	69	200
Elk Mountain**	107	196	190	127	146	181	190
Medicine Bow**	338	328	392	455	665	744	900
Saratoga**	810	926	1,133	1,181	1,400	1,539	2,000***
Encampment	331	288	333	321	403	463	500
Dixon, Baggs, Savery*	315	330	307	218	254	297	350
Wamsutter (Sweetwater County)	169	103	110	139	162	219	315

*These three communities are located in close proximity and are therefore shown combined. Savery is unincorporated and its population (perhaps 50 people) is not included in the figures shown.

**Will probably be affected by proposed development.

***Includes population in the vicinity of Saratoga.

Sources: 1940, 1950, 1960, 1970, U.S. Department of Commerce, Bureau of the Census, Census of Population, Volume I, "Characteristics of the Population", Wyoming, U.S. Government Printing Office, Washington, D.C.

1973, 1975, U.S. Department of the Commerce, Bureau of the Census, Current Population Reports, Population Estimates and Projections, Series P-25, No. 698, U.S. Government Printing Office, Washington, D.C., April 1977.

1977, Estimates made using the Water Resource Research Institute Economic Simulation Model, Water Resource Research Institute, University of Wyoming, 1978. Figures differ slightly from those contained in the Regional Southcentral ES based on information that has recently become available. (Primarily, 1976 Population Estimates are from the Census Bureau.)

Table CA2-7

EMPLOYMENT BY SECTOR
CARBON COUNTY

Sector	1977	% of Total
Farm	526	6.5
Manufacturing	360	4.5
Mining	1,658	20.5
Contract Construction	715	8.9
Government	919	11.4
Farm and Forest Processing	46	0.6
Railroads	480	6.0
Business Services	1,415	17.5
Consumer Services	1,948	24.1
TOTAL	8,067	100.0

Source: Water Resources Research Institute Economic Simulation Model, Water Resources Research Institute, University of Wyoming, March 1978.

Table CA2-8

AVERAGE WEEKLY WAGE BY NON-AGRICULTURAL SECTOR - CARBON COUNTY

Sector	Y E A R					Average Annual Change (%)
	1970	1973	1974	1975	1976	
Manufacturing	161.16	187.81	229.69	264.84	312.96	11.7
Mining	196.22	233.27	269.67	332.75	377.24	12.1
Contract construction	139.55	204.38	221.39	241.05	245.85	10.6
Wholesale trade	110.58	126.25	177.75	170.04	182.00	8.7
Retail trade	70.08	72.96	93.18	114.21	113.44	8.5
Finance, insurance & real estate	105.82	122.27	142.29	173.01	175.76	8.8
Transportation, Communication, & Public Utilities	146.31	180.30	188.34	232.06	244.53	8.9
Services, including agriculture, forestry and fisheries	65.40	80.33	86.57	98.96	106.30	8.4

*Based on monthly data for January 1977 through June 1977.

Sources: Wyoming Employment Security Commission, Administrative Services Division, Research and Analysis Section, Casper, Wyoming.

Table CA2-9

FINANCIAL CHARACTERISTICS
1977

County City	Assessed Valuation	Mill Levy (per \$1,000 assessed) Valuation	Bonded Indebtedness
Carbon County	188,630,804	12.61	\$ 159,100
Rawlins	14,505,124	14.76	2,993,000
Baggs	255,290	8.00	None
Dixon	63,843	8.00	20,500
Elk Mountain	202,399	13.00	27,000
Elmo	96,963	12.26	144,000
Encampment	528,175	17.28	43,000
Hanna	1,403,186	11.40	133,000
Medicine Bow	631,144	8.00	40,000
Saratoga	2,584,955	8.00	282,000
Sinclair	4,721,591	8.00	None
Wamsutter (Sweetwater County)	303,480	48.53	198,000

- Sources: 1. Assessed Valuation, Mill Levy--Wyoming Taxpayers Association, Wyoming Property Tax Rates, 1977, Cheyenne, August 1977.
2. Bonded Indebtedness--Community budgets and/or phone conversation with city clerk.

Table CA2-10

HOUSING IN INCORPORATED AREAS
TOTAL AND BY TYPE
1977

County Community	Total year Round Units	Single Family	Type of Unit		Mobile Home
			Multiple Family	Home	
Carbon County					
Rawlins	3,428	2,034 (.60)	700 (.20)	694 (.20)	
Sinclair	203	198 (.97)	0 (.00)	5 (.03)	
Hanna	510	325 (.64)	0 (.00)	185 (.36)	
Elmo	77	35 (.45)	0 (.00)	42 (.55)	
Elk Mountain	95	70 (.74)	0 (.00)	25 (.26)	
Medicine Bow	246	100 (.41)	6 (.02)	140 (.57)	
Saratoga	765	477 (.62)	87 (.11)	201 (.26)	
Encampment	241	155 (.64)	2 (.01)	84 (.35)	
Total housing in incorporated areas	5,747	3,473 (.60)	795 (.14)	1,479 (.26)	

Note: Figures in parentheses are the fraction of total housing units. These figures may not add to 100 due to rounding.

Source: Except for the towns of Rawlins, Hanna and Medicine Bow, the data on housing were taken from land use plans submitted by the communities to the Carbon County Council of Governments in the fall of 1977. Although the figure on the total housing units in Rawlins was taken from a land use plan, data on the type of housing were estimated from conversations with local officials. Housing figures for Hanna reflect estimates reported by the local town clerk. Total housing units for Medicine Bow reflect the results of a survey conducted by the local high school students in the spring of 1977. Figures on the type of units in Medicine Bow were estimated based on conversations with local officials.

Table CA2-11

PUBLIC SCHOOL CHARACTERISTICS
1977-78

School District School (Grade)	Student Enrollment	Full-Time Equivalent Teachers	Student/ Teacher Ratio	Building Design Capacity
School District #1				
Mountain View (K-6)	368	18	20.4	460
Pershing (K-6)	282	15	18.8	370
Sunnyside-Central (K-6)	465	14	33.2	488
Baggs-Morrow	213	16	13.3	275
Bairoil (K-8)	65	6	10.8	110
Sinclair (K-6)	65	3.5	18.6	140
Rawlins Jr. High (7-8)	387	22	17.6	525
Rawlins Sr. High (9-12)	823	47	17.5	1,000
School District #1 Total	2,668	141.5	18.8	3,368
School District #2				
Elk Mountain (K-6)	39	3	13.0	140
Encampment (K-12)	214	14	15.3	300
Hanna (K-6)	276	13	21.2	100
McFadden (K-8)	16	3	5.3	100
Medicine Bow (K-6)	114	7.5	15.2	150
Platte Valley (K-6)	275	16.5	16.6	300
Shirley Basin (K-6)	79	7.5	10.5	140
Beer Mug (1-6)	2	1	2.0	--
Hanna-Elk Mountain Junior-Senior High (7-12)	200	15	13.3	300
Medicine Bow-Shirley Basin Junior-Senior High (7-12)	153	13	11.7	400
Platte Valley Junior High (7-8)	91	6.5	14.0	
Platte Valley Senior High (9-12)	199	10	20.0	300
District #2 Total	1,658	110	13.1	2,430
Carbon County Total	4,326	251.5	16.0	5,798

Sources: Wyoming State of, Department of Education, Division of Planning, Evaluation and Information Services, Fall Report of Staff/Teachers/Pupils/Enrollments 1977, "Statistical Report Series, No. 2", 1977, Cheyenne, Wyoming.

Wyoming, State of, Department of Education, Communications Services, Wyoming Education Directory, 1977-78, Cheyenne, Wyoming, 1977.

Telephone conversations with Hugh Simmons, School Superintendent, District #1, March 22, 1978; and John Tynon, School Superintendent, District #2, March 22, 1978.

DESCRIPTION OF THE ENVIRONMENT

Local Services

The Carbon County Sheriff's Office is currently adequately meeting demands and recent increases in workload (drug arrests increased 250%, and number of prisoners handled increased 30% in the past year) are not resulting in decreases in the quality of service (Personal Communication Hansen 1978). A significant proportion of the Carbon County Volunteer Fire Department equipment dates from the 1940s and 1950s and is in need of replacement. The major inadequacy of the department is its inability to extinguish major fires requiring chemical or foam equipment.

The major problem with the Rawlins Police Department is inadequate facilities. The department is also considered understaffed, and staff turnover because of high wages paid to miners adds to personnel problems (Personal Communication DeHerrera 1978). The largest potential problem in fire protection service in Rawlins is low pressure in the water system, particularly during the summer when demands for water peak. Rawlins' fire protection rating is seven which is considered adequate (Insurance Services Office 1978). Current improvements underway in Rawlins' water system are designed to meet water needs of the city until the year 2000, based on current growth rate (Personal Communication Paris 1978). Rawlins' present sewer system is being improved to correct major inadequacies. These improvements will significantly upgrade the system; however, the system will continue to have problems with old, undersized sewer lines that are overloaded and with ground water seeping into older lines (Personal Communication Yamashiro 1978).

Both police and fire protection in Sinclair are considered adequate. Peak water demands can presently be met. A study is underway to determine future needs resulting from potential population growth.

Turnover in the Hanna Police Department is an ongoing problem since those hired frequently quit to work in the mines. Hanna's fire protection rating is nine, which is considered inadequate by the Insurance Services Office in Denver, Colorado. Hanna is currently improving its water system to meet current demands.

Elmo has no fire or police department. These services are provided by the town of Hanna and by Carbon County. Elmo's water is supplied by Hanna. A 10,000 gallon storage tank has recently been built to solve the town's low water pressure problems.

Elk Mountain's fire protection rating is ten which is considered inadequate (Insurance Services Office 1978). The town's water system is considered adequate only for present needs. Elk Mountain is the only incorporated area in the county which relies on septic tanks for sewage treatment. With the current population, septic tank leachate is not considered a major problem.

Water service has been the most critical problem in the delivery of local services in Medicine Bow. By mid-summer of 1978, current improvements to the water system should correct water supply problems. The town's new sewage treatment lagoon is more than adequate to serve current needs. Medicine Bow's fire protection rating is nine, which is considered inadequate (Insurance Services Office 1978).

Saratoga is in the process of improving its water and sewer systems. These improvements allowed the town to lift a 15-month moratorium on building caused by inadequacies in its water system. The town's sewage lagoon, however, cannot adequately treat the amount of sewage generated by the town, and it is currently operating at about 105% of capacity. Police and fire protection are adequate to meet the community's needs.

Transportation and Utilities

Interstate 80, which is one of the principal interstate routes crossing the United States, is the most heavily traveled road.

A major Union Pacific Railroad main line passes through southcentral Wyoming. In 1979 freight traffic through Rawlins averaged 45 trains per day carrying a wide variety of products between eastern and western markets. Current coal production in the Hanna Basin added 6 trains per day (loaded and empty return) to transport coal to market. These trains will travel eastward from the Hanna Basin. For a more detailed description on rail transport, see Southcentral Wyoming Coal ES and Southwest Wyoming Coal ES.

Amtrak provides passenger railroad service from Rawlins. There is one eastbound and one westbound train daily.

There are four airports in Carbon County. The Rawlins airport runway is paved; its length is 5,500 feet. The Saratoga airport runway is also paved, with a length of 8,400 feet. Regularly scheduled air service is provided to these airports by Trans Mountain Airlines. In addition, the Rawlins airport is served by Star Airways. The other two airports, located just outside Hanna and Dixon, both have unpaved runways and are used only by private planes (Personal Communication Donnelly Corporation 1978).

Interstate bus service is available on a daily basis. The bus depot in Rawlins is served by Continental Trailways, Greyhound, Central Wyoming Transportation, and Zanetti Bus and Fast Express (Russel's Railway and Motor Bus Company Guide 1977).

Carbon County is served by four electric utilities: Pacific Power and Light, Carbon Power and Light, Hot Springs REA, and Yampa Valley Electric.

The Northern Gas and the Mountain Fuel Supply Companies distribute natural gas to the county.

Attitudes and Expectations

The attitudes reflected in this section were derived from the Hanna and Overland Planning Unit Planning Area Analyses and some limited opinion surveys that have been completed in the region.

General Attitudes

In October 1974, the Wyoming Conservation and Land Use Planning Commission published a resident survey done as preliminary work in formulating a land use program in Wyoming.

From the replies, it could be seen that in 1974 the people of Carbon County wanted land use planning and

DESCRIPTION OF THE ENVIRONMENT

that both economic and environmental effects should be considered in that planning. They also preferred attracting non-mineral industries over mineral industries and did not want any development to be at the expense of unique scenic beauty.

In 1975, T.A. Bougsty sampled opinion of residents in the Hanna Basin. This study, done for the Wyoming State Department of Economic Planning and Development, explored residents' preference on the size of their communities and satisfaction with various community services. It was found that 73% of the residents of Elk Mountain prefer no growth, while residents of Hanna and Elmo would tolerate some growth. Satisfaction with community services varied somewhat between communities and the Hanna Basin as a whole. The residents were most dissatisfied with medical services, natural gas supply, streets and roads, community beautification, and recreation facilities. Medicine Bow residents favor growth through development of a mine in their area. Housing and utilities are planned to accommodate the anticipated growth.

Information regarding the attitudes of residents in other areas of the Hanna Planning Unit is not presently available.

A resident survey covering the Overland Planning Unit was done in 1976 by Bickert, Browne, Coddington, and Associates. Among other things, residents were asked to rate adequacy of various community services. The results showed that only five services were rated "very adequate" by 10% or more of the sample. These were fire protection, schools, utilities, roads and highways, and trash disposal.

Specific Attitudes

The following attitudes were derived from material contained in the Overland and Hanna Planning Area Analyses:

1. Forest Management: The timber industry, including the Wyoming Wood Producers' Association, supports a continued timber sale program.

2. Access: Hunting and recreation groups strongly support a program to obtain access in checkerboard land areas and other areas where private lands block access to public lands. Groups such as the Carbon County Conservation Club and the Wyoming Game and Fish Department support programs to obtain access.

3. Livestock Grazing: Livestock organizations support a freeze or cutback of grazing fees on public lands. Most operators desire to have increased flexibility with respect to use of grazing allotments, in terms of class of stock, numbers of stock, season of use, etc. Most operators favor predator control and strongly favor management of feral horses and return of feral horse numbers to 1971 levels.

Lifestyles

Lifestyle means an internally consistent way of life or style of living that reflects the attitudes and values of an

individual or a culture. It is influenced by infrastructure (housing, health care, educational system, police and fire protection, etc.) existing at the time.

Many changes are already occurring in the lifestyles of the region's residents. These changes are most evident in Rawlins, which has grown 34% since 1970. This is an annual growth rate of approximately 5%. Any community growth of 5% or more creates social and economic problems and could be considered a boom situation (Gilmore and Duff 1974).

As identified in the Construction Worker Profile Final Report, 1975, one of the adjustments communities have made in response to this growth has been in the area of role switching. This role switching can take several forms: (1) new roles are created; (2) more positions within existing roles are created; (3) old roles are redefined in light of changing needs; and (4) newcomers replace oldtimers in existing roles.

The most common creation of new roles has been in the local economic order, as business people have started businesses not previously present in the community.

Positions Are Created Within Existing Roles

More people are hired to increase employment in occupations already existing in the community. More teachers are hired as enrollment picks up, more waitresses are hired as business increases, and so on.

As institutional responsibilities change, old roles get redefined. A merchant's role is changed as he or she is forced to update merchandising, advertising, or financing. Social workers suddenly find themselves confronted with problems they never encountered before. In many cases these changes are such that former role occupants cannot or will not make the change; thus, they vacate the roles.

In some communities, the oldtimers are unable or unwilling to keep up with the changes demanded of them. Very often a newcomer to the community will take over an oldtimer's role.

Cultural changes are also occurring in the region's communities. As the towns grow larger, they become less relaxed, less friendly, less traditional, less isolated, less harmonious, and more run down. At the same time they become more expensive, more difficult, more progressive, and more competitive. The communities are becoming more culturally diverse as new people bring in new ideas. In addition, more professionalism and respect for expertise occurs along with specialization and bureaucracies become more complex. People begin to hold the belief that big is better as well as more efficient and cheaper. The workings of the profit motive become more evident. People complain about their neighbors chasing the almighty dollar or increasing prices to whatever the market will bear. People begin to rely more on institutions. Problems that were once solved at the family level are brought to social workers for solution. At the same time, residents become more demanding of institutions. In areas where medical care has always been lacking residents begin to demand such care.

DESCRIPTION OF THE ENVIRONMENT

The nature of social life is such that people, institutions, and culture are all intricately bound up with one another in a system; when one component changes, other components must also change as well. Among long time residents the cultural and social changes take their toll. In some cases these responses are pathological: in Rock Springs, for example, the mental health clinic has increased eightfold over the past 5 years, and its director says much of that increase is from long time residents. Among long time residents, at least three ways of responding to the changes in their communities have been observed.

Make The Change. For the majority of people, taking the changes in stride has been the response. The overworked social worker accepts the larger caseload and works harder. The police chief starts keeping better records, sends his employees to in-service training, and in general updates the department. The shopowner realizes that he/she should remodel the shop if he/she wishes to attract the expanded market. The long time resident goes next door and welcomes the newcomer to the community.

Maintain The Status Quo. Some impact community residents seem to be taking the approach of doing things as they always have, while also mourning the passing of a way of life (which may or may not have been romanticized). If these individuals are in business, they have not expanded or remodeled; if in government, they have not held more meetings or hired more staff. Such persons are the ones most likely to find themselves relieved of their roles by newcomers or others more willing to adjust to the new demands.

Leave The Situation. Flight has always been one of the options persons have open to them in uncomfortable situations. Flight from the bad situation can take the form of leaving the role that is changing (e.g., sell the store, resign from public office), or it can take a more extreme form of leaving the community entirely.

For newcomers the reaction to living in a boom town is based on not what the town used to be before the boom but what the town they came from was like. Their reactions are also based on their reasons for moving to the new community. For example, a family fleeing the pace of a big city to the small town life may be extremely happy; the family may be nearly oblivious to the urbanization of the town and may see any lack of facilities or goods as a minor inconvenience more than compensated for by cleanliness, neighborliness, and space. Another family moving from a big city only because the company transferred them may hate the town and may feel the lack of goods and services to be a constant irritant. Finding themselves strangers in a place where large numbers of people know each other may increase their feelings of loneliness. Those who move to towns as large as Rawlins from smaller towns may find the pace too fast, the culture too urban.

While long time residents who are unhappy blame the boom (or occasionally the newcomers or some "element" among the newcomers), the newcomers blame the town itself. Thus, those newcomers who are unhappy tend to isolate themselves from the town and from its or-

ganizations, groups, politics, and the like. This is particularly easy since the newcomers have other newcomers with whom to socialize. The extreme of this behavior can be seen in those newcomers who know they will be leaving soon and who socialize almost exclusively with coworkers who will also leave soon. Newcomers who like the town are much more likely to cross the old/new barrier and participate in the social life of the community.

Change in the physical environment also has affected lifestyles in the region. One change perceived almost universally is an increase in noise, which to many small town residents must certainly symbolize the shift from a small town way of life toward the way of life that characterizes big cities. The overcrowding that some respondents noticed probably means to them the same thing. In places where physical growth has been most extensive, the pattern has been unmistakably suburban; that is, the physical appearance and ambience of the new areas are not western or small town. The new areas look like new areas in the surrounding suburbs of any big city: strip commercial developments, car orientation (e.g., large parking lots, many drive-in facilities), tract homes, chain stores, and residential areas with cul-de-sacs and curving lanes. Thus as the culture of the communities changes from that of small town to that of mass society, the physical appearance of the towns undergoes the same change, starting to resemble, urban areas or at least suburban areas.

Provisions for Revenue Sharing and Taxation

The state government provides several methods of offset energy development impacts: (1) the infusion of additional revenues to local units of government, (2) the provision of information and technical assistance, and (3) the introduction of state and local influence into the siting of energy facilities. Efforts to increase local revenues have included automatic increases in the distribution of state tax receipts, legislated increased in the distribution of the sales tax, joint powers loans, coal impact tax grants, and the enactment of an optional sales tax. The state has tried to provide information and technical assistance to local governments through the Department of Economic Planning and Development and the Industrial Development Information and Siting Act.

Joint Powers Act

Cities and counties share revenues, facilities, and services.

Local Sales Tax

Cities and counties have the option to impose a 1% sales tax. This option has been exercised in Carbon County.

DESCRIPTION OF THE ENVIRONMENT

Mineral Leasing Royalties

The state receives 50% of the mineral royalties from any mineral leasing projects as provided by the Federal Coal Leasing Amendments Act of 1976. The state divides its share as follows: municipalities (7.5%), counties (2.25%), state highway work in counties affected by resource development (2.25%), the school foundation program (37.50%), the state highway fund (26.25%), capital outlays for higher education (6.75%), public schools capital construction (4%), and other (13.5%).

Severance Taxes

The state receives from operating coal companies 10.1% of the value of gross products extracted from mines. This 10.1% is allocated for the state general fund (2%), the permanent trust fund (2.5%), the water development account (1.5%), a capital facilities revenue fund (1.6%). The proceeds to the coal impact fund will increase to 2.0% in 1979, bringing the total severance tax on coal to 10.5%.

Coal Impact Tax

The state is using its option to tax coal mining companies to furnish a source of revenue to be spent for roads, streets, highways, water, and sewer projects. Limited funds accrued from the coal impact tax may be bor-

rowed by local governments to upgrade certain public facilities.

Ad Valorem Revenues

Property taxes of 6.0 mills are presently collected in Carbon County for the state school equalization fund. The equalization levy is determined annually by the state and can vary from 0 to 6 mills.

The future environment would be approximately the same as it is today without issuance of the federal coal leases or of rights-of-way for ancillary facilities. Without these approvals, the project would be more costly and no practical mining development would be feasible because of the "checkerboard" land pattern of public and private lands. Because of this, only about 50% of the coal would be available for mining, the railroad spur could not be built, and coal would have to be hauled to the railroad main line at Medicine Bow.

Land use recommendations are to maintain wildlife habitat and livestock grazing on the area. The present populations of prairie dogs and eagles in the area would not be disturbed.

The population in those portions of the region that would be impacted by the Carbon Basin project would increase dramatically even without the project. The population of Carbon County would increase 62% to a total of 29,530 by 1990. Rawlins would increase 90%, Hanna/Elmo would increase 56%, and Saratoga would increase 13%. Employment, income, housing demand, school-age populations, etc., would increase in a like manner through 1990.

DESCRIPTION OF THE FUTURE ENVIRONMENT

The future environment would be approximately the same as it is today without issuance of the federal coal leases or of rights-of-way for ancillary facilities. Without these approvals, the project would be more costly and no logical mining unit would be feasible due to the "checkerboard" land pattern of public and private lands. Because of this, only about 50% of the coal would be available for mining, the railroad spur could not be built, and coal would have to be hauled to the railroad main line at Medicine Bow.

Land use recommendations are to maintain wildlife habitat and livestock grazing on the area. The present populations of prairie dogs and eagles in the area would not be disturbed.

The population in those portions of the region that would be impacted by the Carbon Basin project would increase dramatically even without the project. The population of Carbon County would increase 62% to a total of 29,530 by 1990. Rawlins would increase 90%, Hanna/Elmo would increase 56%, and Saratoga would increase 13%. Employment, income, housing demand, school-age populations, etc., would increase in a like manner through 1990.

CLIMATE

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

ASSUMPTIONS AND GUIDELINES

The analysis developed in this chapter is an assessment of impacts that would result from the development of coal within the Carbon Basin project area. The development of the Carbon Basin project consists of two phases which employ different mining methods, namely surface and underground. The development of each phase would be accomplished concurrently. The mining operations are independent of each other except for some mine facilities (shop, office, coal handling, etc.) and ancillary facilities (railroad spur, access road, etc.) which are common to both.

The following narrative and table were developed to establish assumptions and guidelines for analysis of the proposed Carbon Basin project.

Assumptions

Complete data on reclamation success in the southcentral region are not available. Preliminary success, based on observations of seedings on reclaimed areas less than 4 years old, has been minimal and in some cases a total failure. These minimal results are attributed primarily to climatic conditions such as low precipitation, low humidity, strong winds, and the like. They are also attributed to the method of handling overburden, parting material and topsoil, and the minimal use of seed mixture, contour furrowing, and mulching (Southcentral ES, Regional, Chapter 2, Vegetation).

Based on field observations of other reclaimed areas such as roadside cuts and fills, barrow areas, and consultation with others, it is estimated that reclamation would occur as outlined in items 2 and 3 that follow, assuming that proper reclamation procedures would be applied as described in Chapter 4.

Guidelines

1. Impacts are analyzed for two time points: 1990 and end of mine life.
2. Preliminary reclamation on an area is considered complete when disturbed lands have been backfilled, graded, contoured, and seeded.
3. Complete reclamation of an area would occur on the following schedule:
 - a. Filling, shaping, contouring, seedbed preparation, and seeding would require 1½ years.

- b. Establishment of vegetative cover of the seeded species which would support small game animals, rodents, and limited deer use would require 4½ years.

- c. Establishment of a desirable shrub cover would require 15 to 20 years.

4. One out of three seedings will fail because of climatic conditions.

5. All livestock grazing on the project area would be deferred during the life of the mine.

6. The extent, magnitude, and length of time subsidence could occur is unknown at this time. Subsidence will be affected by the mining method used, depths of beds mined, and the number of beds mined. The type of rock strata, or "roof" rock over the beds would also influence subsidence. Subsidence could range from 0-50 feet (the maximum amount, assuming complete recovery of coal in the Blue and Finch groups and the Johnson bed). In reality, surface expression of subsidence would most likely range from 0 feet (no surface expression) to a maximum of 20 feet over the whole area.

Table CA3-1 presents an overview of the total land disturbed. The locations of these possible facilities and the acreage associated with each cannot be determined without additional data. Table CA3-1 portrays the acres of land disturbed and reclaimed during each designated time period by various activities in the development of the Johnson coal seam. The relation of the Carbon Basin development to other energy related developments (proposed mines, existing mines, and non-coal development) discussed in the Southcentral Regional Coal ES is shown in Chapter 1 (Table CA1-3).

CLIMATE

The mining activities at the proposed Carbon Basin Mine site would probably not affect the frequency of shower or thunderstorm activity, or the amount of precipitation received. Possible changes in the radiation balance resulting from changes in soil character would be undetectable. The alternation of the terrain could change local drainage wind patterns, but this impact beyond a local level would be undetectable.

Table CA3-1

ACREAGE DISTURBED BY ACTIVITY AND ACREAGE RECLAIMED
OVER PERIODS OF TIME

Activity	Acres Disturbed		Total
	1990	1990+*	
Final contour	1,416	0	1,416
Mine pit areas	(807)	(0)	(807)
Overburden storage	(437)	(0)	(437)
Haul roads	(172)	(0)	(172)
Mine facilities a.	209	18	227
b.	(241)**		(241)**
Ancillary facilities	500	0	500
Relocation (county road)	<u>6</u>	<u>0</u>	<u>6</u>
Subtotal	2,131	18	2,149
Population	<u>331</u>	<u>0</u>	<u>331</u>
Total	2,462	18	2,480
Acres reclaimed	833	1,316	2,149
Underground mining	1,282	11,240	12,522

Source: BLM 1978

NOTE: This table does not include the acreage of surface disturbance that could occur with the development of the Blue and Finch groups.

* 1990+ refers to end of mine life.

** The 241 acres would be first surface mined and then partially reclaimed and utilized as mine facility construction sites. This acreage is included in the final contour acreage of 1,416.

IMPACTS OF THE PROPOSAL

AIR QUALITY

Emissions from the Proposed Mine

Typical mining activities in Carbon Basin would produce large quantities of particulate emissions. Only a small portion of the total particulate emissions from a mine can be applied to existing national ambient air quality standards (NAAQS). Fugitive dusts (native soil uncontaminated by pollutants resulting from industrial activity) are excluded from assessment as part of the NAAQS and prevention of significant deterioration (PSD) standards (43 CFR 118). They are, however, considered as an impact for purposes of cumulative impact assessment. The Wyoming Department of Environmental Quality presently includes fugitive dust in its determination of compliance with the Wyoming Ambient Air Quality Standards (WAAQS). TSP emissions from a typical Carbon Basin mine would probably violate WAAQS at the mine boundaries and a short distance beyond the boundaries (Chapter 3). Fugitive dusts are controlled through best management practices (includes all procedures that can be reasonably used to control fugitive dusts) on a case-by-case basis. In any event, the worst case mine scenario is discussed, and best management practices (addressed in Chapter IV mitigation and discussed in detail in Appendix A) would produce fewer and less intense impacts.

Ten major sources of fugitive dust would be associated with the potential mining facility: haul road traffic, truck dumping, shovel/truck loading, front-end loading, drilling, blasting, topsoil removal, stockpiling, access road traffic, and wind erosion from exposed areas. Two point sources would be coal crushing and train loading. Table CA3-2 lists these emission sources and the corresponding emission factors. The annual emissions from the proposed site were calculated using the emission factors listed in the table. A minor source of fugitive dust and TSP will be coal dust blown from the coal cars of the train transporting the coal to market. The majority of the coal dust lost should occur within the first few miles of the trip. The operational parameters were obtained from the typical mining and reclamation report for Carbon Basin.

Emission inventories were performed for the mining years 1990 and the end of mine life. These inventories are the best approximations of the complex interaction of variables. Table CA3-3 presents the annual emissions from each source for the designated years.

Other potential air pollution sources identified are exhaust emissions from diesel-powered locomotives, haul trucks, and employer/employee motor vehicles. Emission factors for vehicular travel were obtained from EPA's most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in Table CA3-4. These emissions are from both employer/employee travel on the typical mine site and haul trucks. The amount of gaseous emissions resulting from diesel-powered locomotives is insignificant when compared to total emissions from the area or along the railroad main line.

Impact on Air Quality

The impact of the above annual emission on the nearby ambient total suspended particulate (TSP) concentration were determined by use of the Modified Climatological Dispersion Model-Version 3 (MCDM-V3), (PEDCo Environmental, Inc. 1976).

The model performs both annual and worst case 24-hour averaging period. Source data input consist of the following: source locations; source emissions rates; emission heights; locations where ground level pollutant concentrations are desired; and frequency of occurrence of each of sixteen wind directions, six wind speeds, and six stability classes.

MCDM determines long- and short-term quasistable pollutant concentrations at any ground-level receptor using average emission rates from point and area sources and a joint frequency distribution of wind direction, wind speed, and stability for the same period. Climatological input data are in the form of a stability rose (STAR) deck. The STAR deck used for modeling the Carbon Basin typical mine was generated from data collected at the Rawlins, Wyoming, weather station. Also included in the program is a particulate fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particulate size (PEDCo Environmental, Inc. 1978).

Maps CA3-1 and CA3-2 show the annual predicted and resulting ambient TSP concentrations for the years 1990 and end of mine life as determined by the model. Maps CA3-3 and CA3-4 show the worst case 24-hour predicted and resulting ambient TSP concentrations for the same study years. Concentrations in both situations are shown to decrease rapidly with distance.

Maps CA3-1 and CA3-2 and Table CA3-3 indicate that fugitive dust emissions from overburden removal and access road traffic dominate the resultant ambient particulate concentration.

The majority of the air quality impact would be centered around the mine access road and haul roads and the prevailing winds would cause the impact to take place mostly to the east and northeast of these sources. By comparing Map CA3-1 to Map CA3-2, the haul road impacts can be distinguished somewhat from the access road impact since at the end of mine life the haul road usage would be at a minimum. Annual particulate concentrations of 46 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and above 50 $\mu\text{g}/\text{m}^3$ 24-hour worst case would be predicted as far as 14 miles northeast and 10 miles east of the Carbon Basin typical mine.

Stationary sources of particulate emissions at the Carbon Basin typical mine are not expected to violate the annual and 24-hour NAAQS nor the Class II increments (based on 43 CFR 118). However, fugitive dusts, to be controlled under best management practices are still the most significant impact of surface mining. Chapter 4 discusses additional mitigating measures which can significantly reduce fugitive dust impacts.

Table CA3-2

FUGITIVE AND POINT SOURCES OF DUST IDENTIFIED AT THE CARBON BASIN
TYPICAL MINE WITH CORRESPONDING EMISSION FACTORS

EMISSION SOURCE	EMISSION FACTOR
1. Truck traffic (hauling)	6.8 lb/vehicle mile traveled
2. Truck dumping	
a. Coal	0.02 lb/ton dumped
b. Overburden	0.002 lb/ton dumped
3. Shovel/truck loading	
a. Coal	0.007 lb/ton loaded
b. Overburden	0.037 lb/ton loaded
4. Front-end loading	0.12 lb/ton loaded
5. Drilling	
a. Coal	0.22 lb/hole drilled
b. Overburden	1.5 lb/hole drilled
6. Blasting	
a. Coal	72.4 lb/blast
b. Overburden	85.3 lb/blast
7. Topsoil removal	
a. Scraping	0.35 lb/yd ³ scraped
b. Dumping	0.03 lb/yd ³ dumped
8. Stockpile (coal)	8.64 lb/acre-hour
9. General vehicular traffic	5.11 lb/vehicle mile traveled*
10. Wind erosion (exposed areas)	0.42 tons/acre-year**
11. Coal crushing	0.005 lb/ton crushed
12. Train loading	0.0002 lb/ton loaded

Source: PEDCo Environmental, Inc., 1978.

*Calculated from formula in U.S. Environmental Protection Agency, 1975.

**Calculated from formula by Midwest Research Institute, 1975.

Table CA3-3

ANNUAL EMISSIONS FROM EACH MAJOR SOURCE
FOR EACH STUDY YEAR
(Fugitive Dust and TSP)

Emission Source	Tons per year	
	1990	End of Mine Life*
1. Truck traffic (hauling)**	6,917	0
2. Truck dumping	51	0
3. Shovel/truck loading	671	0
4. Front-end loading	9	0
5. Drilling	11	0
6. Blasting	20	0
7. Topsoil removal	186	0
8. Stockpiling (coal)	240	240
9. General vehicular traffic	4,599	3,679
10. Wind erosion (exposed areas)	631	217
11. Coal crushing	13	10
12. Train loading	1	1
Total	13,349	4,147

Source: PEDCo Environmental, Inc., 1978

*Last active year of mining

**Includes watering

Table CA3-4

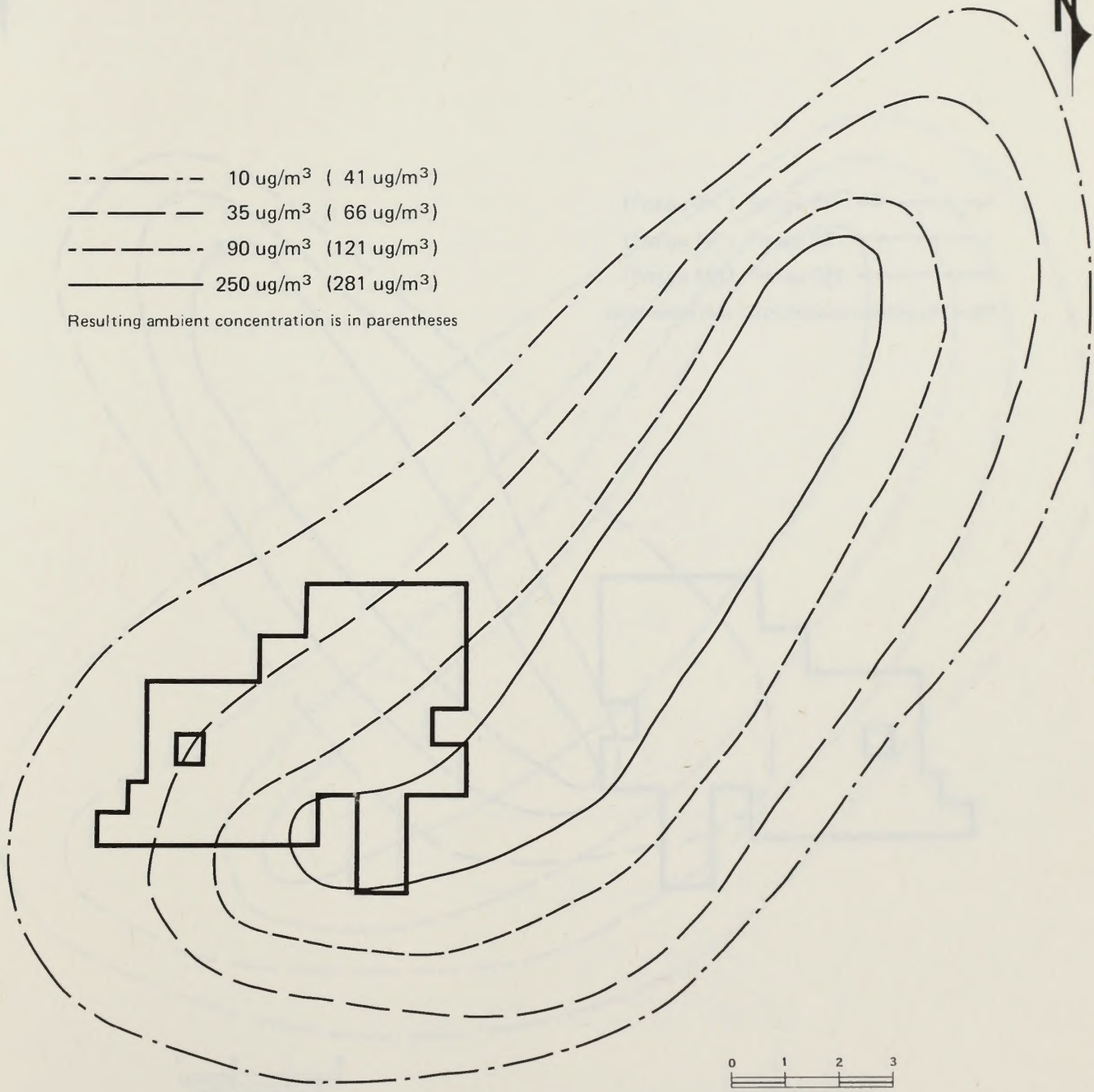
EMISSIONS OF GASEOUS POLLUTANTS FROM VEHICLES AT THE
CARBON BASIN TYPICAL MINE

Year	Total Emissions (Tons/Yr)			
	CO	HC	NO _x	SO _x
1990	36.4	3.9	9.9	3.7
End of Mine Life	35.3	3.5	9.3	0.6

Source: BLM 1978

- 10 $\mu\text{g}/\text{m}^3$ (41 $\mu\text{g}/\text{m}^3$)
- 35 $\mu\text{g}/\text{m}^3$ (66 $\mu\text{g}/\text{m}^3$)
- 90 $\mu\text{g}/\text{m}^3$ (121 $\mu\text{g}/\text{m}^3$)
- 250 $\mu\text{g}/\text{m}^3$ (281 $\mu\text{g}/\text{m}^3$)

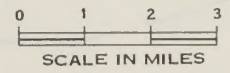
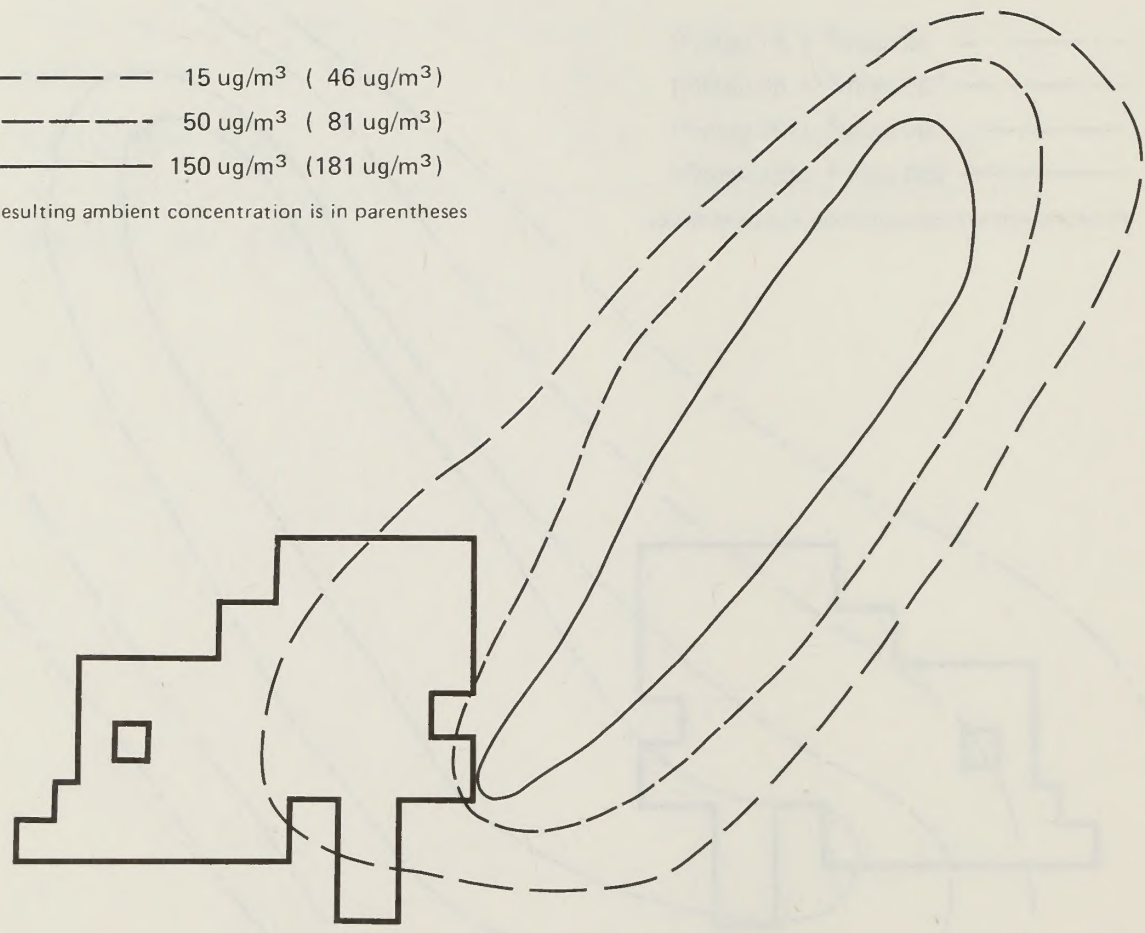
Resulting ambient concentration is in parentheses



Map CA 3-1
**ISOPLETH MAP SHOWING ANNUAL PREDICTED AND RESULTING
 AMBIENT PARTICULATE CONCENTRATIONS FOR 1990**



— — — — — 15 ug/m³ (46 ug/m³)
- - - - - 50 ug/m³ (81 ug/m³)
————— 150 ug/m³ (181 ug/m³)
Resulting ambient concentration is in parentheses

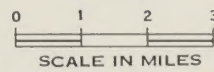
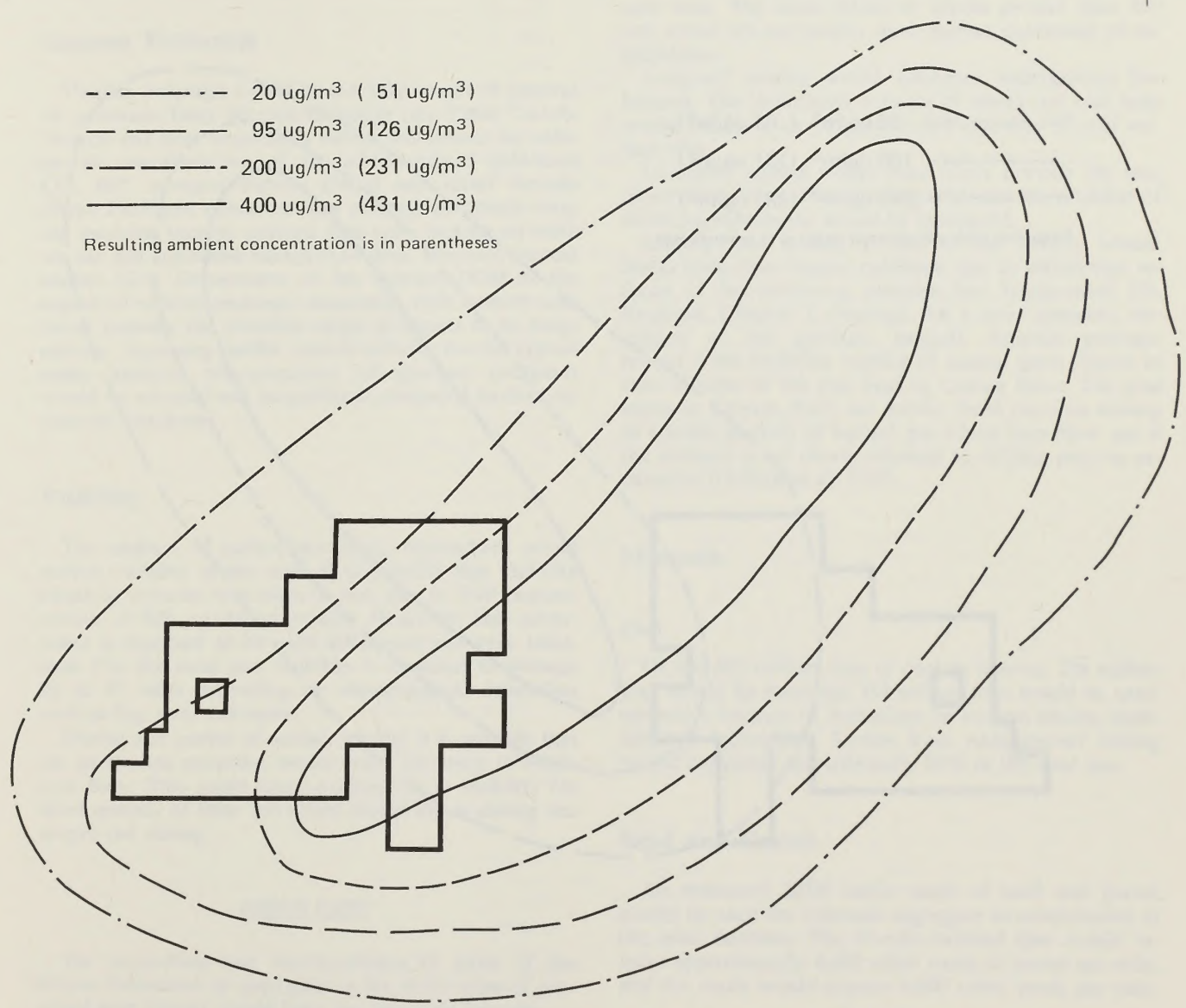


Map CA 3-2
**ISOPLETH MAP SHOWING ANNUAL PREDICTED AND RESULTING
AMBIENT PARTICULATE CONCENTRATIONS FOR THE END OF MINE LIFE**



- - - - - 20 ug/m³ (51 ug/m³)
- - - - - 95 ug/m³ (126 ug/m³)
- - - - - 200 ug/m³ (231 ug/m³)
- - - - - 400 ug/m³ (431 ug/m³)

Resulting ambient concentration is in parentheses

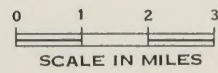
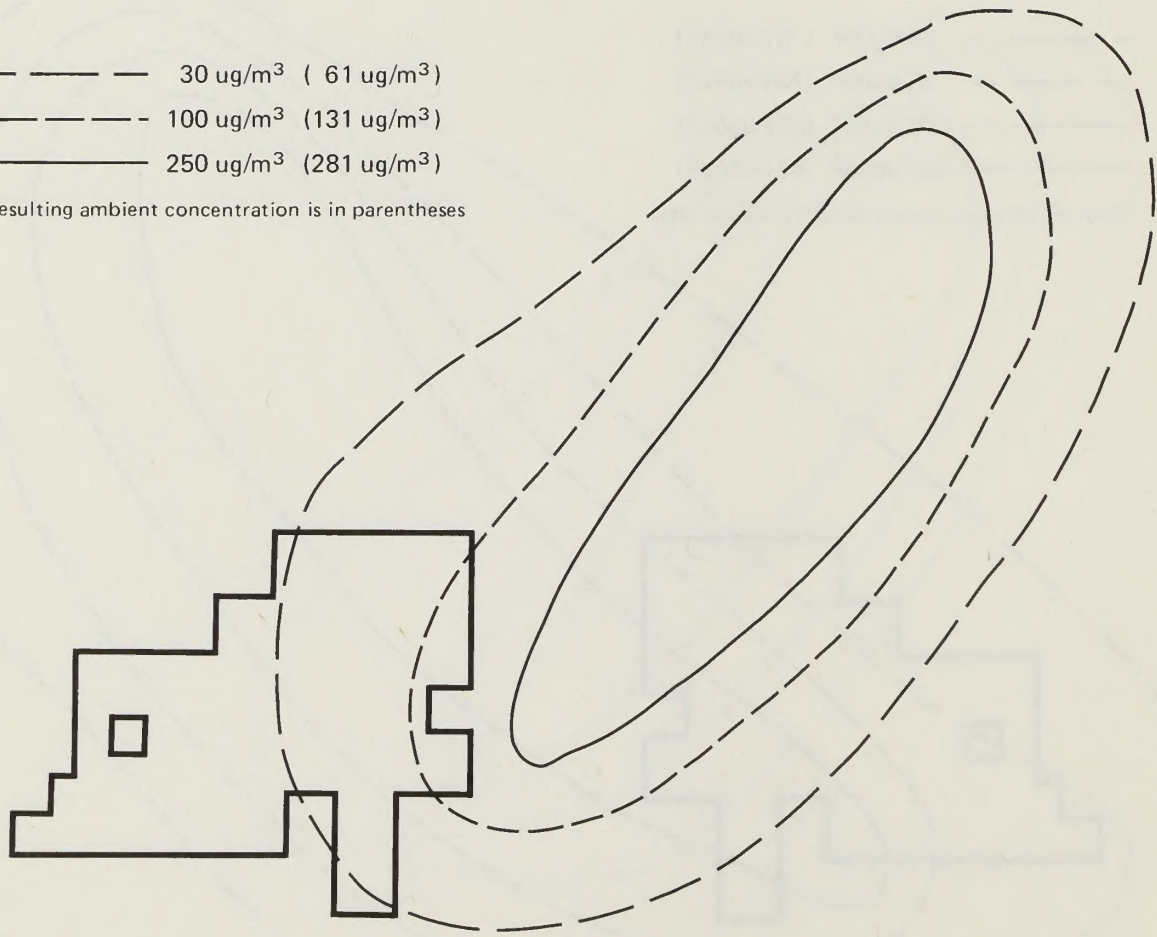


Map CA 3-3
ISOPLETH MAP SHOWING 24-HOUR WORST CASE PREDICTED AND
RESULTING AMBIENT PARTICULATE CONCENTRATIONS FOR 1990



- — — — — 30 ug/m³ (61 ug/m³)
- - - - - 100 ug/m³ (131 ug/m³)
- 250 ug/m³ (281 ug/m³)

Resulting ambient concentration is in parentheses



Map CA 3-4
**ISOPLETH MAP SHOWING 24-HOUR WORST CASE PREDICTED AND
RESULTING AMBIENT PARTICULATE CONCENTRATIONS FOR THE END OF MINE LIFE**

IMPACTS OF THE PROPOSAL

Fugitive dust from other sources such as wind erosions of exposed area, dragline operations, and topsoil removal could not be controlled using best management techniques. However, by applying mitigating measures outlined in Chapter 4, total fugitive dust impacts would be reduced by approximately 64% in 1990 and by 81% when confining mining to underground methods only.

Gaseous Pollutants

Vehicle emissions would be the only source of gaseous air pollutants from the typical facility (see Table CA3-4). Federal and state regulations include limitations on ambient air concentrations of the vehicle-related pollutants CO, HC, nitrogen dioxide (NO₂) and sulfur dioxide (SO₂). Predicted concentrations of these pollutants were not modeled because detailed data were lacking on vehicle use and applicable background data. However, recent studies (U.S. Department of the Interior 1976) of the impact of vehicle emissions associated with western coal mines estimate the probable range of impact to be insignificant. Assuming similar vehicle activity for the typical mine, ambient concentrations of gaseous pollutants would be minimal and insignificant compared to their respective standards.

Visibility

The addition of particulates to the atmosphere would reduce visibility in the area. It is possible that visibility could be reduced to 4 miles or less, due to TSP concentration of 400 µg/m³ or greater. However, this occurrence is expected to be very infrequent and very localized. For the most part visibility is expected to average 26 to 47 miles depending on climatological conditions such as fog, rain, and snow.

During the period of surface mining it is possible that the particulate emissions would reach the town of Medicine Bow. This could cause a reduction in visibility for short periods of time. No effect would occur during underground mining.

GEOLOGY

The excavation and transformation of parts of the Hanna Formation to spoil piles in the three areas of proposed strip mining would have the following impacts:

1. There would be a decrease in the stability (shear strength) of the ground to a depth of about 170 feet.
2. Geophysical exploration for possible deeper mineral deposits would be more difficult.
3. The local geologic history in Early Tertiary time (40 to 60 million years ago) would be partially lost. However, there would be enough of the Hanna Formation left between the three mining blocks and the surrounding area to preserve the regional geologic record of the area.

Some subsidence of the surface would probably occur over areas where underground mining would be carried out. However, the areas that would subside cannot be determined until a more detailed underground mine plan is developed.

Rapid subsidence of the surface in areas being mined by longwall methods is much more likely because the method involves the intentional collapse of the mined-out coal beds. The areas mined at depths greater than 300 feet would not necessarily show surface expression of the subsidence.

Longwall mining would minimize underground fire hazards. The intentional collapse of mined out coal beds would minimize air movement and exposure of coal surface area.

Longwall mining would most likely provide the best opportunity to recover the resource, and the problem of recurring subsidence would be minimized.

Underground mining of coal in the western United States sometimes causes rockburst due to differential releases of the continuing pressure (see Southcentral ES, Regional, Chapter 3, Geology, for a more complete discussion of this geologic hazard). Another geologic impact is the probable venting of natural gases known to exist in some of the coal beds in Carbon Basin. The coal seams in Carbon Basin are known from previous mining to contain pockets of natural gas which may blow out if the pressure is not slowly released by drilling prior to excavation (Dobbin et al. 1929).

Minerals

Coal

Of the 400 million tons of coal in reserve, 206 million tons would be removed; 194 million tons would be unrecoverable because of limitations on current mining methods and technology. Losses from underground mining would constitute approximately 99% of the total loss.

Sand and Gravel

An estimated 2,000 cubic yards of sand and gravel would be used for concrete aggregate in construction of the mine facilities. The 13-mile railroad spur would require approximately 6,600 cubic yards of gravel per mile, and the roads would require 6,000 cubic yards per mile.

Paleontology

Impact to paleontological resources would consist of losses of plant, invertebrate, and vertebrate fossil materials for scientific research, public education (interpretative programs), and to other values. Losses of various degree would result from destruction, disturbance, or removal of fossil materials as a result of coal mining activities, unauthorized collection, and vandalism.

IMPACTS OF THE PROPOSAL

A beneficial impact of development would be the exposure of fossil materials for scientific examination and collection which might otherwise never occur except as a result of overburden clearance, exposure of rock strata, and mineral excavation.

TOPOGRAPHY

The temporary effect of strip mining on existing landforms (1,244 acres) during the proposed period of mining (1979 to 1990) would be the moving cut up to 170 feet deep and the increasing piles of spoils behind the cut. The net effect after reclamation would be a gently rolling topography that would be similar to, but different than, the existing land surface. A depression would be left in the final cut area that would have a maximum slope of 16 degrees.

Taking an average thickness of the Johnson coal bed of 20 feet and assuming a 20% swell factor for an average overburden thickness of 130 feet, the average elevation of the land surface would be increased by about 6 feet following reclamation. It would gradually resettle to some indeterminate value that would be slightly lower than the present average elevation.

Topography would also be affected by subsidence in the existing land surface above some of the areas being mined by underground methods. The amount of subsidence could range from 0 to 50 feet but would most likely range from 0 feet (no surface expression) to a maximum of 25 feet because of elastic expansion of the geologic strata directly above the underground cavity. It is expected that subsidence of the surface would not occur over the entire area to be mined underground, but would only occur on the shallower parts less than some critical depth depending on the strength of the existing strata. Present data are not adequate to predict the critical depth, but it may be as low as 300 feet over the short term or as great as 1,000 feet over the long term (greater than 50 years). Areas of abrupt differential subsidence would be recontoured similar to, but different than, the existing topography.

Topography would also be impacted by the construction of the railroad spur, haul roads, and access roads, but the effects of necessary cuts and fills would be relatively minor. Because the existing land surface is gently sloping, no deep cuts or high fills would be required. Some diversion of existing drainages would be required.

SOILS

Underground mining would cause soil disturbance by the construction of mine facilities (surface buildings, portals, ventilation shafts, power lines, and telephone lines), ancillary facilities (access road, railroad spur, water storage), and relocation of county road. This disturbance cumulatively would occur on 956 acres by 1990 and 974 acres by end of mine life. An additional 331 acres would be utilized by mine-related population needs (see Tables CA3-1 and CA1-3). Some expected surface subsidence

resulting from underground mining could cause soil disturbance cumulatively on 1,282 acres by 1990 and 12,522 acres by end of mine life or continuing into the long term. This subsidence could continue after end of mine life depending upon the method of underground mining (room and pillar versus long wall). The subsidence is expected to be a gradually uniform process (long wall). Subsidence would effect soils because of changes in topography and drainage patterns, thus changing erosional patterns. With present data, it is impossible to ascertain the extent of subsidence that could occur. The soils data is incomplete on the proposed railroad spur right-of-way, and analysis of soil impacts is not complete.

Surface mining (final contour acreage) would cause additional soil disturbance cumulatively on 1,175 acres by 1990. The surface mine would use the same surface and ancillary facilities constructed for the underground mine.

Mining and other activities would impact soils by alteration of existing soil characteristics. These include soil microorganism composition, structure, textures, organic matter content, infiltration rates, permeability, water holding capacities, nutrient levels, soil-climatic relationships, and productivity levels that have developed over geologic time (Brady 1974; BLM 1975a; Bay 1976). The established levels of soil productivity (see Soils, Appendix A, Agricultural) would be lost for the period from disturbance until reclamation were successful.

The loss of soil productivity (premining average 250 to 1,200 pounds air dry vegetation per acre per year) levels on 2,149 acres would be reclaimed to approximately 100% of average premining levels. At the time of initial seeding and vegetative establishment, the post-mining soil productivity over most of the reclaimed areas would be an estimated 75% of the potential. This potential would be an estimated average 250 to 1,200 pounds of air dry vegetation per acre per year. The productivity levels would increase during the following 10 to 15 years after the start of initial reclamation, primarily due to proper management and increased microbial interactions. Physical and chemical changes in the soil ecosystem would also be initiated.

Reclamation (shaped, topsoil replacement, seedbed preparation, and initial seeding) of surface mining areas would cumulatively occur on an estimated 833 acres by 1990; and 2,149 acres by end of mine life. Amounts of suitable topsoil material, steep slopes, aspect, surface manipulations, and climate (precipitation) are important variables of reclamation success. Some of these factors could impact soils by increasing erosion rates and losses in soil productivity (Monsen 1975; BLM 1975a, May et al. 1971). The analysis in Table CA3-5 shows amounts of available suitable material (approximately 2,049.2 acre feet) would allow for replacement of an average of 12 inches. This depth of replacement would allow for reestablishment of soil productivity and reduction in erosional losses. The lack of suitable soil material, the soils characteristically poor for reclamation aspect, and moderately steep to steep slopes are evident on Carbon Basin in mapping unit 401 and 3-1 (see Soil Map CA2-2). The disturbance of these soils (in 401 and 3-1) could lead to

Table CA3-5

VOLUME OF USABLE TOPSOIL MATERIAL

Map Unit ¹	Composition of Unit ²	Disturbed Acres ³	Average Depth Of Usable ⁴ Soil (Inches)	Volume of Usable Soil ⁵ (ac-ft)
2-3	Blackhall (50%) Blazon (30%)	16	4-10 6	2.7-6.7 2.4
3	Blazon (75%)	34	6	12.7
3-1	Blazon (40%) Shinbara (30%)	380	6 0	60.0 --
3-4	Blazon (50%) Delphill (30%)	37	6 27	9.2 25.0
3-10	Blazon (40%) Satanka (30%)	199	6 13	40.0 65.0
6	#15 (75%)	56	20-60	70.0-210
6-7	#15 (40%) Forelle (40%)	172	20-60 29-60	115.0-344.0 166.3-344.0
7	Forelle (75%) #15 (25%)	53	29-60 20-60	96.1-198.7 22.1-66.2
8-2	Ryan Park (40%) Blackhall (30%)	25	17-60 4-10	14.2-50 2.5-6.2
8-5	Ryan Park (40%) Grieves (30%)	82	17-60 12-60	46.5-164.0 24.6-123.0
9	Rock River (75%) Satanka (25%)	16	12-60 13	12.0-60.0 4.3
9-2	Rock River (40%) Blackhall (20%)	17	12-60 4-10	6.8-34.0 1.1-2.8
257	Havre (85%) Glendive	52	6-60	22.1-221.0
401	Torriorthents- Rock Outcrop	341	0	--
	TOTAL	1,480		820.6-2,049.2

Table CA3-5--Continued

Sources: VTN 1978; USDA SCS 1978; BLM 1978

- 1 Mapping units from soil Map CA2-2
- 2 Composition of mapping units are those of the dominant soil series: minor soils comprising a part of soil associations are not included in this table; therefore, the composition does not total 100% for each association.
- 3 Acres disturbed are those acres in Sections 35, 31, 1, and 29 that would be disturbed by surface mining and construction of mine facilities (both surface and underground).
- 4 Estimated usable depths of usable topsoil material in each association (includes A, B, and C horizons).
- 5 Volume of soil material available in acre feet based upon acres disturbed, % in soil association, and inches available in each.

IMPACTS OF THE PROPOSAL

an improvement in soil productivity, since soil depths and slopes would be improved.

Mining would involve the excavation and storage of topsoil (4 storage areas) and the storage (437 acres) of usable and unusable overburden material. Increased wind and water erosion would occur from stockpiled materials. Mining activities would also increase soil loss from increased fugitive dust levels, especially haul road dust.

Mining would expose materials in the Hanna Formation that could hamper reclamation. The paucity of overburden data (4 test holes) over surface mining area limits the impact analysis. Additional overburden analysis data would be required from any successful lessee when submitting a mining and reclamation plan. The limited overburden data does identify that surface mining operations would expose overburden parting materials that would be unsuitable for reclamation (see Table CA3-6). This includes material with high pH, salinity (E.C.), alkalinity (SAR), high levels of Boron (4.01 ppm), and material with high amounts of clay (greater than 40%). This material would have to be separated and buried beneath the suitable overburden. The soil survey (VTN 1978; USDA, SCS 1978) over the project area shows a moderate or high accumulation of salinity and/or alkalinity in subsoil (below 6 inches) in mapping unit 257. The high salinity and alkalinity levels would make localized portions of the subsoil of 257 soils unsuitable for topsoil reclamation material.

The exposure, compaction, burial, stockpiling, disturbance, and contamination of surface soil would cause reductions in the current levels of soil productivity and would increase soil loss from wind and water erosion. The stockpiling of surface soil would degrade the biological, chemical, and physical properties, causing temporary reductions in productivity when used as reclamation topsoil material (Monsen 1975; BLM 1975a; Singleton and Cline 1976). Accidental spills of oil, gasoline, and other toxic materials would contaminate soil profiles, especially around mine facilities. This spillage would contaminate and sterilize soil horizons, rendering the affected soil unusable for reclamation.

All of the mining disturbances would result in accelerated erosion by wind and water upon presently existing soils, soil material, and overburden spoil piles, as a result of exposure and increased activity (Monsen 1975). Wind action, which is fairly constant over the area, would cause fine particles to be lifted from the exposed surfaces and blown away. Wind erosion from the exposed areas would be an estimated 0.42 tons/acre-year. Prior to revegetation of exposed, disturbed, and stockpiled soils, high intensity storms (possibly occurring about 1 year in 10 years to 1 year in 25 years usually in late May or June) could lead to increased water erosion (Lowham 1976; Becker and Alyea 1964). The increased erosion would result from the disturbed soils not having any protective cover and the reduction of soil infiltration rates (resulting from compaction and steep slopes) causing increased runoff (Dollhopf et al. 1977). The erosional rates over the final contour areas prior to revegetation would be an estimated 2.4 to 5.0 tons/acre-year.

Alterations of soil horizons resulting from mining, subsidence, culverts, drainage ditches, diversions, and changes in topography (slope) could increase flow velocities from unprotected surfaces and could accelerate sheet, rill, and gully erosion. The areas of concern would be on reclaimed areas where loss of protective ground cover would subject surfaces to increased erosion, and diversions on Third Sand Creek (Mapping unit 257).

Off-road vehicle (ORV) use by the increased population would cause soil loss through disturbance and erosion of sensitive surface soil horizons (USDA SCS 1978 and BLM 1975a).

All developments (surface mining, mine facilities, ancillary construction, and mine-associated increased population needs) would cumulatively disturb soils on 2,462 acres by 1990; and 2,480 acres thereafter (1990). The disturbance on 2,149 acres would be temporary since the disturbed lands would be eventually reclaimed. The loss of soil productivity would be permanent on 331 acres by the end of mine life, since urban facilities would be retained. The 2,149 acres disturbed by surface mining and mine facility construction (surface and underground) would be approximately 14% of the project area.

WATER RESOURCES

Ground Water

Although insufficient data are available to permit an accurate numerical assessment of impacts, the types of impacts can be predicted.

The aquifers in Carbon Basin are separate from regional aquifers; therefore, all impacts on ground water would be confined to the basin and would be minimal. Not more than 10% of the recharge area around the rim of the basin would be disturbed and replaced by spoils as a result of surface mining.

The coal, which is a principal aquifer of the basin, would be removed through underground mining. In its place would be left either an open or fractured zone that would transmit water at a faster rate than the coal. Both surface and underground mining, but especially underground, would intercept small quantities of water that move through the coal (Mesilla Valley Engineers—1978 estimate a maximum drainage of 40,000 gallons per day—gpd to surface pits) and could disturb relatively unimportant aquifers lying above and below the coal. The aquifers above the coal could be dewatered through downward drainage to the underground mine. The drainage could be intensified by fracturing that resulted from subsidence. Aquifers below the coal could be dewatered by upward movement of water into the mine. Although pressures of 200 to 300 pounds per square inch (psi) may exist, the pressure would dissipate rapidly and there would be little potential for mine floors to buckle from this source.

Clay mineral characteristics of the strata immediately underlying the mine coal bed could also have an influ-

Table CA3-6

OVERBURDEN ANALYSIS FOR SUITABILITY AS SOIL MATERIAL

Test Hole No.	Depth of Level (feet)	Limiting Factor*
35-12-3	10- 20	Low pH, clay
	20- 65	Clay
	65- 80	High pH, clay
	80-100	High pH, clay
1-19-6	25- 30	E.C., clay
	80-105	Clay
	100-115	SAR
	115-135	High pH
31-38-1	0- 5	Clay
	25- 30	Boron
	55- 80	Clay
	80- 95	Clay SAR
29-20-2	5- 10	Clay
	15- 35	Clay
	75- 80	Clay
	85- 90	Clay
	100-110	Clay
	110-120	Clay SAR
	120-130	Clay

Source: VTN 1978; Overburden Analysis; BLM 1978

*Limiting Factors--The overburden with limiting parameters would have to be separated and buried beneath suitable overburden material.

Low pH--acidic material; High pH--alkaline material;

E.C.--salinity; SAR--alkalinity and/or salinity;

Clay--high clay content >40%; and Boron (4.01 ppm).

IMPACTS OF THE PROPOSAL

ence on whether or not the floor would buckle in the presence of water.

After mining ceased, water levels would gradually return to the premining level in aquifers immediately above and below the mined area. Complete recovery would take at least 40 years; therefore, aquifers would be non-productive for about 80 years. Aquifers lying higher above the mined area might never recover to preexisting levels. Complete loss of aquifers in Carbon Basin would cause very little impact on any phase of the regional economy.

The aquifers, which are small in areal extent, are unimportant because they contribute little to the regional water supply and are essentially undeveloped. Loss of the aquifers would cause no hardship on nearby users, but could cause some springs used by wildlife to go dry. These springs are not primary water sources for the animals; therefore, their loss would also cause little impact.

Surface Water

Surface mining would alter the drainage pattern of several small ephemeral streams. The drainages would be partially restored after surface operations were completed, leaving no lasting impact. Even during mining there would be no impact outside the project area. Surface patterns could also be altered as a result of subsidence caused by underground mining. Subsidence may also cause sufficient fracturing to allow water to drain from stream channels into the mined out area.

Third Sand Creek and its tributaries flow through an area where surface mining is feasible; therefore short reaches of these streams probably would be diverted around mine pits through temporary diversion channels, and water would be treated in sedimentation ponds that at least meet the minimum legal requirements. Downstream from the ponds, channels would adjust to the amount of water they were required to carry (see Map CA3-5). The magnitude of the changes would depend on the amount of water released. The normal change occurring, when discharge is reduced and the cleaning effect of flood is eliminated, is for banks to cave and become vegetated causing a narrower less defined channel. Neither the impoundment of water nor the resultant channel changes would have any impact on the general economy of the region, and there are no downstream users to be impacted.

The railroad spur would cross Second Sand Creek and a plain on which there are few defined channels. The impact on water resources from the railroad spur would be negligible.

Quality

The isolated nature of Carbon Basin precludes any impact on water quality outside of the basin. Waters within the basin are moderately to highly mineralized but showed no tendency to be acidic or toxic. Also there are no dangerous quantities of acid or toxic producing ele-

ments in the overburden. Therefore, no significant changes in quality of ground water are anticipated.

Water released from the ponds would of necessity be of better quality than that now carried by the undisturbed streams. The sediment load delivered to the Medicine Bow River during the period of sedimentation pond operation would be significantly less than the load delivered by undisturbed streams; however, if clean water were released at a rate sufficient to cause scour as described above, the net amount of sediment reaching the river would not differ appreciably from what now reaches the river.

The chance of a pond failure releasing a large slug of sediment to the Medicine Bow River during the 16 year period required to complete surface mining, reclamation, and revegetation was estimated to be about 5%; whereas the chance of a similar slug of sediment coming from the undisturbed basin in the same time period was estimated to be about 30% to 40%.

Water Use

An increase in municipal water needs, because of the population influx, would be the most significant impact on water resources that would result from the proposed mine. Maximum impact would occur about 1990.

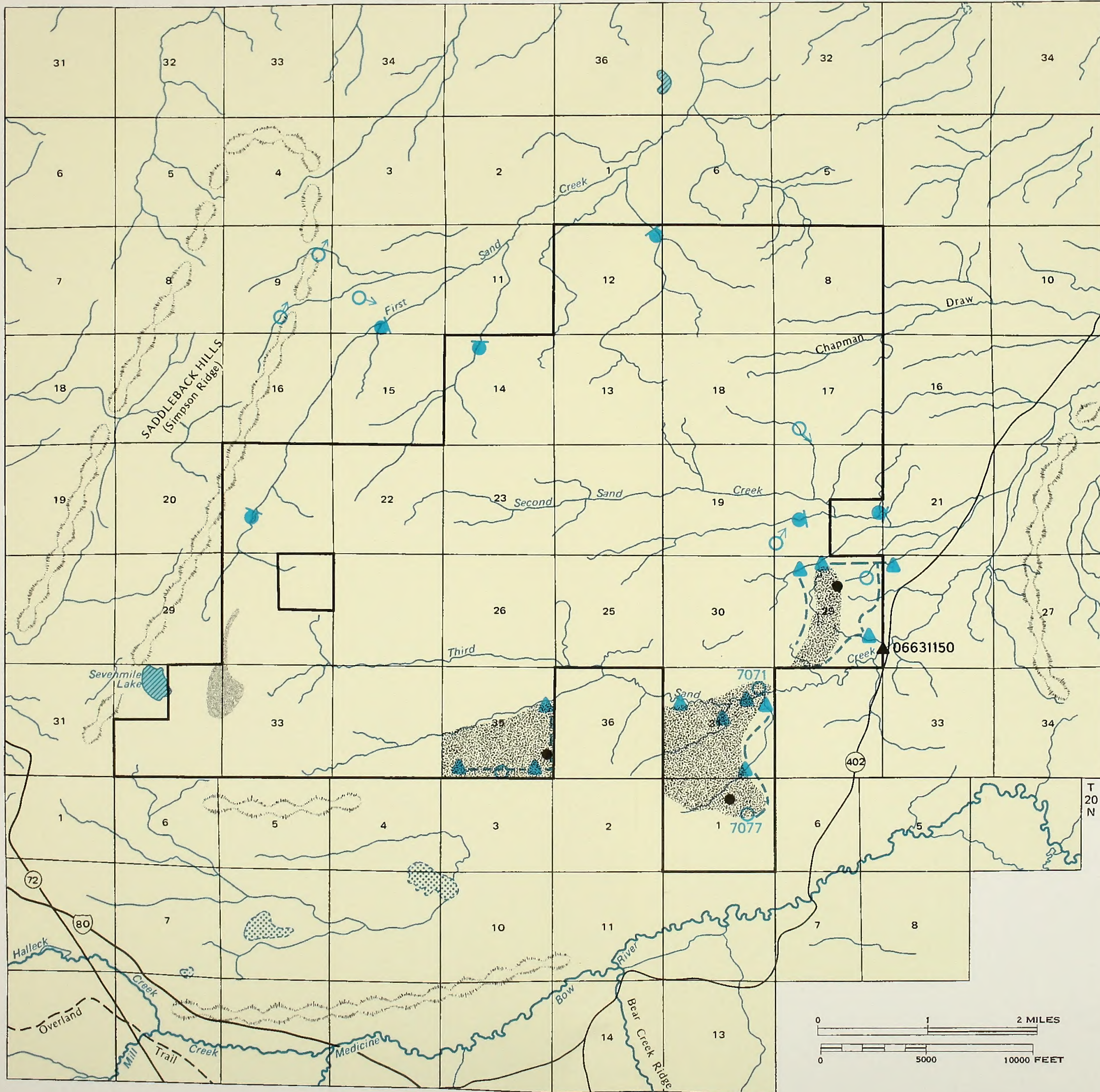
A mine the size of the typical mine would increase the municipal use in the southcentral Wyoming coal region (BLM 1978) by 530 acre feet per year or about 10% over what it would otherwise be in 1990. A Carbon Basin mine added to those discussed in the Southcentral ES would increase total usage from the 1977 level of 3,600 acre feet per year to 8,620 acre feet year in 1990.

The largest numerical increase would occur at Rawlins, but large percentage increases would occur at Elk Mountain and Medicine Bow (Table CA3-7).

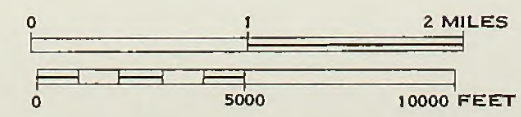
Distribution systems in towns would be overtaxed; however, the systems will all need to be enlarged to provide for the natural population increase. Additional water is available or can be obtained to meet the demands of the increased population. The additional facilities required to meet the demand imposed by the Carbon Basin Mine would add little to the cost of the enlargement. Sources of municipal water and capacity of existing systems are given in the Southcentral Regional ES.

Increased water use would also increase sewage to be treated by local communities. Hanna and Medicine Bow treatment facilities have the capacity to handle the estimated amount of effluent, but the facilities in other towns do not. The treatment facilities to be constructed for Rawlins in 1979 will provide adequate capacity. The facilities in other towns will need to be enlarged even if no Carbon Basin Mine is developed. As with water, increasing the capacity to handle the load imposed by the Carbon Basin Mine would be relatively inexpensive.

Surface mines would use water at a rate of about 50 acre feet year for dust suppression and equipment washing. The underground mines would use about 220 acre feet per year for cooling equipment and suppressing dust. In addition, the mine would require about 3 million gal-



- Spring
- Stock Pond
- Test Well (number is altitude of groundwater table)
- Intermittent Stream
- Perennial Stream
- Stream Gaging Station (number is USGS identification)
- Intermittent Lake
- Playa
- Proposed Diversion Channel
- Proposed Settling Pond
- Proposed Sedimentation Pond
- Area to be Surface Mined
- Old Surface Mine Area



Map CA 3-5
WATER RESOURCES

Table CA3-7

INCREASE IN MUNICIPAL WATER USE THAT WOULD BE CAUSED
BY A CARBON BASIN MINE
(1990)

Community	ac ft/yr	<u>Increase</u> percent
Rawlins	100	2
Sinclair	10	5
Hanna	60	14
Elk Mountain	30	25
Medicine Bow	140	64
Saratoga	80	19
Albany County	110	N/A

Source: BLM 1978

Note: Increase exceeds what would be used in 1990 without a Carbon Basin mine but with other mines that are proposed for existing coal leases (see Southcentral ES).

IMPACTS OF THE PROPOSAL

lons per year of potable water in bath houses and other sanitary facilities.

Excess water in the underground mine would be pumped to the surface into some of the settling ponds shown on Map CA3-5. The water would be treated as necessary and reused in the mining operation for dust suppression. More specific impacts might be identified during the review of any subsequent mining and reclamation. Such impacts would be considered at that time.

VEGETATION

Terrestrial

As stated in the Assumption and Guideline section, the surface mine and the underground mine would be developed concurrently. The development of these mines would cause disturbance to 2,462 acres by 1990 and 2,480 acres by the end of the mine life (Table CA3-1). Table CA1-3 shows the time relationships of this project such as final contour, mine facilities, ancillary facilities, and the like.

The acreage of vegetative disturbance caused by surface mining would be more than that caused by underground mining. This acreage, composed of the mine pits, haul road, overburden storage areas, and topsoil stockpiles, would total 1,175 acres. As the surface mine would have a life of approximately 10 years, this disturbance is expected to occur in the 1980s.

The underground mine development would cause a vegetative disturbance of 1,148 acres by 1990 and 1,166 acres by the end of mine life. This total acreage is composed of 468 acres of mine facilities, 500 acres of ancillary facilities, 6 acres for county road relocation, and 331 acres for housing and support facility site for the increase in population (Table CA3-1). This disturbed acreage would be out of production for the life of the mine which is expected to be 40 years or more.

Preliminary reclamation of surface mine acres (1,175) would be accomplished within 2 years after the areas were mined. The areas that were first surface mined and subsequently used for mine facilities (241 acres) would be reclaimed to a limited degree at the time of facility construction and would undergo final reclamation at the end of mine life. Since reclamation would progress at approximately the same rate as surface mining, the maximum unreclaimed disturbed acreage that would exist at any one time would be about 150 acres. The cumulative acreage that would be primarily reclaimed (shaped, seedbed prepared, and seeded) would be 833 acres by 1990 and 2,149 acres within 2 years after the end of mine life. The vegetative types and non-vegetated areas that would be disturbed by surface mining and ancillary facilities are sagebrush grass (1,469 acres), birdfoot sagewort (460 acres), greasewood (98 acres), mountain shrub (23 acres), and the disturbed area (99 acres). The assumption that one out of three seeding or plantings would fail results in a probability for success of 67% with the application of proper reclamation procedures. Failures could

range from partial requiring only spot reseeding or planting to complete requiring total reestablishment. Complete reclamation would be accomplished 10 to 15 years after successful initial reclamation measures were established.

The acreage disturbed could be increased with additional development of coal through surface mining methods (Chapter 1, Typical Operation of Surface Facilities).

FISH AND WILDLIFE

The impacts to the wildlife resource can be divided into two general categories: (1) loss of wildlife habitat and the associated wildlife carrying capacity of that habitat; and (2) the actual loss of wildlife populations for the entire period of mining activities.

The mine project area would involve a total of 15,495 acres of wildlife habitat. The various vegetative types that could be impacted by surface and underground mining would include sagebrush—12,996 acres; birdfoot sagewort—1,675 acres; greasewood—388 acres; mountain shrub—233 acres; and disturbed area—216 acres.

Habitat Losses

Implementation of the mining proposal would result in both direct and indirect losses of wildlife habitat. Direct losses include habitat that would be destroyed by the mining operation and construction of ancillary facilities. Losses of habitat that would be classed as indirect would be those areas of habitat that would not be physically destroyed, but are areas that are outside the mined area that would become temporarily unusable by wildlife because of isolation, noise, dust, etc. These areas of indirect loss could also be called a "zone of influence" around mining areas. Direct losses of habitat on the project area, the railroad spur and the county road relocation would be 2,131 acres by 1990 which is composed of 1,175 acres which is attributed to surface mining and an additional 956 acres disturbed by activities attributed to underground mining. By about the year 2010, reclamation of the 1,175 acres would be completed. From that time on until the end of mine life, a total of 974 acres (including 18 acres disturbed after 1990 for a ventilation shaft and associated facilities) would remain disturbed because of underground mine activities.

As identified later in this chapter, the Carbon Basin project area is classified as critical range for pronghorn and sage grouse. As provided for in the Hanna Area MFP, activities on the land will be regulated to the degree necessary to protect these critical habitats.

State resident wildlife species which are of high state interest were inventoried in a manner acceptable to coal unsuitability criteria concerning these species (pronghorn and sage grouse in this instance). Mining activities in this area would not significantly impact essential habitat for these species if procedures in the Hanna MFP were followed for protection of wildlife habitat. Therefore, the area can be classed as acceptable for coal mining, pend-

IMPACTS OF THE PROPOSAL

ing acceptance of mitigation measures identified in Chapter 4.

Wildlife Population Losses

Wildlife populations in the project area would be lost or reduced with the advent of mining activities. These losses would increase as the size of the disturbed area increased during the period of mine life.

Wildlife

Birds

Nongame. The major small nongame songbirds that would be lost or displaced by the loss of 2,149 acres of habitat would be horned larks, sage sparrows, sage thrashers, Brewer's sparrows, vesper sparrows, and green-tailed towhees. The best available bird population density estimate that is presently available for the project area is an average of 21 breeding pairs per 100 acres with the population turning over or replacing itself every 3 years and each nesting pair fledging an average of three young per nest (personal communication, Max Schroeder, USFWS, March 1978). It is not possible to calculate a population estimate for small birds because natural mortality data are not available for computer simulation. However, if it is assumed that small birds occur equally spaced over the entire project area, estimates of small bird losses could total 2% of the bird population on the project area. Additionally, this loss is estimated to be less than 1% of the regional bird population.

If development occurs in accordance with the typical mining operation described in Chapter 1, the buffer zone around two active and seven inactive golden eagle nests would be disturbed because of their close proximity to the mine area. In addition, 12 other raptor nests and one great-horned owl nest would also be disturbed by mining activities and by recreationists and workers in the area (see Map CA2-5). Before mining could proceed, studies of the effects of surface mining and related activities on the nests and the associated buffer zones would be completed. These studies will be completed according to coal unsuitability criteria.

Game. Sage grouse are the only game bird that would be significantly impacted by the proposed action. The proposed mining operation would physically disturb 529 acres of critical nesting habitat associated with the two strutting grounds (leks) located on the project area and the one lek located just northwest of the northern portion of the project area. Of the 529 acres of critical nesting habitat disturbed, an estimated 344 acres would be disturbed as a result of surface mining activities, while the remaining 185 acres would be disturbed by the underground mining operations (see Map CA3-6).

According to sage grouse population analysis techniques provided by the Wyoming Game and Fish Department, the three leks in and around the mining area

would have 19,235 acres of critical nesting habitat associated with them, 9,066 acres of which would be located on the project area. Of these 9,066 acres of critical nesting habitat, an estimated 499 acres would be destroyed by surface mining, construction of portals, and ancillary facilities, thus reducing critical nesting habitat by 5.5% on the project area.

Since the mine project area is an important sage grouse production area, protection of the critical nesting habitat associated with the two sage grouse strutting grounds on the proposed lease is essential. This habitat can be protected by restricting public access to the area during the critical nesting period. Closure of these areas to vehicle use during this period is covered in the Hanna Area MFP.

In addition to critical nesting areas that would be affected on the project area, there are about 30 acres of critical nesting habitat outside the project area that would be destroyed by construction of the railroad spur. In total, about 529 acres of critical nesting habitat would be destroyed until reclamation was completed at the end of mine life and the habitat was returned to vegetation capable of supporting premining use.

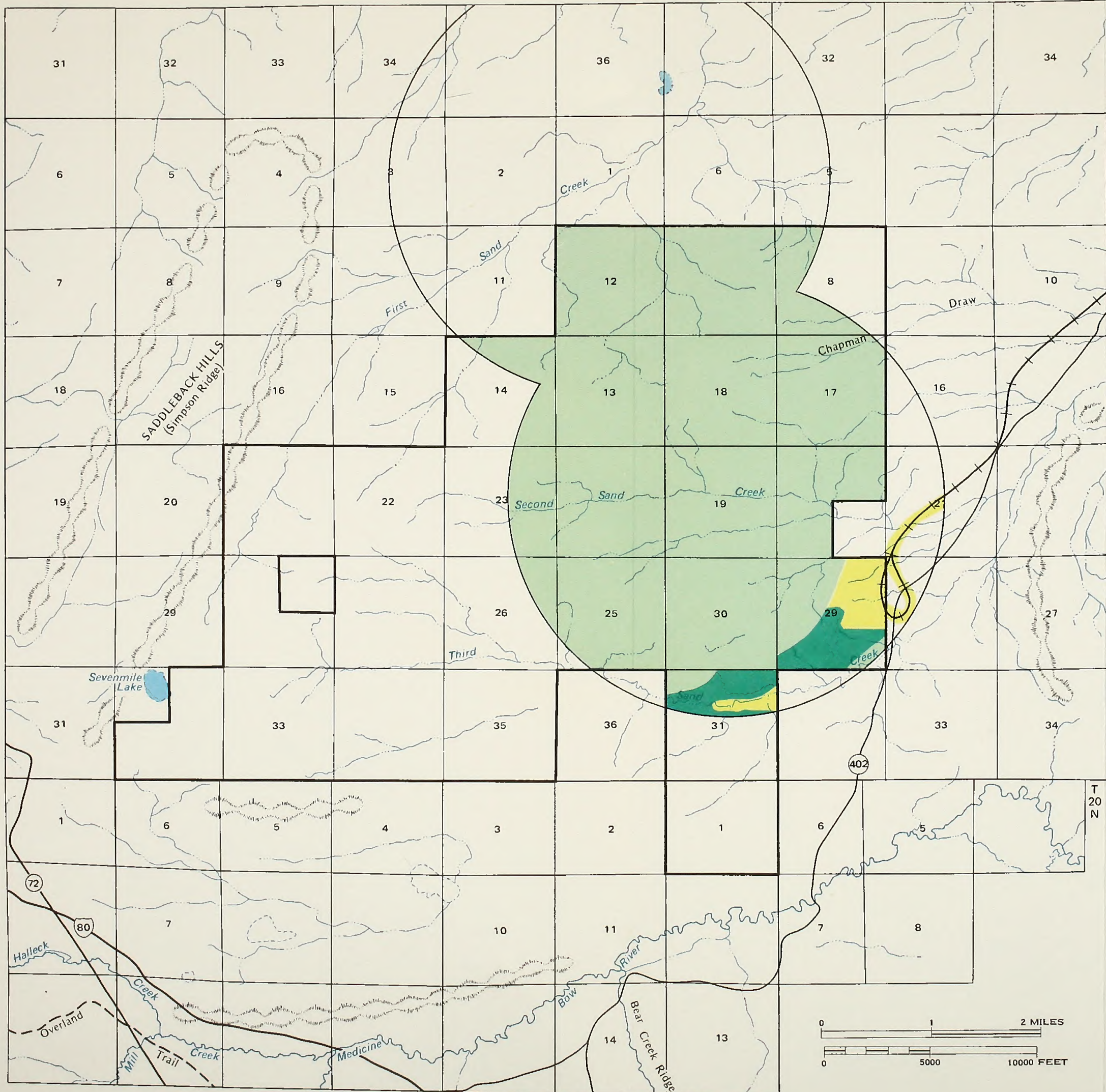
Mammals

Nongame. The principal small nongame rodents found on the project area include deer mice, least chipmunks, Richardson's ground squirrels, and whitetail jackrabbits. The removal of topsoil and its storage for later reclamation and other mine related activities would also result in direct losses to small rodents.

Quantification of these losses by computer simulation is not possible at the present time because published mortality data for small rodents are rare and not available at all for southcentral Wyoming. Losses of small rodents on 2,149 acres over the life of the mine would be heavy, but the high reproductive potential of these species indicate that repopulation of reclaimed mine areas would be rapid. If it is assumed that small rodents space themselves equally over the project area, estimates of losses would be about 2% of the rodent population on the project area.




Game. The pronghorn habitat on the mine project area totals about 15,494 acres which is classified as year-round range by the Wyoming Game and Fish Department. Included in this acreage total is 3,607 acres which are classed as critical winter range for pronghorns (see Map CA2-7).

An estimated 468 acres of critical pronghorn winter range would be destroyed by various mining activities until the end of mine life and the reclamation period. This acreage totals an estimated 13% of the critical habitat on the project area. This destruction of critical winter range would displace wintering pronghorns into surrounding areas of habitat, but little or no detrimental effects upon the herd would result because of the small area involved. Critical winter range for pronghorns outside the project area totals about 85,000 acres (Southcentral Wyoming Environmental Statement, Appendix A,



T 22 N
T 21 N

T 21 N
T 20 N

-  Critical Sage Grouse Nesting Area
-  Nesting Area Disturbed by Surface Mining Operations
-  Nesting Area Disturbed by Underground Mining Operations
-  Railroad Spur

Map CA 3-6
**CRITICAL SAGE GROUSE NESTING AREAS
 DISTURBED BY MINING**



IMPACTS OF THE PROPOSAL

Map 8). This large area could easily support displaced pronghorns from the 468 acres on the project area.

Since the entire mine project area is an important pronghorn fawning area, protection of the habitat from undue harassment by vehicles during the critical fawning period is essential. In Chapter 1, measures are recommended that would eliminate disturbance of these areas through the Hanna Area MFP.

The mine project area supports a year-round resident herd of about 50 mule deer. The entire project area is classed as year-round deer range, and of this area an estimated 9,923 acres are classified as winter range for deer. There is no critical range for deer on the project area. Of the 9,923 acres of winter range, it is estimated that 2,149 acres would be lost until the end of mine life and the reclamation period because of construction of portals, ancillary facilities, and access roads. Displacement of the deer using this portion of the winter range is not anticipated to result in a significant loss because of the small area involved plus the small number of deer using the area.

There would be an increase in poaching and vehicle-wildlife collisions as a result of the population increase from the Carbon Basin project. Table CA3-8 summarizes the estimated losses of big game in Carbon County as a result of poaching and accidents.

The destruction of 2,149 acres of brushland habitat would result in a population loss to desert cottontails on the project area. In this habitat type, the Wyoming Game and Fish Department estimates that there are about five rabbits per acre on the average. Cumulative losses of cottontails cannot be simulated since natural mortality data needed for a computer simulation run are not available. However, if it is assumed that cottontail rabbits occur equally over the project area, it can be estimated that losses due to mining would total 2% of the cottontail population on the project area. In addition, this loss would be less than 1% of the rabbit population in the region. While these losses could be heavy, the high reproductive potential of this species would enable it to quickly repopulate the area after reclamation.

Reptiles and Amphibians

The principal reptile species that could be impacted by the project include eastern shorthorned lizards, northern side-blotched lizards, and northern plateau lizards. The lack of free surface water and riparian vegetation limits the occurrence of amphibians in the project area; therefore, no impacts are anticipated to this class of animal.

CULTURAL RESOURCES

If sites of National Register quality are identified within the project area, compliance with Section 106 of the Historic Preservation Act will be undertaken, and appropriate mitigation developed in accordance with procedures outlined in 36 CFR 800. Approximately 27% of private land and none of the federal surface in the proposed project area has been surveyed by Western

Wyoming College (1977). In accordance with the coal unsuitability criteria concerning historic lands and sites, the area is acceptable pending a survey of the remaining unsurveyed portion of the project area.

Subsurface sites which cannot be located prior to mining may be impacted by mining operations.

Subsidence of the ground surface in areas of underground mining may affect sites by disturbing spatial horizontal and vertical distribution of the site, and possibly increasing erosion. This subsidence may occur over long periods of time, but it does not preclude the destruction of significant subsurface sites.

Increased population resulting from coal development and other activities would also increase the probability of indirect impacts to cultural resources in the area. Sites would be subject to vandalism and damage from increased vehicular traffic.

VISUAL RESOURCES

Visual resources contrast ratings were derived for the Carbon Basin project area using points along County Road 402 as critical viewpoints (Map CA2-8). These contrast ratings, summarized in Table CA3-9, are available for review at the Rawlins District Office of the BLM. Further explanation of the Visual Resource Contrast Rating System (BLM Manual 6320) is available in the library of the Rawlins District Office of the BLM.

Contrast ratings are assessed in terms of how the proposed action would affect the basic elements (form, line, color, and texture) of the existing landscape features; landform, vegetative pattern, and structures (e.g., power lines and buildings). Resultant contrast ratings are then compared to the maximum acceptable impact limit for the visual resource management (VRM) class as seen from a viewpoint. Two time periods (during active mining and post reclamation) were used for the Carbon Basin site contrast ratings.

Viewpoints A and B

From these viewpoints, the east side of the project area is visible. Surface mining activities and structures in the Class III area (which could be seen) would create a contrast to all basic elements. This would be especially true if the buildings or utility poles were shiny or were painted contrasting colors with the existing environment. The visual resource management class would change to a Class V in the actual surface mining area and where structures would be located.

RECREATION RESOURCES

With an increased visitor use due to increased population in Carbon County there would be a general lowering of the quality of the outdoor recreation experience in the area. There would also be increased use in urban recreation areas in the city of Rawlins and the towns of Hanna, Elk Mountain, Medicine Bow and Saratoga. The

Table CA3-8

KNOWN AND PROJECTED WILDLIFE LOSSES FROM ILLEGAL KILLS AND VEHICULAR ACCIDENTS IN CARBON COUNTY

TYPE ANIMAL	ILLEGAL KILLS			VEHICULAR KILLS		
	1978 KNOWN*	ESTIMATED**	PROJECTIONS**	1978***	1985	PROJECTIONS****
		1985	1990			1990
Pronghorn	48	1,872	2,876	11	17	20
Deer	37	1,443	2,217	17	26	31
Elk	25	975	1,498	1	2	2

Sources: Personal Communications, Dennis Smith, Wyoming Game and Fish Department 1979.

Vilkitis, J. R., in Bradley, J. 1976. Report from Fort Apache on crime and violence in southwest Wyoming. Unpublished report from Wyoming Game and Fish Department, Cheyenne, Wyoming.

*Based on information obtained from Dennis Smith, Wyoming Game and Fish Department.

**Estimated and projected figures are based on the Vilkitis formula.

***Reflects only collisions for which police accident reports were filed. The number of big game accidents from collisions are probably much greater.

****Projected losses were calculated in proportion to anticipated human population increases.

Table CA3-9

SUMMARY OF VISUAL CONTRAST RATINGS

Views from Critical Viewpoint	A	B
Visual Management Class	III	III
During Active Mining (Land)	3/20	3/20
Post Reclamation (Land)	2/17	2/17
During Active Mining (Vegetation)	3/30	3/30
Post Reclamation (Vegetation)	2/15	3/20
During Active Mining (Structure)	2/20	2/20
Post Reclamation (Structure)	1/10	1/10
<u>Visual Management Class</u>	<u>Maximum Acceptable Impact</u>	
Class III	2/16	

Source: BLM 1978

IMPACTS OF THE PROPOSAL

municipalities currently do not have enough urban recreation facilities to adequately support the existing populations according to standards set by the National Recreation and Park Association.

Visitor Use Data

Table CA3-10 depicts estimated resident visitor use changes by activity as a result of coal mining in the year 1990. The changes are those which would occur in the region and result from increased population in Carbon County. Data used to calculate use are available in the files at the BLM Rawlins District Office.

Hunting

Impacts to hunting would result when restricted access or displacement occurred to antelope, rabbit, rodent, coyote, and game bird populations. This would result as construction and mining destroy wildlife habitat (see Fish and Wildlife). With an increased number of people in the area, some ranches would restrict access across private lands. Increased human population would induce a greater demand for hunting and decrease the quality of the hunting experience in the area.

Sightseeing

The construction and mining would cause minor impacts to existing recreational sightseeing values in the area because few people pass through the site. Some access would be blocked causing people to use other routes to see the old town of Carbon. There would be opportunities for geological and industrial interpretation as the mining operations draw people in to view the area.

Specialized Activities

Off-road vehicle use would be restricted from the mining area, thus causing inconveniences to hunters in the area.

AGRICULTURE

Livestock Grazing

The project area is located in the North Anschutz allotment which has a grazing capacity of 8,321 animal unit months (AUMs) of grazing. Of the 8,321 AUMs, 1,551 are contained within the project area.

The MFP provides for removing all livestock grazing from the mine project during the life of the mine. Under the principle of managing the project area for the benefit

of wildlife during the life of the mine, the annual grazing loss would be approximately 1,551 AUMs. This annual loss would be sustained for the life of the mine and until all reclaimed areas support adequate vegetation to support the post mining use. Nonuse of the project area by livestock during the mine life would benefit the undisturbed acres since it would permit the range to improve because use would be limited to that of wildlife species. Over the years, improvement would occur in range vegetative composition, plant vigor, and quality of wildlife habitat. Opportunities would also be present to study the unused area to measure trend, changes in condition, and establishment and monitoring of wildlife habitat improvement techniques.

SOCIOECONOMICS

Demographics

Population

The proposed Carbon Basin project would result in a population increase of 2,640 residents in Carbon County by 1990. In addition, the project would result in a population increase of 574 in adjacent Albany County. The new population would reside primarily in Medicine Bow, Rawlins, Saratoga, and unincorporated areas in the vicinity of the project area. Medicine Bow, located about 15 miles north of the project area, is a logical area for new residential development and would receive 24% of the population increase. With the project, the 1990 population in Medicine Bow would be 64% greater than the 1,200 population expected without the proposed Carbon Basin project. Population in Rawlins would be increased by 506 residents, which is only 2% over the population expected without the proposed action. The 1990 population in Saratoga would be increased by 19% by the proposed action, and Hanna's population would be increased by 14%. The proposed project would increase population in rural areas near the project area by 427 persons (Table CA3-11). This growth would partly result from the inability of communities near the mine to absorb the expected population increase.

Employment

Construction on the Carbon Basin project would take place during the 1980s. By 1990, the permanent work force would total approximately 1,035 employees.

Miners and mine-related construction workers receive higher wages than employees in other sectors of the economy; therefore, the Carbon Basin project would be in a favorable situation to compete with other employers in the region for the available labor supply. This may actually lead to a slower growth in employment in other sectors of the economy for the years immediately following the mine employment increases. By the mid 1980's there would be 885 workers employed at the mine. However, total employment in the region would only increase

Table CA3-10

ESTIMATED RESIDENT VISITOR DAYS CHANGE AS A RESULT
OF POPULATION CHANGE FOR 1990

	Fishing	General**	Hunting	Off-road vehicles	Urban recreation***	Water Sports****	Winter Sports*****
1990 (population <u>3,158</u>)*							
without proposed action	129,341	170,684	38,389	4,725	92,429	65,261	20,081
increase due to proposed action	13,832	18,253	4,105	505	9,885	6,979	2,147
total projection	143,173	188,937	42,494	5,230	102,314	72,240	22,228
% of projection due to proposed action	9.7%	9.7%	9.7%	9.7%	9.7%	9.7%	9.7%

* Population changes due to project (socioeconomic section)

** General includes camping, picnicing, sightseeing, etc.

*** Urban includes rodeos, golfing and attending athletic events

**** Water Sports includes boating, swimming and water skiing

***** Winter Sports includes only skiing

Table CA3-11

SOUTHCENTRAL WYOMING POPULATION ESTIMATES

County City	1977 Population	Mid 1980s		1990	
		Total	Increment of the Proposed Action	Total	Increment of the Proposed Action
Carbon County*	18,137	29,343	1,699	33,685	2,640
Rawlins	10,500	18,478	199	22,293	506
Sinclair	560	641	23	637	28
Hanna/Elmo**	1,500	2,174	199	2,314	285
Elk Mountain	190	261	38	285	57
Medicine Bow	900	1,703	537	1,968	768
Saratoga	2,000	2,511	300	2,667	427

*In addition, population in Albany County will increase by 300 in mid 1980s and 574 in 1990.

**These towns are located several miles apart and share some community infrastructure (e.g., a water system). They have been considered as a single community when making population estimates.

Source: Water Resources Research Institute Economic Simulation Model, University of Wyoming, Water Resources Research Institute, Laramie, 1978. Regional totals have been allocated to communities based on historical trends, gravity model proportions and interviews with local officials and employers. Allocation proportions for the Carbon Basin project were derived based on consensus figures developed at a meeting with local planning officials (W. Cooper and F. Olson, Medicine Bow; H. Young, Rawlins; A. Scibelli and M. Baclawski, Carbon County, April 30, 1979).

IMPACTS OF THE PROPOSAL

by 880 workers, so the mine employment would cause a net decline of 5 workers in other sectors of the economy (Table CA3-12). This impact would be felt most strongly in agriculture, retail trade, services, and some local government departments (e.g., police and fire) where wages are traditionally low. This would be a temporary situation which would disappear when migration increased the available labor supply sufficiently to supply all potential employers.

In a report by F.L. Leistriz and T.A. Hertsgaard, it was shown that when industry (coal development) moves into a rural area, farm and ranch operators are faced with the necessity of offering higher wages or reorganizing their farms or both. Operators of small farms and ranches who have been underemployed in their farm or ranch business may take advantage of the new off-farm job opportunities that coal development provides.

Operators who are fully employed with adequate incomes from agriculture and who do not hire much extra labor would be least affected by increased competition for labor. Those operating large farms and ranches requiring large amounts of labor would be likely to make significant adjustments in their operations. These adjustments would likely include dropping certain labor-intensive enterprises, adopting labor-saving technologies, and perhaps even reducing the size of their operation.

New mining activity creates a need for additional employment in industries which serve the mine (e.g., mine supply firms) and in businesses and organizations which serve the new mine and mine-related employment (e.g., merchants, store-keepers, and school teachers). By 1990, the Carbon Basin project would create 1,323 new jobs in the regional economy. This increase represents a total employment to direct mine employment ratio of about 1.28. In the "normal" economy, the employment of an additional mine worker creates about 1.6 total additional workers, indicating that by 1990 the regional economy would not have fully adjusted to the employment increase resulting from the Carbon Basin Mine. In the early 1990s, when the economy had adjusted to the Carbon Basin Mine employment, total additional employment would be expected to grow to about 1,656 workers, which is about 25% greater than the number of additional workers in 1990 (Centaur 1978).

The increased employment opportunities created by the Carbon Basin project would tend to hold the unemployment rate at or below the current 3% level.

Income

The Carbon Basin project would increase annual personal income in the region \$48.2 million (in constant 1977 dollars) by 1990 because of increased wage earnings \$29.7 million and proprietor's income \$18.5 million. This would be an increase of 33% over the 1990 income expected without the project. With 1,323 additional workers employed in 1990 as a result of the project, the \$29.7 million rise in wage and salary income represents an increase of \$22,400 (in constant 1977 dollars) per additional worker.

This increase in income would create local inflationary pressures. This would occur because the miners and mine-related employees would have more money to spend on goods and services than would others. This would affect those on fixed incomes (retirees, welfare recipients, etc.) more than anyone else. As incomes and prices rise rapidly, their incomes do not. This effectively reduces their buying power.

Infrastructure

Private Sector

The increase in personal income in the region that would result from the Carbon Basin project would generate additional wholesale and retail sales. These additional annual sales would be \$12.3 million in 1985 and \$21.9 million in 1990 (in constant 1977 dollars) (Centaur 1978).

Along with these increased sales, there would be diversification of business types to take advantage of the new sales opportunities. New businesses would locate in the region that were not previously represented in the local economy.

Although only 16% of the increased population resulting from the Carbon Basin project would live in Rawlins, about 31% of increased sales and new businesses would occur there because of Rawlins' position as a local trade center in the region.

Housing

The Carbon Basin project would create an additional housing demand of 1,214 units (858 single family units) by 1990 (Centaur 1978). Housing demand is based on the historical relationship of 2.7 persons per housing unit in Carbon County. Housing shortages are difficult to anticipate. No major constraints to rapid expansion of mobile homes are known (trailer parks can be built quickly and financing has not been unduly difficult to obtain) if the necessary water and sewer service can be provided. However, water and sewer capacity constraints have presented problems in the recent past (several communities have imposed temporary building moratoriums), and the population growth expected as a result of the proposed project could lead to housing shortages. (Medicine Bow, which would receive the largest share of the population increase, appears to have sufficient water and sewer capacity.) Some new residents would likely rent rooms in existing homes, live temporarily in motels, or share rental units with others.

Demand for single family homes is estimated based on the expected preferences of new residents and long-time residents. Because new residents are often reluctant to purchase or build homes, they would exhibit fewer demands for single family homes than those who have lived in the community for a number of years. Even so, the supply of single family homes is not expected to increase sufficiently to meet this increased demand. Single

Table CA3-12

SOUTHCENTRAL WYOMING EMPLOYMENT

Sector	1977 Total Employment	Mid 1980s		1990	
		Total with the Proposed Action	Impact of the Proposed Action	Total with the Proposed Action	Impact of the Proposed Action
Farm	526	525	0	525	0
Manufacturing	360	427	0	525	0
Mining	1,658	3,687	+885	3,763	+1,035
Construction	715	1,126	-6	1,514	+26
Government	919	1,421	+2	1,844	+90
Farm and Forest Processing	46	48	0	49	0
Railroads	480	680	0	780	0
Business Services	1,415	2,001	-4	2,493	+60
Consumer Services	1,948	2,479	+3	2,989	+112
Total Employment	8,067	12,394	+880	14,425	+1,323

Source: Water Resources Research Institute Economic Simulation Model, Water Resources Research Institute, University of Wyoming, 1978.

Note: The impact of the proposed action is the difference between total employment with the proposed action and total without the proposed action.

IMPACTS OF THE PROPOSAL

family shortages now exist (partially the result of past construction moratoriums) and would likely become larger as a result of the proposed action.

Education

The school-aged population in District 1 would increase by 148 students by 1990. School-aged population in District 2 would increase by 426 students (Centaur 1979).

The increase in school-aged population in School District 1 would place additional pressures on the school system. (Even without the proposed action the district will need to expand capacity rapidly to meet projected needs.) School District 2 would be affected to a lesser degree than District 1 as a result of the proposed action. Current capacity and planned new construction appears adequate to meet 1990 needs. The largest increase in students would occur in Medicine Bow and Saratoga.

The assessed valuation of School District 2 would be increased by the value of the mine property. School District 1 would not receive any increase in assessed value as a result of the mine property.

Health Care and Safety

The level of health care in the region is currently inadequate, with fewer physicians and dentists available than are needed by the existing (1977) population. With the proposed action, the present inadequate availability of health care specialists would worsen slightly.

By 1990, the Carbon Basin project would lead to a need for an additional three physicians, two dentists, eleven registered nurses, and one professional mental health counselor (Centaur 1978).

The Memorial Hospital of Carbon County, located in Rawlins, presently has a capacity to provide medical services for a population of 29,000 to 33,000. Even with the additional people that would come into the region the hospital would still have excess capacity.

Based upon 1976 nationwide figures, 12.63 injuries occurred for every million tons of coal mined in strip mining. In underground mining, 73.55 injuries occurred per million tons of coal mined. Fatalities per million tons of coal mined for strip mining were 0.06 and for underground mining were 0.39. In Wyoming, for all coal mining, 10.37 injuries occurred per million tons of coal mined of which 0.07 were fatalities (Personal Communication, Carl Starch, Bureau of Mines).

In early years there would be 1 million surface tons and 4 million underground tons mined annually. Based on the 1976 nationwide figures, there would be an expected 306.83 injuries and 1.62 fatalities annually. In later years there would be 5 million underground tons mined annually with no surface mining. Based on the 1976 nationwide figures, there would be an expected 367.75 injuries and 1.95 fatalities annually.

Because underground coal mining appears more dangerous than does the average industry, increase in injury or illness would be more than expected from employment increases in other sectors of the economy.

Local Services

Several communities (including Rawlins, Hanna/Elmo, Elk Mountain, Medicine Bow, and Saratoga) would have heavy demands placed on their services (water, sewer, police, fire protection, solid waste). For many communities, this would require substantial investment in new water and sewer systems, increased staffing of police and fire departments, and expanded solid waste programs.

Transportation and Utilities

Highway access to the Carbon Basin project is via Interstate 80 and the County Road 402, which is adjacent to the project.

Local access roads would receive the largest increase in travel. Congestion would be most severe at the time of shift changes. Accidents would also be expected to increase as the numbers of vehicles on the road increased.

The Carbon Basin project would result in an annual coal production level of about 5 million tons. In Table CA3-13, projected 1990 Carbon Basin coal production is shown in relation to local existing mines, the southcentral region, and the southwest region. Table CA3-14 presents anticipated daily train volumes for the region. Weekly unit train activity is estimated by dividing annual coal production levels by 10,000 tons (the capacity of a unit train) and then by 52 (the number of weeks in a year). This figure is then doubled to account for return traffic of empty cars. Train activity from the mine would add 2.7 trains per day, or 3.8% of the total train volume. Air pollution, noise emissions, and traffic delays at railroad crossings would increase significantly. Currently, rail traffic causes delays and inconveniences in a number of Nebraska communities. The projected increase even without the proposed action will place a severe burden on the communities of Sidney and Grand Island, Nebraska, and Julesburg, Colorado, according to local officials if grade separations are not constructed. Traffic delays at railroad crossings would increase 15 minutes per day as a result of the proposed action. All coal from this project would be shipped eastward to markets in the Chicago, Illinois, area. A 13-mile railroad spur from the main Union Pacific tracks near Medicine Bow would be required.

Approximately 3 miles of a 34.5-kv power line crosses the east side of the project area. Power for the mine would be acquired from this line. Service to existing customers is not expected to be interrupted.

Table CA3-13

PROJECTED ANNUAL COAL PRODUCTION IN SOUTHERN WYOMING BY 1990

Source	Projected Production (MM Tons)	% of Total
Carbon Basin	5.0	9.3
Existing Mines (Southcentral ES Region)	11.8	21.8
Proposed Mines (Southcentral ES Region)	6.0	11.1
Proposed Existing (Southwest ES Region)	<u>31.2</u>	<u>57.8</u>
Total	54.0	100.0%

Source: BLM 1978

Table CA3-14

DAILY TRAIN VOLUME PROJECTIONS FOR THE STUDY REGION

Train Type	Mid 1980s		1990	
	Number of Trains*	Percent of Total	Number of Trains*	Percent of Total
Total Coal Trains:	13.9	21.6	14.2	20.0
Carbon Basin Mine	2.2	3.4	2.7	3.8
Hanna Basin Coal Trains**	6.7	10.4	6.5	9.2
Southwestern Wyoming Coal Trains***	5.0	7.8	5.0	7.0
Non-coal Freight Trains	50.6	78.4	56.7	80.0
Total Coal and Non-coal Freight Trains	64.5	100.0	70.9	100.0
Percent Increase from 1977 Total Train Volume Excluding Carbon Basin Mine		+24.6		+36.4
Percent Increase from 1977 Total Train Volume Including Carbon Basin Mine		+29.0		+41.8

Source: Centaur 1979

Note: These figures represent the average train volume projected on the Union Pacific mainlines east of Rawlins.

*Reflects both loaded and empty train traffic.

**Reflects production and related train activity from the following mines: Carbon County, Medicine Bow, Rosebud, Seminole I, Seminole II, and Vanguard-Rimrock.

***Estimated from Data on Transportation of Coal by Railroad from Southwest Wyoming, Union Pacific Railroad Company, May 1978 and conversation with Ron Dutton, ABT Associates, Englewood, Colorado, May 18, 1978.

IMPACTS OF THE PROPOSAL

Attitudes and Expectations

Residents opposed to continued growth and disturbance of the wide-open spaces would view the mine as a further aggravation of their position. In spite of the benefits (employment and income), they would resent the increased population and urbanization that would occur, even though those increases would be only slightly due to this one mine (see Population). Those persons who would benefit from the mine directly (e.g., mine employees and local merchants) would welcome the employment opportunities and higher wages. Their positions would advance financially, and they would see the mine as a chance to improve the quality of their lives. Those in the lower income brackets and those unable to improve their positions because of the mine could see it further depressing their situation. They could see it as detrimental because it would continue to inflate prices, make it harder to compete for goods and services, and widen the gap between their incomes and those in the mining section (Abt Associates 1977 and Gilmore 1974).

Lifestyles

The changes currently occurring in the lifestyles of Carbon County residents (see Chapter 2, Lifestyles) would continue with or without this project. The Carbon Basin Mine would reinforce and possibly speed up those changes in the impacted portions of the region. The magnitude of the impacts that would be due to the Carbon Basin Mine is not quantifiable.

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

This chapter includes lease stipulations, leasing constraints, and mitigation criteria designed to lessen the potential impacts of the proposed action upon the existing environment and to provide for mitigating of impacts as required by SMCRA and other regulations. Also included are mitigation measures which will be compared with the measures in the mine and reclamation plan (M&RP) and right-of-way permits that would demonstrate the ability to reduce or eliminate impacts. The comparison will be made to analyze the effectiveness of the M&RP and permits toward meeting the mitigation criteria of this chapter and Chapter 1, and to determine the significant unavoidable impacts. The constraints, stipulations and mitigation measures are to be made part of the conditions of the lease and right-of-way permit. If the lease is issued they will be included in the mine and reclamation plan and will demonstrate how the company plans to meet the conditions of the lease.

Lease Stipulation

The following stipulation will be included in the lease if issued:

1. Sage grouse nesting areas and the pronghorn fawning habitat will be protected by applying vehicle restrictions contained in the Hanna Area MFP. Areas to be closed and recommended closure dates are shown in Map CA4-1. Some vehicle use of the closed areas during the initial periods will be necessary for maintenance and operation of mine facilities. Travel necessary for administrative purposes throughout the area will also be allowed.

2. The post-mining land use on the project area will be in accordance with the Hanna Area MFP and the Carbon Basin ES (Chapter 1). At present, the MFP long-term land use decision is for continuing management for livestock grazing, wildlife use, and recreation. In time, this decision may be modified to change management of the area to a higher and better use for the benefit of the environment and good of the people. The M&RP would then have to be revised to meet the requirements of the change of use.

3. The lease holder will provide data in the M&RP that demonstrates that reclamation standards set by the lease and SMCRA can be achieved.

4. All developments made and operations conducted on the project area and within the right-of-way limits of the ancillary facilities will be subject to the con-

straints and restrictions of the Hanna Area MFP and mitigation criteria as they would apply.

Lease Constraints

The following constraints will be included in the lease if issued:

1. No mine and reclamation plan will be approved for the Carbon Basin site until the studies of the golden eagle nests have been made under coal unsuitability Criterion 11 which classifies the area as acceptable for lease pending further studies of the golden eagle nest.

2. No mine or reclamation plan will be approved until the BLM has coordinated professional cultural resource surveys with the Wyoming State Historic Preservation Officer and until BLM has received his written comments and review. (Cultural resources include archeological, architectural, and historical remains.) A Class III inventory will be conducted on the unsurveyed public surface and the remaining unsurfaced private land within the project area (Chapter 1, Preleasing Inventories, Cultural). The four sites located along the proposed railroad spur (Ziemens 1977) will be tested for significance and properly recorded with the appropriate agency prior to the issuance of rights-of-way. Additional surveys and mitigation may be necessary if surface evidence indicates further evaluation is necessary.

Mitigation Measures

The following measures will be used to determine the effectiveness of the measures in the mine and reclamation plan.

1. The maximum time for successful reclamation of a site will be 15 years after reclamation is initiated on that site.

2. Vegetative cover will be established with a species composition that will provide for use by both livestock and wildlife.

3. All reclaimed areas will be protected from grazing by livestock and pronghorn until the desired vegetative cover is established.

4. Reclamation can be considered complete when the provisions of 30 CFR 816.115 revegetation standards for success are met.

MITIGATING MEASURES

5. Topsoil of acceptable quality will be placed on the shaped surface to a depth sufficient to insure adequate root zone and soil moisture for long-term plant vigor, production, and plant species diversity. (A depth in excess of 6 inches is recommended to achieve the long-term goal.)

6. Fugitive dusts will be controlled through best management practices.

7. All surface facilities will be designed (shape, color, materials, location, etc.) to minimize the contrast with the natural environment.

8. The reclaimed areas will be returned to the approximate original contour, and a cover of diverse plant species will be established which will result in the return of the area to its present Class III visual quality.

9. Based on production data from the area, the selected reference areas and acceptable reclaimed areas should have a production of 500 to 600 pounds of air dry forage per acre as a minimum from acceptable grass species.

10. An acceptable reclaimed area would contain 450 or more viable shrubs 2 years old or older per acre to be present at final inspection.

Standard Evaluation Criteria

The following criteria are considered essential for obtaining successful reduction or elimination of impacts resulting from the proposed action. Although the measures may not be included verbatim in the M&RP, they are recommended and would be used as a standard for evaluating the measures in the M&RP to meet the mitigation criteria. Criteria 1, 2, 6, 7, 12, 14, and 15 exceed the minimum requirements of SMCRA Regulations. More stringent requirements are considered necessary to overcome adverse conditions identified for this area.

1. Unsuitable overburden, parting material, and toxic material should be separated, stored, and buried beneath overburden suitable for sustaining plant growth. All unsuitable material should be buried to a depth of no less than 8 feet.

2. All slopes consisting of fine-loamy or fine surface soil textures should be regraded so that the slope does not exceed a 7:1 (horizontal to vertical) ratio.

3. All topsoil piles stored for 3 months or longer during growing season should be seeded with sodar streambank wheatgrass or similar grass types at the rate of 12 pounds PLS per acre and a cover crop of fall rye (biennial plant) at a rate of 10 pounds PLS per acre.

4. All topsoil material (plant growth medium) comprising "A" "B" and "C" horizons should be replaced to a depth of 12 inches or more.

5. An average of 4 inches of replaced topsoil should be disc'd into the regraded and contoured overburden before the final application of topsoil is completed. The final application of topsoil should be to a depth of 8 inches or more.

6. Contour terraces, furrows, or other soil and water conservation structures should be constructed on all

slopes recommended by, and to the specifications and design of, the appropriate managing agency.

7. All seedbed preparations, beginning with topsoil replacement, seeding, planting, and all conservation practices initiated should be done on the contour within the limitations of the equipment and safety of the operation.

8. If climatic conditions are such that perennial stands of grass are not likely to become established, all regraded and topsoiled slopes having exposure to southerly or westerly prevailing winds should be planted with an annual cover crop such as spring wheat, annual rye, or oats. The cover crop should be planted prior to June 1 to take advantage of any late spring moisture.

9. All drill seeding should be done with a rangeland drill with depth bands attached or similar equipment with adequate seed depth control.

10. Seeding should be done at a minimum rate of 13 to 15 pounds of pure live seed (PLS) per acre. Recommended seed mixture and seeding ratio (pounds PLS/acre) is shown in Table CA4-1.

11. When soil conditions are favorable, all seeding should be done after October 1 and before May 15.

12. All areas that are too steep to be seeded by rangeland drill should be seeded on a roughened surface by broadcast method at a minimum rate of 1½ times the drill seeding rate. Mulch should be manually applied and anchored with a netting, wire mesh, or other suitable material.

13. All seed could be prilled to aid in seed distribution and germination.

14. All seed should be treated with a repellent to prevent seed damage by rodents or birds.

15. Open areas between contour furrows or contour terraces on south or west facing slopes should be planted with seed mixture only and should not receive potted shrubs.

16. Native hay or straw used as mulch or for snow catchment must be certified as noxious weed free. It should be applied to seeded areas at a minimum rate of 2 tons per acre.

17. All mulch should be anchored to the ground by crimping with a notched coulter to a depth of 5 inches or more.

18. Shrub planting on contour furrows or contour terraces would be of a width extending 1 foot above and 2 feet below the constructed width of the furrow or terrace.

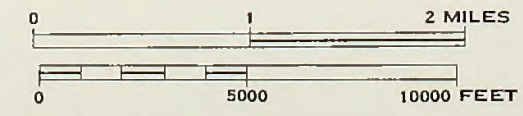
19. Potted shrubs should be planted in a random manner in accordance with Table CA4-2. Shrubs and/or plugs should be planted in early spring (prior to May 15) as soon as soil moisture and soil temperature conditions permit.

20. All potted shrubs should be watered during planting and the planting root zone saturated to avoid root dehydration and to insure soil-root contact. Minimum application should be 1 gallon per plant. A water soluble fertilizer-root stimulant could be added to the manufacturer's recommended rate to the water used for shrub plantings. Potted shrubs should be watered for two growing seasons after planting when soil moisture conditions indicate need for plant survival.

R 80 W R 79 W



- Critical Sage Grouse Nesting Area
Closed From March 1 – June 30
- Pronghorn Antelope Fawning Habitat
Closed From May 1 – June 30
- Exempt From Vehicle Closures



Map CA 4-1
AREAS CLOSED TO VEHICLE USE

SOURCE: BLM, 1978

Table CA4-1

RECOMMENDED SEED MIXTURE

Species Name	Ratio of Seeding* (pounds per acre)
Rosana western wheatgrass	3 to 4 PLS
Sodar streambank wheatgrass	1 to 2 PLS
Indian ricegrass	1 to 2 PLS
Bluebunch wheatgrass	1 to 2 PLS
Critana thickspike wheatgrass	1 to 2 PLS
Sweetclover	0.5 to 1 PLS
Four-wing saltbush	2 to 3 PLS
Winterfat	1 to 2 PLS

Source: BLM 1978

*Ratio of seeding indicates the range in pounds PLS/acre for individual species that may be used to determine a seed mixture of 13 to 15 lbs PLS/acre (see Item 9).

Table CA4-2

POTTED SHRUB PLANTING DENSITIES

Plant Species*	Level Areas	Aspect along terraces, contours, catchment basins special areas**	North and East Slopes		
			Upper Third	Mid Third	Lower Third
Big Sagebrush	250***	350	250	300	450
Bitterbrush	200	150	200	150	---
Little rabbitbrush	100	100	100	75	---

Source: BLM 1978

*Based upon shrubs available from commercial nurseries.

**Special areas may include construction draws, swales, leeward side of snow catching structures.

***Planting rate is number of potted shrubs per acres.

MITIGATING MEASURES

21. On selected areas, plugs with native vegetation could be placed with a minimum spacing of 3 to 7 per acre in lieu of potted shrub. Plugs would be 5 feet by 5 feet in size with a minimum depth of 3 feet. Plugs would be removed from areas planned to be stripped of topsoil. All plugging should be done during the months of February through May. (Other times and methods of planting may be done with prior approval of the managing agency.)

22. Snow fence panels (5 to 6 feet long and 3 feet high) or bales of hay set on the cut edge could be placed perpendicular to the prevailing wind at random intervals over reclaimed areas having 3% or less slopes. Placement of snow catchment structures should not be less than 60 per acre. After bales have been in place through two winters, they could be used as mulch in newly reclaimed areas.

23. All reclaimed areas should be temporarily fenced in a manner that would exclude livestock and pronghorn and not be a hazard to wildlife.

24. The project area should be fenced to control trespass livestock onto the project area during the life of the mine. The existing fence on the north and west sides of the project area could be considered the project boundary. All new fence construction should be built to specifications that permit passage of wildlife while presenting minimal entrapment hazard.

25. Haul roads, the largest source of fugitive dust emissions, should be chemically stabilized. This measure would reduce the impact by 50% to 75%.

26. Access roads, the second largest source of fugitive dust, should be paved (asphalt). This measure would reduce the impact by approximately 95%.

27. The final topography of the rehabilitated lands should be rolling terrain similar to that presently in the area to minimize fugitive dust emissions.

28. Coal storage silos could be used to store mined coal prepared for shipping. Storing coal in this manner would provide essentially a 100% reduction in coal dust emissions.

29. No surface mining activities of any kind would be allowed within $\frac{1}{4}$ mile of any active or inactive golden eagle nest (see Map CA2-5) located on or adjacent to the project area according to standards in the coal unsuitability criteria. In addition, active prairie falcon nests on and near the project area should be protected from all types of mining activities to a distance of $\frac{1}{4}$ mile in accordance with provisions contained in the unsuitability criteria concerned with falcon cliff nesting sites or as determined for both falcons and eagles by the appropriate managing agency. Studies of any migratory birds affected by mining should be completed according to coal unsuitability criteria.

30. All buildings would be designed to blend with the existing environment (brown, green, and the like).

31. All utility lines could be buried underground.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

The proposed project would result in a projected regional population increase of 2,640 people and would be felt primarily in Rawlins, Hanna/Elmo area, Saratoga, Elk Mountain, and Medicine Bow. Temporary, but locally severe, impacts would include worker shortages in other industries, housing shortages, increased demands on all local community services, and need for capital expansions of local facilities. The growth movement for Medicine Bow is estimated at 64% (on a 1990 base of 1,200); for Saratoga the growth increment would be about 1% (on a 1990 base of 2,240). It is expected that over a period of several years, the communities' services would adapt to the increased populations, but there would be changes in community makeup, intercommunity relationships, and services. Higher wages, resulting from increased competition for scarce labor, would result in local inflationary pressures on persons of fixed incomes.

Air and noise pollution would increase along the route from the Carbon Basin project to the marketplace in Illinois. Congestion, especially during shift changes, and traffic delays would increase on local access roads and at railroad crossings along the route.

The principal air quality degradation would be from particulates. Total annual suspended particulate (TSP) emissions are projected at 4,872 tons per year in 1990 and 778 tons per year at end of mine life with the proposed best management practices (BMPs). This contrasts with possible levels of 13,349 and 4,147 tons per year if BMPs were not required. About 98% of the TSP emissions would be fugitive dusts and would be excluded from air quality assessment (43 CFR 118). The Carbon Basin model would probably not exceed NAAQS or the Class

II increment under this review procedure. Since present levels of SO₂, NO₂, CO, and HC emissions are far below standards and only insignificant amounts of these pollutants would be released during the operation, no significant air quality impact from these pollutants is expected. Visibility is expected to average 26 to 47 miles but could under worst case conditions be reduced to 7 miles near the mine site and access roads under BMP or 4 miles if BMP were not required.

Destruction of anticipated cultural resources would occur where these resources were present in the mining area but not recognized prior to mining. Significant losses in scientific knowledge could occur if unique sites were in fact present but not recognized prior to destruction.

There would be an estimated soil loss of 0.42 ton-acre-year as a result of wind erosion on disturbed areas. Prior to revegetation, soil loss on final contour areas resulting from water erosion would be an estimated 2.4-5.0 tons-acre-year. An estimated 25% of this water erosion would remain and would not be excessive as it would be within limits of premining erosional levels. An unknown amount of subsidence and the resulting effects to soil surfaces on 12,522 acres of underground mined lands could occur.

The average elevation would be decreased over the balance of the project area mined by underground methods, but the elevation would probably change locally less than 25 feet on the areas affected.

Several changes would occur in the hydrologic regime, but the impacts from these changes would be minimal and would be confined basically to Carbon Basin because the hydrologic regime of the basin is largely independent of the regime in neighboring areas. The following changes would occur: (1) about 10% of the area supplying recharge to Carbon Basin aquifers would be disturbed resulting in reduced recharges; (2) the coal which serves as an aquifer would be removed, and water flowing in the coal adjacent aquifers would be intercepted by the mine; (3) surface mine pits would interrupt the underflow of Third Sand Creek; (4) drainage patterns of several small ephemeral drainages would be altered; and (5) seven springs would dry up.

The surface mine would use about 50 acre-feet of water per year during the period of surface mining, and the underground mine would use about 220 acre-feet per year. The population increase resulting from the mine would require 530 acre-feet per year.

Impacts to the paleontological resources might include destruction by activities in the mining area and increased unauthorized collecting from sites elsewhere in the region. Significant losses in scientific knowledge could occur if unique sites were present and not recognized prior to destruction.

All impacts to wildlife identified in Chapter 3 would be mitigated if measures detailed in Chapter 4 were implemented. If these measures were not implemented, the following adverse impacts would occur:

Destruction of 2,149 acres of wildlife habitat would occur during mining operations. Over 15,000 acres of wildlife habitat would be affected by increased activity during mining operations. Three sage grouse leks could be disturbed during mining, reducing critical nesting habitat in the area by 5.5%. About 468 acres of critical pronghorn winter range would be disturbed, displacing wintering pronghorns onto adjacent areas, but the impact

UNAVOIDABLE ADVERSE IMPACTS

on total herd size would probably be light because of the small acreage involved. Some displacement of the 50 mule deer using the area could be expected, but the loss would not be significant. Rodent, songbird, rabbit, and other small wildlife losses could total 2% of the local populations. If the area were successfully reclaimed to suitable wildlife habitat upon completion of mining, wildlife carrying capacities could recover to or above pre-mining levels.

The exclusion of livestock grazing from the project area would result in an annual loss of 1,551 animal unit months (AUMs) of grazing for the life of the mine.

In the area to be disturbed by surface mining (final contour, construction of mine and ancillary facilities), soil profiles and properties that have developed over geologic time would be destroyed on 2,149 acres. The existing soil biota and soil forming process would be drastically reduced. The loss of soil productivity, vegetative production, and wildlife habitat on these 2,149 acres would be lost during the life of the mine and reclamation

period. Conventional surface strip mining would destroy approximately 150 acres a year, with additional exposed acres for mine facilities construction.

Fatal or debilitating injuries and illnesses associated with mining activity would be an unavoidable adverse impact. By 1990, the proposed underground mine (surface operations would cease about 1990) would result in an expected 367.75 injuries and 1.95 fatalities annually.

There would be a 9.7% increase in use of all urban and outdoor recreational facilities throughout the area as a result of the Carbon Basin project. These impacts would likely continue after the end of mine life.

Approximately 14% of the Class III visual resource management area would be changed to Class V in the area of surface mining.

CHAPTER 6

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

Issuing the coal lease would enable the successful lessee to prepare technically and administratively complete mine plans which, upon approval, would require maximum economic recovery of the coal resource consistent with the protection of environmental resources in and adjacent to the proposed lease area.

Coal was mined on the southwest corner of the project during the early 1900s. Mining, if approved, would be new to the remainder of the area.

The Carbon Basin area is presently used for livestock grazing, wildlife habitat, and oil exploration. The area could return to premining land uses after reclamation of the site.

The short-term use of the mine site would expose or disturb over 2,149 acres of land surface over the life of the mine. The air pollution caused by the mining operation during coal extraction would be a short-term event which would cease at the end of the mine life. The largest potential threat to long-term productivity in terms of air quality would be the failure of complete reclamation of the exposed and disturbed acreage. Wind erosion could continue to generate fugitive dust emissions from the mine site until a proper vegetative cover was established. With successful land reclamation, no long-term problems from wind erosion would be expected. Since the land would be returned to grazing, the long-term effects of mining would be nonexistent.

The major portion of particulate air quality impact from the Carbon Basin Mine site would be to the east and northeast of the mine site. Annual particulate concentrations of 46 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and above 50 $\mu\text{g}/\text{m}^3$ 24-hours worst case would be predicted as far as 14 miles northeast and 10 miles east of the Carbon Basin Mine site. At the present time, however, no active mining is taking place nor has any interest been shown in these areas. Therefore no interaction or cumulative effects would be predicted between Carbon Basin and other mine sites or areas of interest.

Short-term use of the soil resource resulting from construction of mine facilities, ancillary facilities, and mining operations (final contour) would disrupt the productivity, destroy existing soil profiles, and increase soil erosion losses on 2,149 acres. Potential soil productivity levels over the long term would be restored to an estimated 100% of average premining levels with successful reclamation. The long-term commitment of 331 acres for urban needs would utilize the soil resource for an alternate use.

Water used at the mine and by municipalities to meet population increases resulting from the mine would not be available for other uses. At present, there is no competitive use for this water. Seven springs could be dewatered due to subsidence affecting the long-term productivity of those springs.

The development of the Carbon Basin project would result in short-term losses of native vegetation of 2,149 acres. The productivity on the 2,149 acres would be regained within the 10 to 15 year reclamation period. This short-term loss would be borne in order to gain the benefits received through the development of the project.

The development of 331 acres for housing and support service sites would be a conversion of land use for the long term from lands supporting vegetative cover to land supporting housing and business enterprises. Productivity in relation to vegetation would be lost, but productivity as measured in benefits to other categories, such as people, would be enhanced for the long term.

Short-term losses of wildlife shrub habitat would be that vegetation destroyed on 2,149 acres of mined area and ancillary facility locations. After completion of surface mining, 1,175 acres would be reclaimed to a native and native-like vegetation which would begin to furnish some wildlife habitat after the grass was established. Under the proposed action, underground mining would continue for 40 years or more at which time the remaining 974 acres of disturbed area would be reclaimed.

There would also be heavy unquantifiable losses over the short-term of small rodents, cottontail rabbits, small songbirds, mourning doves, and reptiles over the 2,149 acres of surface mine, mine facilities and ancillary facilities. Under the proposed mine development, short-term benefits to wildlife would occur since livestock would be removed from the project area for the life of the mine.

A long-term commitment of cultural resources would result from the destruction of sites, whether by unknowingly destroying subsurface sites or through converting in situ cultural resource to cultural resource data. Sites could also be partially destroyed through the effects of subsidence. If all sites were left in situ, more information could possibly be extracted from the site by new techniques and data demands in the future.

Short-term improvements to Class V areas could be achieved when mined areas were reclaimed. Long-term improvement would be achieved by reclamation and natural plant succession; removal of mine equipment, railroad spur, and power lines; and restoration of waste disposal areas. The area could be reclaimed to a Class III if,

SHORT TERM VERSUS LONG TERM

in the long term, the reclaimed land would blend in with the undisturbed adjacent topography.

Development of the proposed mine would change the nature of the primary recreational activity (hunting), since most of the reclaimed areas would not be suitable for wildlife habitat for the life of the mine (see Vegetation section). In the short term, as human activity increased at the mine, disturbance to all recreation activities would occur because of the loss of land suitable for recreation.

In the long term, recreation use on the area could resume with removal of mining equipment, successful reclamation, and reestablishment of wildlife species.

A short-term trend would be the tendency for recreational visitors to go elsewhere in the region, thus impacting other areas. Impacts to urban recreational facilities would remain after mine life.

As livestock grazing would be eliminated from the project area during the life of the mine, the short-term loss to grazing would be 1,551 AUMs annually. The impact of this grazing loss would be cushioned by the benefits received from developing the mine and the secondary benefits received from nonuse of the range resource. These benefits of improved vegetative composition, increased vigor, and enhanced wildlife habitat would extend into the long term. Range and trend conditions could be measured and livestock range and wildlife habitat techniques could be established and monitored under a nonuse situation. There would be no long term loss as livestock grazing would be one of the post mining uses of the area.

The major trade-off in mineral resources would be between the short-term use of the coal, sand, gravel, scoria, oil, and diesel fuel and long-term availability of these resources. The primary long-term commitment of resources would be the coal produced during the life of the mine. Present data are insufficient to accurately predict the amount of coal that would be produced over the life of the mine. It is possible that the entire Johnson Bed and portions of both the Blue and Finch groups would be mined.

In the short term, the increased employment at the Carbon Basin project would create labor shortages in other regional sectors of the economy. In the long term, as more people moved into the region, a labor force of

sufficient size to meet the needs of all employers would be available. In addition, this increased employment would tend to hold the unemployment rate at its current low level.

Increased wage earnings and higher per capita income would in turn increase retail and wholesale trade over the life of the mine. This would be a short-term gain while the loss of buying power of persons on fixed incomes would be long term.

In the short term, housing prices would rise and crowded conditions would occur. However, over the long term, the housing stock would increase, allowing such crowded conditions to subside.

Crowding and increased student/teacher ratios would occur in the short term. Better, new facilities would be built over the long term, more teachers would be hired, and the tax base and royalties from federal coal would increase to pay for these needs.

Health care in this region may never be considered up to standard, but over the long term the population/health care specialist ratios would return to at least the current levels.

Although there would be short-term overtaxing of some local services (water, sewer, police and fire protection, solid waste), this situation would be corrected as new sewer and water systems were built, more policemen and firemen were hired, and new solid waste disposal sites were developed in the long term.

Impacts directly associated with mining of coal (congestion on access roads, traffic delay at railroad crossings, air and noise pollution) would be short term and would disappear when the mining ceased at the project.

Work-related injury and illness would be a short-term loss as a result of the proposed action. Those injuries or illnesses which would be fatal or debilitating would reduce long-term human productivity. Since underground mining is much more dangerous than the average for all industries, more injuries and illness would occur from mining in the Carbon Basin Mine than from other new industries.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Implementation of the project would result in commitments to use the area more intensively and would significantly alter the use of various resources. Some use and consumption of land and resources would be irreversible or irretrievable. Irreversible refers to use and impact trends which, once initiated, could not be reversed for a long time, if at all. Irretrievable refers to permanent loss of resources for other uses. Some commitments are both irreversible and irretrievable.

Soils, vegetation, wildlife, and present land uses on the proposed project area would be irreversibly committed during the life of the project and thereafter until reclaimed. Air and water would be irreversibly committed during the life of the project to the extent that air quality would be degraded and water used by the project would not be available for other uses. A major irretrievable commitment would be the removal of approximately 400 million tons of coal which would not be available to future generations. Cultural values, construction materials, fuels, and any loss of human lives would also be irretrievable if the project should be implemented.

During the active life of the Carbon Basin Mine, air quality at the mine site and some closely surrounding areas would be slightly degraded. During this period the loss of air quality such as existed prior to mining activities would be irretrievable. However, upon completion of mining activities, the air quality would return to the premining level if successful reclamation occurred. Any reductions in visibility during the mine life would also be irretrievable; however, visibility would increase to normal distances at the termination of mining activities.

Changes in contours and surface characteristics would irreversibly alter the wind field and surface heating of the air. Changes in the composition of topsoil and vegetation could alter the specific heat of the surface material, which in turn would alter the absorption and radiation of solar heat. Although these potential climatological changes would be irreversible, their adverse impacts, if any, would be very minimal. The climatological changes would be contained within the mine site and probably would not be noticed.

An irretrievable commitment of an undetermined number of uninventoried exposed and unexposed fossil localities would result from mining, as well as an increase in unauthorized fossil collecting. The destruction resulting to the resources would be an irretrievable commitment.

The destruction of existing soil profiles on 2,430 acres by mining, mining facilities, ancillary facilities, and associated urban needs would be an irretrievable utilization

of soil resource. Any loss of soil by erosion (unquantifiable) caused by mining activities, as well as the soil surface disruption caused by increased activity, would be an irretrievable utilization of the soil resource.

The occurrence of subsidence could result in the draining of aquifers that supply water in seven springs. Once drained these aquifers might not be recharged again, especially if the aquifers were drained because of fracturing.

The development of housing and support service facilities on 331 acres at various regional population centers would irreversibly and irretrievably commit the existing native vegetative cover to facilities of higher use.

The destruction of sites, either unknowingly or through converting in situ cultural resources to cultural resource data, would be an irreversible and irretrievable commitment of the resource.

Because of soil variations, slopes, and climate, vegetative reclamation scars would be evident on the project area; however, the area could be returned to a Class III.

The 61,400 cubic yards of sand, gravel, scoria, and other types of aggregate material for railroad spur, road, and mine facility construction would for all practical purposes be irretrievable because replacement under prevailing natural conditions could take centuries.

Coal produced over the life of the mine would be committed to use at power sites. It is not known if it is economically feasible to mine the Blue and Finch coal groups. If it were feasible to mine either or both of these groups, mining only the Johnson bed could result in the loss of reserves in these beds due to technical problems associated with mining at a later date (see Chapter 3).

The coal-related population increases would impact recreational activities (especially urban). Although some of the coal-related population would leave once mining were completed, the regional population increase would cause an irreversible impact on recreation resources.

The Carbon Basin project would irreversibly reduce the buying power of persons on fixed incomes. The buying power they would lose during times of inflation would never be regained.

Fatal or debilitating injuries and illnesses would be an irreplaceable loss of the human resource. Based upon nationwide figures (1976), the proposed underground mine would result in an expected 367.75 injuries and 1.95 fatalities per year, assuming 5 million tons were mined annually.

Community expansion would lead to an irreversible change in land use from rangeland to residential around and near those communities receiving additional population from this mine.

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
RESEARCH REPORT

The first part of this report deals with the synthesis of a new class of compounds. The reaction of C_6H_6 with C_2H_2 in the presence of a catalyst yields a product which is identified as C_8H_8 . This compound is shown to be a new member of the benzene family, and its structure is discussed in detail. The second part of the report describes the physical properties of C_8H_8 , including its boiling point, melting point, and refractive index. The third part of the report discusses the chemical reactions of C_8H_8 , particularly its reaction with bromine and potassium permanganate. The fourth part of the report describes the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The fifth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The sixth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The seventh part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The eighth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The ninth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The tenth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties.

The first part of this report deals with the synthesis of a new class of compounds. The reaction of C_6H_6 with C_2H_2 in the presence of a catalyst yields a product which is identified as C_8H_8 . This compound is shown to be a new member of the benzene family, and its structure is discussed in detail. The second part of the report describes the physical properties of C_8H_8 , including its boiling point, melting point, and refractive index. The third part of the report discusses the chemical reactions of C_8H_8 , particularly its reaction with bromine and potassium permanganate. The fourth part of the report describes the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The fifth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The sixth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The seventh part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The eighth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The ninth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties. The tenth part of the report discusses the synthesis of a new class of compounds, the C_8H_8 derivatives, and their properties.

CHAPTER 8

ALTERNATIVES

The Secretary may offer for lease the proposal as described in Chapter 1 and Chapter 4, reject it on various environmental or other grounds, approve it in part and reject it in part, or modify the proposal in light of the following alternatives.

NO-ACTION

Under the no-action alternative, the federal coal lease would not be granted and no rights-of-way would be granted for ancillary facilities. Consequently the Carbon Basin project would not be developed because it would not be economically feasible to mine private coal separately from federal coal.

In this case, all environmental elements on the project area would remain very much the same as they presently exist. The interested parties would have to continue to purchase coal from other sources.

Commonwealth Edison could initiate one or more of the following actions to provide coal for their installation in Illinois.

1. Continue their present coal contracts in Illinois indefinitely.
2. Obtain coal from existing coal producing leases in Montana, Wyoming, or other states.
3. Acquire an existing coal lease and submit a proposal for development.
4. Modify the installations in Illinois to permit the utilization of a lower quality coal available.

The holdings of Belco Petroleum are not extensive enough to warrant development without acquiring federal coal and other adjacent private coal. Under this alternative, Belco Petroleum would either sustain the loss of production from their coal holdings in the area or seek exchange coal as authorized under P.L. 95-544 in other locations.

UNDERGROUND MINING ONLY

Under this alternative, a maximum of approximately 7 to 15 million tons of strippable coal would not be mined. However, 4 to 8 million tons of these strippable reserves could probably be recovered by underground mining methods.

The development of the mine portals, entryways, conveyor system, and other facilities as shown in the proposed action would probably be accelerated in order to meet the desired production schedule. This would reduce

the period of coal truck hauling by approximately 1 year. Surface disturbance would be confined to areas needed for mine and ancillary facilities which would be 641 acres and 500 acres, respectively, or a total of 1,141 acres. Since employment levels would be the same as those of the proposed action over the long term, 331 acres of land in or adjacent to population centers of the region would be developed for housing and support service facilities.

Under this alternative the various impacts (except those associated with subsidence) on the resources would be the same as those of the proposed action, but they would be of lesser magnitude. The impacts that would be lessened to the greatest degree would be those surface mine impacts related to soil, vegetative and wildlife resources. Impacts to wildlife and alluvial valley floors that are identified as being affected by unsuitability criteria would not occur under this alternative (Chapters 2 and 3). This would be a direct result of eliminating the surface mine area on private land of the proposed action.

The elimination of potential surface mine areas (Chapter 1) and the reduction of surface disturbance of the proposed project would be a benefit in potential habitat for threatened and endangered wildlife. Reducing planned surface disturbance by 1,008 acres would reduce disturbance to prairie dog habitat by 47%.

Impacts to the water resource are the same as those identified in Chapter 3 in relation to underground mining.

SURFACE MINING ONLY

Under the proposed action, the Surface Mining Only alternative would include only the property owned by Commonwealth Edison. Commonwealth Edison stated in their comment document that since the area to be mined is not under federal control, Edison Development could proceed with the option regardless of whether or not a lease is issued. Morrison-Knudsen Company, Inc., Engineering advisors to Commonwealth Edison, stated in a letter of May 8, 1978, that if no federal coal would be developed, the entire project would be postponed or abandoned. The statements lead to conclusions that question the economic feasibility of the Surface Mining Only alternative when considering the Commonwealth Edison holdings only. However, a track of federal coal on the project area and other coal tracts outside the project area under both federal and private control have been identified as feasible for surface mining. These coal areas

ALTERNATIVES

are located in the S $\frac{1}{2}$ SE $\frac{1}{4}$ Section 30, T. 21 N., R. 79 W., NE $\frac{1}{4}$ Section 2, N $\frac{1}{2}$ N $\frac{1}{2}$ Section 4, N $\frac{1}{2}$ N $\frac{1}{2}$ Section 5, T. 20 N., R. 80 W., and the SW $\frac{1}{4}$ Section 33, S $\frac{1}{2}$ S $\frac{1}{2}$ Section 34, T. 21 N., R. 80 W. All the coal properties located inside and outside the project area should be included in the Surface Mining Only alternative to prevent the loss of coal on tracts which would not be economical to mine as individual units. The inclusion of all coal regardless of ownership would meet the criteria for being designated as a logical mining unit (LMU).

The impacts to the vegetation, soils, and water resources with this alternative would be similar to those of the proposed surface mine except for magnitude. Visual quality from I-80 may be impaired as surface mining approaching the ridge to the southwest of the proposed project would be visible from I-80. Archeological, paleontological, and threatened and endangered (plant and animal) surveys would have to be conducted on the area. Additional information on the coal reserves would have to be obtained to ascertain the economic aspects of the development.

SPLIT LEASE OFFER

By the selection of this alternative, two or more logical mining units (LMUs) could be developed. This would allow both presently interested companies to mine their individually owned coal resources in addition to the intermingled federal coal resources. However, a separate environmental assessment would have to be conducted to determine impacts from the additional facilities and rights-of-way. If two LMUs were offered under competitive bid procedures the lessee(s) would have to submit mine and reclamation plans (M&RPs) that would demonstrate that reclamation performance standards established could be achieved. Under Public Law 94-377 and 43 CFR 3475.5 all economical coal would be mined within a given area and logical mining units would be developed to accomplish removal of the coal reserves. Post-mining use as described in Chapter 4 would be a requirement of the M&RP(s). Before the alternative could be selected, proof of additional coal reserves would have to be provided through Geological Survey's drilling program. (If Belco Petroleum Corporation were the highest bidder, additional lease areas in Carbon Basin could be exchanged as required in Public Law 95-544.)

CHAPTER 9

CONSULTATION AND COORDINATION

TEAM ORGANIZATION

The Wyoming State Director of the BLM was assigned the lead responsibility for preparation of this final environmental statement. The primary interagency effort involved the BLM and the Geological Survey (GS).

Project Coordination

James Lambert, Project Manager
Robert Currier, Assistant Project Manager
Robert Armstrong, Environmental Coordination
Jay Akers, Geological Survey
Merlin Hehnke, Fish and Wildlife Service

Document Preparation

Edward C. Coy, Team Leader
Vernon Hoffman, Vegetation and Agriculture
Raymond Boyd, Fish and Wildlife
Vernon Lovejoy, Recreation, Visual and Land Use
Lawrence Thomas, Soils
Mark Newman, Minerals and Mining
Walter Stiles, Minerals and Mining
Richard Deery, Minerals and Mining
Stanley Frazier, Socioeconomics
Roy Allen, Socioeconomics
Tom Lukow, Climate and Air Quality
Mitch Baer, Climate and Air Quality
Jay Akers, Topography and Geology
Byron Aldridge, Water
Melanie Stright, Cultural
Nina Dalla, Cultural
Joann Graham, Editor

PUBLIC COMMENTS AND RESPONSES

On December 15, 1976, a public coal issues meeting was held at Jeffery Center in Rawlins to discuss proposed coal development in southcentral Wyoming. A coal issues brochure and two news releases were published to solicit attendance at this meeting and input to the environmental process. About 60 people attended and significant issues were raised at the meeting.

Representatives from the coal industry mentioned their need for assured coal supplies to meet their obligations to supply power generation facilities in other areas of the

country. Agricultural representatives were concerned about the possible losses of agricultural land, water, and changing life styles resulting from mining operations. Spokespersons for conservation organizations expressed concern over mining's possible impacts on local wildlife, overall environmental quality levels, and questioned the real need for more coal leasing at this time. A third press release, dated January 24, 1977, was issued to encourage public comments.

Public meetings were scheduled to receive comment on the draft environmental statement in Rawlins. News releases, Federal Register notices, and special postings were issued on specific hearing dates.

Copies of the draft ES were available from the BLM Rawlins District Office and Cheyenne State Office upon request.

CONSULTATION AND COORDINATION IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

During preparation of the draft environmental statement, federal, state, county, and local agencies; private industry; and individuals and organizations with special expertise relating to the proposed actions were contacted to gain information and close data gaps. The substantive results of these consultation and coordination efforts follow. Various federal and state agencies provided contract data or cooperated in preparation of the ES.

Federal Agencies

U.S. Department of Agriculture (USDA), Forest Service

The Forest Service Shrub Science Laboratory in Provo, Utah, provided information on reclamation methods.

USDA, Soil Conservation Service (SCS)

The Upper Colorado Environmental Plant Center (Douglas Creek and White River Conservation Districts, Rio Blanco County) provided information on reclamation procedures and success. The SCS in Boseman, Montana, also provided information on these subjects.

CONSULTATION AND COORDINATION

U.S. Department of the Interior (USDI), Fish and Wildlife Service (FWS)

The FWS was contacted for consultation under the Endangered Species Act, for coordination under the Bald Eagle Protection Act and for assistance under the Migratory Bird Treaty Act.

Environmental Protection Agency (EPA)

The EPA provided tabulations of water quality data.

State Agencies

Wyoming Recreation Commission, State Historic Preservation Officer (SHPO)

The office of the SHPO provided information on historic sites and a listing of National Register sites.

Wyoming Department of Agriculture

The Department of Agriculture provided information on agricultural water use.

Wyoming State Engineer

The State Engineer's office provided information on water studies, water rights, and water decrees.

Wyoming Department of Environmental Quality (DEQ)

The DEQ provided information on water quality, air quality, and reclamation.

County and Local Entities

Carbon County Council of Governments

The Carbon County Council of Governments provided data on zoning, population distribution, and public services within the county.

Carbon County Planning Commission

The planning commission provided data on zoning, population distribution and public services within the county.

City of Rawlins

The city provided information on present water supply, sewer needs, future development, and population projections.

Private Industries

Union Pacific Railroad

The company provided information on train traffic.

Edison Development Company

The company provided a mine and reclamation report.

COORDINATION IN THE REVIEW OF THE DRAFT ENVIRONMENTAL STATEMENT

Comments on the draft environmental statement were requested from the following agencies, state clearing houses, and interest groups. Respondents are marked with an asterisk (*).

Federal

*Advisory Council on Historic Preservation
Department of Agriculture

*Soil Conservation Service
Forest Service

*Agricultural Stabilization and Conservation Service
Department of Commerce

Department of Energy

Department of Health, Education and Welfare

Department of Housing and Urban Development

Department of the Interior

*Bureau of Mines

Bureau of Reclamation

Fish and Wildlife Service

*Heritage Conservation and Recreation Service

*National Park Service

*Office of Surface Mining

Department of Labor

*Mining Safety and Health Administration

Occupational Safety and Health Administration

Department of Transportation

*Environmental Protection Agency

*Federal Energy Regulatory Commission

Interstate Commerce Commission

Mountain Plains Federal Regional Council

Office of Economic Opportunity

State

State of Wyoming Clearing House coordinated comments from all interested agencies.

*Wyoming Game and Fish Department

CONSULTATION AND COORDINATION

Local

Carbon County Commissioners
Carbon County Council of Governments
*Carbon County Planning Commission
*City of Rawlins
Town of Hanna/Elmo
Town of Saratoga
Town of Encampment
Town of Sinclair
*Town of Medicine Bow

Nongovernmental Organizations

Alpine Chapter, Audubon Society
American Horse Protective Association
American Electric Power Service Corporation
American Institute of Mining Engineers
American Sportsman's Club
Carbon County Woolgrowers
Defenders of Wildlife
ENACT
Environmental Citizen's Lobby
Friends of the Earth
International Society for the Protection of Mustangs and Burros
Izaak Walton League
League of Women Voters
National Audubon Society
National Coal Association
National Council of Public Land Users
National Energy Law and Policy Institute
National Environmental Health Association
National Resources and Environmental Council
National Wildlife Federation
Natural Resources Defense Council
Northern Great Plains Chapter, Sierra Club
Powder River Basin Resource Council
Society for Range Management
The Wilderness Society
Trout Unlimited
Wild Horse Organized Assistance
Wyoming Outdoor Council
Wyoming Petroleum Association
Wyoming Woolgrowers
Wyoming Stockgrowers Association
Wyoming Wildlife Federation

WHERE COPIES MAY BE INSPECTED

Bureau of Land Management

Buffalo Resource Area
Buffalo, Wyoming 82834
(307) 684-5586

Casper District Office
951 Union Blvd.
Casper, Wyoming 82601
(307) 265-5550

Cody Resource Area
1131 13th Street
Federal Building
Cody, Wyoming 82414
(307) 587-2216

Denver Service Center Library
Bldg. 50, Denver Service Center
Denver, Colorado 80225

Kemmerer Resource Area
Diamondville, Wyoming 82116
(307) 877-3933

Lander Resource Area
Lander, Wyoming 82520
(307) 332-4220

Newcastle Resource Area
Highway 16 Bypass (P.O. Box 757)
Newcastle, Wyoming 82701
(307) 746-4453

Pinedale Resource Area
Molyneux Building
Pinedale, Wyoming 82941
(307) 367-4358

Rawlins District Office
1300 Third Street (P.O. Box 670)
Rawlins, Wyoming 82301
(307) 324-7171

Rock Springs District Office
Highway 187N
Rock Springs, Wyoming 82901
(307) 382-5350

Washington Office of Public Affairs
18th and C Streets, N.W.
Washington, D.C. 20240
(202) 343-4151

Worland District Office
1700 Robertson Avenue
Worland, Wyoming 82401
(307) 347-6151

Wyoming State Office
2515 Warren (Lea Building)
Cheyenne, Wyoming 82001
(307) 778-2220, Ext. 2385

CONSULTATION AND COORDINATION

Geological Survey

District Mining Office
Federal Building
Casper, Wyoming 82601
(307) 265-5550

Director's Office National Center
12201 Sunrise Valley Drive
Reston, Virginia 22092
(703) 860-7411

District Mining Supervisor's Office
126 Elk Street (Rear)
Rock Springs, Wyoming 82901
(307) 362-7350

Regional Manager's Office
7200 W. Alameda Avenue (Villa Italia)
Lakewood, Colorado 80226
(303) 234-2855

Area Mining Supervisor
Building 25
Denver Federal Center
Denver, Colorado 80225
(303) 234-4435

Public Libraries

Albany County Library
405 Grand Avenue
Laramie, Wyoming 82070

Carbon County Library
Courthouse
Rawlins, Wyoming 82301

Casper College Library
125 College Drive
Casper, Wyoming 82601

Encampment Branch Library
Encampment, Wyoming 82325

Fremont County Library
451 North Second Street
Lander, Wyoming 82520

Laramie County Community College Library
1400 East College Drive
Cheyenne, Wyoming 82001

Laramie County Library
2800 Central Avenue
Cheyenne, Wyoming 82001

Library of Natrona County
307 East Second
Casper, Wyoming 82601

Lincoln County Library
Courthouse
Kemmerer, Wyoming 82101

Rock Springs Public Library
400 "C" Street
Rock Springs, Wyoming 82901

Saratoga Public Library
104 West Elm
Saratoga, Wyoming 82331

Sweetwater County Library
177 North Center
Green River, Wyoming 82935

University of Wyoming Library
University Station
Box 3334
Laramie, Wyoming 82070

Western Wyoming Community College Library
Rock Springs, Wyoming 82901

Wyoming State Library
Government Publications
Supreme Court & State Library Building
Cheyenne, Wyoming

PUBLIC COMMENTS AND RESPONSES

The DES was issued on February 28, 1979. The notice of availability was published in the Volume 44, Number 44 issue of the Federal Register. The notice announced a 45-day public review period ending March 5, 1979, and included a schedule of the formal public hearing on the DES. A second notice was published in the Volume 44, Number 79, issue of the Federal Register extending the comment period to April 23, 1979.

In addition to the Federal Register, publication notices and news releases announcing the hearing and availability of the DES were sent to 3 wire services, 37 newspapers, 14 radio stations, and 9 TV stations within the regional news media area, the State of Wyoming, and the Rawlins District of the BLM.

PUBLIC HEARING ON THE DRAFT

The Bureau of Land Management conducted formal hearings on the adequacy of the DES on April 11, 1979. Eight persons testified at the hearings. Copies of the full hearings transcript were made available for public review in the Bureau of Land Management Offices in Cheyenne and Rawlins, Wyoming.

CONSULTATION AND COORDINATION

The hearings were conducted at the Jeffrey Memorial Center in Rawlins, Wyoming. The hearings were scheduled at 1:30 p.m. and at 7:30 p.m. and were widely announced.

All letters and the hearings transcript have been sent with the final environmental statement to the Secretary of the Interior and Environmental Protection Agency (EPA) and will also be available for public inspection at the State Director's Office, Bureau of Land Management, Cheyenne, Wyoming; BLM District Office, Rawlins, Wyoming; and BLM Office of Public Affairs, Washington, D.C. Additional copies of the DES will be sent upon request until supply is depleted.

COMMENTS AND RESPONSES

All letters and testimony were reviewed and considered. All comments are responded to in this final environmental statement (FES). An index number was assigned to each letter received and to the hearings testimony. The number appears on the upper right corner of the letters; individual numbers were not assigned to those providing testimony. The responses are keyed to individual comments contained in the letters and testimony. Each comment is numbered in the left margin adjacent to the comment. The index, testimony, and responses follow.

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first settlers who came to the continent in search of a better life. They found a land of opportunity, but also a land of conflict. The struggle for independence was a long and hard one, but in the end, the people of the United States won their freedom and established a new nation. The story of the United States is a story of the triumph of the human spirit over adversity.

CHAPTER TWO: THE REVOLUTION

The American Revolution was a turning point in the history of the United States. It was a struggle for independence from British rule, and it resulted in the birth of a new nation. The revolution was fought on many fronts, but the most famous was the Battle of Yorktown. The British were defeated, and the United States declared its independence. The revolution was a triumph for the people of the United States, and it paved the way for the development of a new form of government.

The American Revolution was a struggle for independence from British rule, and it resulted in the birth of a new nation. The revolution was fought on many fronts, but the most famous was the Battle of Yorktown. The British were defeated, and the United States declared its independence. The revolution was a triumph for the people of the United States, and it paved the way for the development of a new form of government.

The American Revolution was a struggle for independence from British rule, and it resulted in the birth of a new nation. The revolution was fought on many fronts, but the most famous was the Battle of Yorktown. The British were defeated, and the United States declared its independence. The revolution was a triumph for the people of the United States, and it paved the way for the development of a new form of government.

The American Revolution was a struggle for independence from British rule, and it resulted in the birth of a new nation. The revolution was fought on many fronts, but the most famous was the Battle of Yorktown. The British were defeated, and the United States declared its independence. The revolution was a triumph for the people of the United States, and it paved the way for the development of a new form of government.

The American Revolution was a struggle for independence from British rule, and it resulted in the birth of a new nation. The revolution was fought on many fronts, but the most famous was the Battle of Yorktown. The British were defeated, and the United States declared its independence. The revolution was a triumph for the people of the United States, and it paved the way for the development of a new form of government.

INDEX TO PUBLIC COMMENTS

TESTIMONY AT PUBLIC HEARINGS

<u>Index Number</u>	<u>Agency, Organization, or Individual</u>
12	Robert Naylor, Assistant Superintendent, Carbon County School District 2
	Harold W. Young, Rawlins Planning Director
	John McPherson
	Kim Keaton, Rawlins City Engineer
	Cathy Dirk, Belco Petroleum Corporation
	Robert C. Brown
	William Cooper, Medicine Bow Planning Commission
	George Rifakis, Vice-President Commonwealth Edison

WRITTEN COMMENTS ON DES

<u>Index Number</u>	<u>Agency, Organization, or Individual</u>
1	City of Rawlins
2	Mine Safety and Health Administration
3	State of Utah
4	Office of Surface Mining
5	William A. Berg
6	Union Pacific Railroad Company
7	USDI, Bureau of Mines
8	Morrison-Knudson
9	USDI, National Park Service
10	USDA, Soil Conservation Service

<u>Index Number</u>	<u>Agency, Organization, or Individual</u>
11	U.S. Environmental Protection Agency
13	Arnex Corporation
14	Advisory Council on Historical Preservation
15	USDA, Agricultural Stabilization and Conservation Service
16	Heritage Conservation
17	Medicine Bow Chamber of Commerce
18	Medicine Bow Lion's Club
19	Arnex Corporation
20	Union Pacific Railroad Company
21	Medicine Bow Jaycees
22	Commonwealth Edison
23	State of Wyoming Game and Fish Department
24	Federal Energy Regulatory Commission
25	Olsen's Enterprises

TESTIMONY PRESENTED AT PUBLIC HEARINGS
AND
RESPONSES TO TESTIMONY

MR. ROBERT NAYLOR: I am Robert Naylor, Assistant Superintendent of Schools, Carbon County School District Number Two headquartered in Saratoga. I am reading from a prepared statement.

Carbon County School District Two encompasses the east half of Carbon County, consequently the proposed Commonwealth Edison Mine.

Carbon County School District Two feels that we are preparing adequately for any impact which might come in the near future. We feel that information gained through various surveys, industry spokesmen and our own trend indexes have helped in the planning.

We are now building new high schools in Medicine Bow, Hanna and Saratoga with an addition in Encampment.

We have entered into cooperative agreements with developers in Saratoga, Hanna and Medicine Bow in developing water, sewer and in some cases streets.

Our target dates for completion are for fall of 1979 at Encampment, fall of 1980 for the other three. The school board has authorized planning for one more new school at Hanna and additions at Saratoga, Medicine Bow and Hanna.

The increased facilities at Medicine Bow are due to a great deal of information given us by Commonwealth Edison Company, Rocky Mountain Energy and Upland Industries. We have requested,

Saratoga High School
Encampment Addition to High School
We have in the planning stage:
Hanna Elementary School
Saratoga, Hanna,
Medicine Bow Additions

Thank you for your time.

HEARING OFFICER ARMSTRONG: Mr. Naylor, are there any questions from the panel? Thank you, Mr. Naylor.

MR. NAYLOR: May I make one more statement that is not included in here?

HEARING OFFICER ARMSTRONG: Yes.

MR. NAYLOR: I noticed in the Draft Statement said the Carbon County School District Number One would be the most affected by this mine, and we take exception to that, feeling that we will get the brunt of it in Medicine Bow and Hanna as we have with the other mines in the Hanna area. Thank you.

Response to Testimony Presented by R. Naylor

Thank you for the information presented on School District Number 2. The data you presented has been used in the update of the Socioeconomics section of the FES.

but not received information which might be helpful from Bureau of Land Management, Department of Energy, Department of Environmental Quality and Environmental Protection Agency.

We are projecting thirty-five percent of the students will go to Hanna, thirty-five percent to Medicine Bow, and seventeen percent divided among Saratoga, Elk Mountain and McPadden. The remaining thirteen percent will attend outside of District Two. Probably Albany County.

Following are a few statistics which might prove helpful in your environmental impact statement:

	Present Enrollment	Facilities	1930	Increase
Hanna	630	620	1150	530
Elk Mountain	70	175	175	0
Medicine Bow	255	310	655	345
McPadden	20	100	100	0

The above schools are most likely to be affected:

Saratoga	580	600	1000	400
Encampment	205	275	350	125
	785	875	1350	525

These schools should be affected some:

Shirley Basin	80	150	150
---------------	----	-----	-----

We have under construction:

Hanna	High School
	Elementary Addition
Medicine Bow	High School

MR. HAROLD W. YOUNG: I am Harold W. Young, Rawlins Planning Director.

My concern is with the analysis of socio-economic impacts of the proposed facility on the impacted communities. These concerns fell into two areas. The first is the calculation of population projections. Secondly, is the ability of the communities to handle the estimated growth.

The estimate of population increase resulting from this project assumes a basic/non-basic multiplier (i.e. the number of jobs generated as a secondary result of these jobs) of 1.28. The Wyoming Department of Economic Planning and Development gives 1.98 for the existing basic/non-basic multiplier. The actual multiplier during rapid growth will, of course, be somewhat below the current one, but how much below is entirely dependent on the City's ability to provide necessary cultural and material services. If we do our job well, the population demand will increase proportionately. At any rate, the multiplier of 1.28 must be too low for the 1990 calculation. If a multiplier of 1.5 were used the projected increment would increase from 3,158 to 3,726. If a basic/non-basic ratio of 1.98 were to be assumed it would place the population impact from this facility at nearly 5,000 persons. The assumed multiplier obviously has a considerable influence on other assumed impacts. Additionally, as the E.I.S. acknowledges, but does not take into consideration in assessing impacts, is

that the multiplier for Rawlins would be higher than for other communities.

A much greater concern is with the ability of communities to absorb the growth. I will use Rawlins as my example, but I am certain that our problems differ only in scale, not in kind. The biggest issues are financial capacity and ability to pay. The E.I.S. acknowledges that there is a legal limit to bonding capacity, but never relates this to existing or proposed debt requirements. Capital needs are mentioned in only a very cursory fashion, giving the general impression that there are no problems and will be none. In fact, the City cannot possibly provide the improvements necessitated by the population projections indicated in the E.I.S.

We have calculated that it would require an investment of about fifty-two million to provide the necessary improvements to accommodate a population of 25,000. A portion of this would be paid by the Federal government, but federal grants require matching funds which we don't have, and loans would just increase the debt load on the tax payers. This E.I.S. estimates a population of 22,148 for 1990. A date well before the full impact of the expected population increase would have been reached, and as I have indicated the assumptions of the projections are doubtful. The City has an assessed valuation of fifteen million. A debt of fifty-two million is obviously an impossible burden.

The E.I.S. contains numerous references to problem areas, without consideration of the fiscal resources necessary for mitigation. It states that the "(sewer) system will continue to have problems with old, undersized sewer lines that are overloaded and with ground water seeping into older lines." To eliminate this problem would require more than two million dollars. The E.I.S. states that the population pressure would "...create local inflationary pressure ... (that) would affect those of fixed incomes more than anyone else. This is an extraordinary piece of understatement. Without substantial immediate relief a substantial portion of the City's population will be unable to continue to live in our City. The E.I.S. states that there are 'no major constraints (known) to rapid expansion of mobile homes.' Mobile homes require the same public services and improvements as permanent houses. If we can't afford one, we can't afford the other. The E.I.S. states that 'the assessed valuation of school District Two would be increased by the value of the mine property.' True, but most of the impact will be in District One.

There are other such examples, but what is fundamentally important, is that the authors of this E.I.S. expect a City of 12,000, a city which is without sewage or water treatment facilities, with a thirty mile long, undersized, decaying, wooden water supply line to provide services and facilities for

a new population larger than the existing population. Rawlins cannot survive as a viable city, and absorb this growth without very substantial outside assistance. Thank you.

Response to Testimony Presented by H. Young

Thank you for the information presented at the public hearing and for your participation in the subsequent meeting of April 30, 1979, at the District Office of BLM, in which socioeconomic issues were discussed and resolved. Changes were made appropriately within the text.

MR. JOHN McPHERSON: Thank you very much. I guess I get to be first because I am going to lose my voice if I don't go first tonight. You can remember me as being the lawyer who couldn't talk.

I appear here this evening, not on behalf of any client, not on behalf of any company, not as a representative of anybody other than myself. I appear as an individual citizen and resident of the community of Rawlins where I was born and raised, where I have lived all my life.

I have reviewed with some interest the proposed Draft, and I would say to you gentlemen, that it is easy to be critical and negative, and I, of course, sitting in your position, you are going to hear more bad things about your draft than you are good things, but there are some good things in there. There are some things that I frankly disagree with, but without delving into those in particular, and because of a voice, I want to express to you, my feelings as a citizen that I fear to endorse letting federal leases within that area. It is, as I said, easy to be negative. Generally, at these meetings, you are inundated with environmentalist and individuals who have, for a variety of reasons, are against the things, and I felt that it was incumbent upon me this evening, not having any vested interest, to appear before you and to express to you my views.

I think it is necessary that federal coal leases within that area be let, because of the inter-relationship of the private and checkerboard land, and I think that result is dictated by that, and I think further letting of federal leases within that area is dictated in the public interest.

All of us are aware of the recent development in the field of energy and the lack thereof, and I think the West must of necessity, play a major role and continued role in furnishing the energy for this country.

I say that I am in favor of letting of federal leases, but not as a representative of anybody, but merely as a citizen of this community. I recognize what it means to this community in terms of impact and in terms of growth, but nonetheless, I don't see that as all being negative either. I think there are some positive things that can result from that in terms of the business community and in terms of enhancement of our way of life in Carbon County. I would submit to you, that under the existing legislation, both on the federal and state levels, that most of the problems can be handled.

I appreciate you letting me address you, and I apologise for the condition of my voice.

Response to Testimony Presented by J. McPherson

Thank you for your comments presented at the public hearings. No response required.

storage rights: (1) 644.5 acre feet at the Atlantic Rim Reservoir. (2) 346.66 acre feet at the Peaking Reservoir. (3) 624 acre feet at the Rawlins Reservoir. This 7.56 cfs is the appropriated water that has supplied the City of Rawlins since 1923. Our population is to double. This means we will have to purchase more water rights to serve the expanded population!

The Atlantic Rim Reservoir will help you say! This will be constructed this summer but cannot be filled until next winter. So what if it is filled, a fourteen inch stave wood pipe line it will still feed the City. The stored water will be there but to get it to Twon we will have to construct an additional feeder line to get the water to the public. A new water line will cost approximately two million dollars.

New water rights. That means the purchase of ranch land to obtain water rights. The North Platte River is already over appropriated. Condemn them you say? Okay. We go to court and condemn the land for municipal use. We will have to pay an appraised value. Where does this money come from?

I have just mentioned a few problems. Such things as extending the airport runway, increasing park facilities, county fair grounds, water shop area, fire protection, police services, social services sanitary land fill and construction of sewage treatment and water treatment plant, Atlantic Rim Reservoir and replacing the Sage Creek feeder line, old folks

MS. KIM KEATEN: My name is Kim Keaten and I am representing the City of Rawlins as assistant city engineer.

The impact on the City of Rawlins way of life was minimized in the E.I.S. I am sure other communities are having the same problems Rawlins is experiencing. The utilities at present barely meet the public needs.

As new subdivisions have been added to the City of Rawlins such things as tying into existing sewage lines have overloaded the existing facilities. Twelve inch sewer lines dumping into eight inch sewer mains will very quickly overload a system.

A major new sewer trunk line needs to be laid through the industrial addition to accomodate additional raw sewage from development to the north, Highland Hills ares. If development is to develop to the west of town a trunk line will have to be laid through the railroad cut and down State Street to connect into the new twenty-four inch Sanitary Sewer line that was laid in 1978. These are improvements that are needed only for expansion of the city limits. Storm sewers will have to be extended also. Sewage? We don't need extended lines until we can get more water.

The City of Rawlins has a total appropriated water rights of 7.56 cfs 5.25 cfs from Sage Creek Basin and 2.31 cfs of flow through rights from the North Platte River. We have

home and Head Start building are problems that the City of Rawlins is facing.

We will have increased maintenance and replacment construction from existing water and sanitary sewer lines, street repairs because of increased usage. This is an added expense to the City of Rawlins budget along with all of these other new problems.

What is our future? Do the Mines affect our life style? Can I water my garden this summer?

Very definitely my life style and yours is affected by each additional mine constructed within the south central portion of Wyoming.

The social economic impact of communities have to be addressed by the energy industry. Thank you.

Response to Testimony Presented by K. Keaton

1. The Socioeconomic section has been revised showing changes in infrastructure.
2. The ES does not discuss Atlantic Rim Reservoir but does discuss total need for municipal water supply.
3. The ES identifies the need for obtaining additional water but does not state the means by which the water rights could be obtained.
4. The Socioeconomic section of Chapter 2 has been revised to include identification of revenue sources (Chapter 2, Provisions for Revenue Shering and Taxation).

MS. CATHY DIRK: I am Cathy Dirk and I am here on behalf of the Belco Petroleum Corporation. The statement that I will be reading this evening has been prepared by Mr. Arnold D. Cunningham. Mr. Cunningham had planned to be here in Rawlins himself, but due to the weather was not able to arrive, so as a consequence, I will be reading his statement.

On behalf of our client, Belco Petroleum Corporation, I have been authorized to call certain conditions in the Carbon Basin Draft Environmental Statement to your attention.

1. The boundary of the proposed environmental statement has not been developed to give a full analysis to the impact of potential development of coal reserves in the event Edison Development Company does not successfully acquire the Federal coal lease in the subject area. The Draft Environmental Statement is based on a model mining plan that ignores certain other contiguous surrounded lands containing coal reserves indicated by published United States Geological Survey maps which would and should be included in a logical mining plan resulting in maximum development of total potential reserves in the area. This includes certain other federal lands which are presently not included and which would probably never be developed if the proposed plan is implemented.

It is felt that in order to achieve maximum development of all potential coal reserves, additional lands should be included in the environmental impact statement area since these

lands form part of a logical mining plan to fully develop the coal reserves in the southern Carbon Basin.

The additional lands include, but are not limited to, specific lands owned or controlled by Belco Petroleum Corporation which are contiguous or surrounded by the DES area and which contain in excess of ten percent of the total reserves of the considered area including the uncommitted federal acreage. The Belco Petroleum Corporation lands are described below:

Township 20 N, Range 79 West

Section 6, Lots 1, 2, 3, 4 SE 1/4

Township 20 N, Range 80 West

Section 2 All (Fee surface and minerals)

Section 12, NE 1/4 NE 1/4, S 1/2 N 1/2, N 1/2, S 1/2

Township 21 N, Range 79 West

Section 16 W 1/2, W 1/2 E 1/2

Section 20 SE 1/4

Section 32 SW 1/4 (Fee surface and minerals)

Township 21 N, Range 80 West

Section 16 SE 1/4

Section 28 NE 1/2

Section 36 All (Fee surface and minerals)

2. The subject draft Environmental Statement includes the proposed construction of certain surface facilities which ignore consideration of development

Belco Petroleum Corporation coal reserves in Section 20 (T 21 N, R 79 W) and Section 36 (T 21 N, R 80 W). In the case of the proposed diversion channel in Section 36 on DES Map CA 3-5, no consideration has been given to Belco Petroleum Corporation's surface ownership or the effect which the construction of the proposed diversion channel would have on ultimate development of the Belco Petroleum Corporation coal reserves in this section.

In summary, it is requested that the Bureau of Land Management consider expansion of the present boundaries of the DES to include other lands owned by our client, Belco Petroleum Corporation, as well as the United States and third party entities since these other lands are critical to other logical mining plans, for development of the uncommitted Federal acreage within the present proposed site specific area.

The Belco Petroleum Corporation reserves position as it relates to development of uncommitted Federal coal reserves in the Carbon Basin area is such that it seems logical that these lands should be included in any environmental study of this area to determine maximum ultimate impact and development.

I wish Mr. Cunningham were here to answer any questions that you might have, but he is not here. Thank you.

Response to Testimony Presented by C. Dirk

The original of the statement presented by Cathy Dirk was submitted to the BLM and is responded to under Letter 14.

MR. ROBERT C. BROWN: I am merely a property owner in the Elk Mountain region appearing here tonight. I am from Denver, Colorado and I do own property in this area. The only reason I am appearing here is to determine where this coal development will be. I have no other comments at this time.

Response to Testimony Presented by R. Brown

Thank you for your comments presented at the public hearings.

MR. WILLIAM COOPER: I am Bill Cooper, Medicine Bow. I am Chairman of the Planning Commission there. I didn't have anything written out and I am now making a statement.

Medicine Bow has a population about a thousand. We know this coal is going to be mined sooner or later and the country needs it and I know that Medicine Bow is trying to get a step ahead of the serious impact.

The Town by July 1 will have water and sewer for approximately five thousand people. We have been working on this for about a year and knew this was coming, so I hope we are ready.

We have three subdivisions ready to start, and will have approximately 250 homes that can be built in these three subdivisions. I think that will be real good for Medicine Bow. The people there want a store and want a small medical center and there is a lot that can be offered there, and I think this kind of impact for the people will really help the Town and I think Medicine Bow is behind this all the way. Thank you.

Response to Testimony Presented by N. Cooper

Thank you for your information and comments concerning the town of Medicine Bow.

MR. GEORGE RIFAKIS: My name is George Rifakis and I represent Edison Development Company. We do have an interest in this property since we own a checkerboard around the federal lands that are under consideration. I think the panel is to be commended for the fine job they did on this study and for completing the job almost on schedule.

I think many of the concerns the panel has, we also have as concerns. The study in addition raises certain issues that we will give careful attention to. We are aware of the potential socio-economic impacts and I think Medicine Bow, with the farsightedness that Mr. Cooper indicated, is to be also commended.

We are interested in working, if we happen to be the successful bidders. We are interested in working with all the communities in order to mitigate the impact.

Coal is a necessary part of the United States energy picture. We are a large utility and a large coal user. We need this coal and we want to produce the coal economically for our customers certainly, but also in the manner that will be acceptable to the neighbors that we will have too, and will live with in whatever area we are producing the coal. Thank you.

Response to Testimony Presented by G. Rifakis

Thank you for your comments presented at the public hearings. No response required.

WRITTEN COMMENTS
AND
RESPONSES TO WRITTEN COMMENTS

RECEIVED 1
MAR 05 1979



City of Rawlins Wyoming

CITY COUNCIL
GLEN WOODBURY
JOHN CARLSON
JUNE R. AYLSWORTH
STEVEN L. OLSON
ARTURO ARCHULETA
DeBARI MARTINEZ

MAYOR
EVERETT E. MANN

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
4015 Wilson Boulevard
Arlington, Virginia 22203



MAR 16 1979

Team Leader
Bureau of Land Management
Coal ES Team
P.O. Box 670
Rawlins, Wyoming 82301

Dear Sir:

This is in response to your undated letter (Reference 1792 (920)), asking for comments regarding your draft environmental statement on the proposed coal leasing in the Carbon Basin of Wyoming.

The statement appears to contain adequate general information and specific analyses to serve its particular purpose. The only relationship between the proposed leasing and our safety and health program would be associated with eventual new mine openings. Our inspection and enforcement activities for this area would increase in number and space as new mines are opened.

We appreciate this opportunity to comment on your statement.

Sincerely,

Robert B. Lagather
Assistant Secretary for
Mine Safety and Health

March 1, 1979

Team Leader
Coal ES Team
P.O. Box 670
Rawlins, WY 82301

Gentlemen:

We have reviewed the draft environmental impact statement for the Carbon Basin area and find it severely deficient in a number of aspects.

Our principal concern is, of course, with the effect of the proposed development on the City of Rawlins. This entire subject was covered in a cursory manner either ignoring, or barely mentioning major considerations. The E.I.S. states that a substantial portion of the anticipated population growth resulting from this proposed development would be expected to reside in Rawlins, but does not consider the capacity of the City to absorb such growth. The E.I.S. states that the bonding capacity of the City is limited, but doesn't discuss the restraint this limit has on our capacity to provide necessary services to the anticipated new residents. Demand on existing utilities and services has already reached the limits of their capacity due to prior growth. Is this not a major impact worthy of analysis?

The effect of inflation is only mentioned in passing, and the general impression given by the report is that somehow the City would benefit from the development. The residents of Rawlins are already responsible for a considerable debt and are suffering from rapid inflation, both caused by having to provide service to miners who do not work in the City. More miners will create greater inflation and debt. How is this beneficial to the City?

page 2
Environmental Impact
March 1, 1979

4 Population growth and inflation are both mentioned under "Adverse Impacts Which Cannot be Avoided". Both can be avoided. Inflation could be avoided by the energy companies paying for the public improvements necessary to house their employees. Population growth could be eliminated by not permitting the mining. Either way the City of Rawlins and all communities in Carbon County would be better off.

Sincerely,

Everett E. Mann
Mayor

EEM/sm

Letter 1 Responses

1. The text has been revised (see Table CA2-6). The population growth was adjusted downward after considering the capacity of Rawlins to absorb additional growth.
2. The text has been revised (see Table CA2-6). Financial constraints are likely to limit Rawlins' capacity to absorb further growth. This was taken into account in revising the population increases in the FES.
3. Demands for local services are discussed in various places throughout the DES such as in Chapter 2, Socioeconomics section, Infrastructures; Chapter 3, Water Resources section, Water Use; and Chapter 3, Socioeconomics section, Infrastructure.
4. The effects of inflation on those with fixed incomes are described in Chapter 3, Socioeconomics section, of the ES. These effects are recognized as adverse impacts which could not be avoided should the proposed action be implemented.



STATE OF UTAH

Scott M. Matheson
Governor
Kent Briggs
State Planning Coordinator

3
Division of Policy and Planning Coordination
Intergovernmental Relations Section
Lorayne Tempest, Assistant State Planning Coordinator
124 State Capitol
Salt Lake City, Utah 84111
533 4981

A/95
State Clearinghouse
533-4976
533-4971

Environmental
Coordinating
Committee
533-5794

Human Resources
Coordinating
Committee
533-6081

A/85
Federal/State
Coordination
533-6083

Federal Resource
Information
Center
533-4983

March 22, 1979

Team Leader
Coal ES Team
P. O. Box 670
Rawlins, WY 82301

Dear Sir:

The Utah State Environmental Coordinating Committee has reviewed the Draft Environmental Impact Statement for proposed coal leasing in the Carbon Basin Area. The Committee offers no comment.

Thank you for the opportunity to comment.

Sincerely,

Lorayne Tempest
Assistant State Planning
Coordinator

LT/jb
790305025



United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
WASHINGTON, D.C. 20240

APR 19 1979

RECEIVED

APR 24 1979

BRANCH OF MINING

Memorandum

To: Director, Bureau of Land Management
Through: Assistant Secretary, Energy and Minerals
From: Director, Office of Surface Mining
Subject: Review of Draft Environmental Statement on Proposed Coal Leasing in Carbon Basin Area, Wyoming

The Bureau of Land Management (BLM) should be commended for its efforts in preparing the draft Environmental Impact Statement (EIS) on the proposed coal leasing in the Carbon Basin Area of Wyoming. The EIS addresses the essential elements of selecting an environmentally preferable and economically sound coal lease tract for future development. We understand that the statement will serve as the prototype for EIS for Federal coal leasing.

The following identifies several areas which could better reflect the objectives of the Surface Mining Control and Reclamation Act of 1977 (SMCRA) and of OSM's permanent regulatory program. We have also assembled a list of detailed technical comments (Attachment A).

Preleasing

One of the most important policy issues in need of further discussion is the relationship between a lease approval and a mine plan approval. We are particularly concerned that neither the EIS prepared prior to issuance of a lease nor the Federal coal lease suggest that the mining and reclamation plan will be automatically approved at a later date. Section 510 of SMCRA specifies requirements for mining and reclamation plan approval. Compliance of the mining and reclamation plan with SMCRA requires site-specific environmental data and analysis at a level of detail not approached at the preleasing phase.

The draft EIS inappropriately infers that mining will take place in the Carbon Basin area. We believe this creates a problem that should be corrected in the final EIS through careful editing and rewrite. In addition, we recommend that the final EIS include a statement that clearly specifies that after a lease is granted mining can proceed only if the Department finds the mining and reclamation plan in compliance with SMCRA.

Mitigation Measures

The inclusion of some of the mitigation measures as possible lease stipulations paves the way for direct conflict with some of OSM's future actions in reviewing the mining and reclamation plan. Specifically, the detailed mitigation measures such as pounds of seeds and depth of topsoil to be used in revegetating the area may be contradicted by OSM at a later date (when site-specific characteristics are known). We agree that guidance should be provided to the bidder as to environmental impacts which must be mitigated, but we do not believe that this guidance should be in the form of lease stipulations for site-specific parameters under OSM's jurisdiction. Rather, identification of those potential environmental problems and recommendations for future consideration should be presented in the final EIS with a statement clarifying that detailed stipulations will be developed by OSM at the mine and reclamation plan review phase.

Lands Unsuitable for Surface Coal Mining

We are concerned with the incompleteness of the discussion of unsuitability determinations in the draft EIS. In addition to the results of the analysis on unsuitability determinations, we believe that the final statement should include the actual analysis and a discussion of the decision process used for making unsuitability determinations in accordance with Section 522(b) of SMCRA.

Specifically, the final EIS should explain the methodology used to identify areas, the interdisciplinary comparisons made, and reasons why potentially unsuitable areas were not excluded from mining. In the past, the Department was criticized for not including planning decisions in the EIS. We believe it is the Department's responsibility to clearly discuss and explain the decision process which will help to assure a successful Federal coal management program.

Coal Resource

The extent of mining and the life of the mining operation can not be determined because of insufficient data on economically recoverable coal reserves. Thus, neither the extent of mining nor the duration of the impact can be determined. The statement on the first page (CAI-1) suggesting that "Issuing the coal lease would enable approval of technically and administratively complete mine plans which would allow maximum economic recovery of the coal resource" is premature. A lease, in the absence of a mine plan, is not sufficient to establish maximum economic recovery.

A determination should be made prior to leasing whether an applicant can be expected to achieve maximum recovery of the coal resource given technological and economic constraints. Although the EIS does not provide sufficient information

to evaluate the efficiency of recovery, it indicates that 206 million tons would be removed from a resource of 400 million tons (51.5% recovery). The percent of recovery is low considering modern technology and use of longwall equipment. It appears necessary to address the relative suitability of this tract in comparison to other Federal coal lease tracts that are available to serve the same area of demand.

General Comments

We believe the overall usefulness of the maps would be enhanced if they were prepared as overlays. This would facilitate better examination of interrelationships likely in the area. Finally, because the EIS is a prototype for future leasing EISs, we strongly recommend that the entire final EIS be printed and made available.

Attachment A
Specific Comments

- 1. (Page CAI-1): The second paragraph should be reworded as follows: "The components . . . permits. Issuing the coal lease would enable the successful lessee to prepare technically and administratively complete mine plans which, upon approval, would require maximum economic recovery of the coal resource consistent with the protection of environmental resources in and adjacent to the proposed lease area."
- 2. (Page CAI-1): The last paragraph should be revised to read as follows: "If leased, the successful lessee cannot commence mining operations until approval of a mining and reclamation plan is secured from the Secretary of the Interior and, as appropriate, the Wyoming Department of Environmental Quality. Mining and reclamation plans must be submitted to the OSM and, as appropriate, the State regulatory authority within 3 years of lease issuance to comply with diligent development requirements."
- Mining and reclamation plans are approved by the Secretary and, as appropriate, the authorized State regulatory authority. Both the Bureau of Land Management (BLM) and the Geological Survey (GS) will be involved in the review process and will provide appropriate stipulations on the final action taken by the Department on plans submitted. Submitted plans must satisfy the regulatory requirements promulgated pursuant to the Surface Mining Control and Reclamation Act of 1977 (SMCRA); all lease conditions, requirements, and stipulations; and all applicable State laws and regulations."
- 3. (Page CAI-1): First paragraph gives two reasons why certain lands contained in the lease application were excluded from leasing consideration. We suggest that a third test to apply is whether adequate environmental data are available to make decisions regarding environmental protection requirements. This is mentioned on page CA8-1 under the Alternatives section, but should also be placed under the description of the action.
- 4. (Page CAI-1): Land ownership - first sentence: The statement that "The remaining land included in the lease application, along with private lands intermingled among the Federal lands, includes an area that would make a logical mining unit" does not follow the statement presented on page CAI-1 that the extent of economically recoverable reserves has not been determined and, therefore, the life of mining cannot be established. Are not sufficient data on economically recoverable reserves and the extent and duration of mining necessary to support the statement that the area contains a logical mining unit?
- 5. (Page CAI-1): Land ownership - last paragraph: Use of strip mining highwalls for location of underground portals would depend upon both the type and stability of the highwall to assure a safe location for the multiple entries required. Suggest referencing P.L. 91-173 as amended by P.L. 95-164 and MSHA regulations in 30 CFR, Parts 73 and 77.

- 14 | 6. (Page CA1-13): Fifth paragraph states that all unsuitability criteria have been reviewed, but the impact statement contains only limited reference to specific reviews and does not contain documentation to support the analysis. For example, on page CA2-9, a discussion is presented on the applicability of the alluvial valley floor criteria, but supporting data are not presented. Considering the importance of making unsuitability determinations prior to leasing, it is essential that these data be presented. Otherwise, the Department will likely be involved in lengthy reviews of unsuitability petitions.
- 15 | 7. (Page CA1-13): Item No. 1 of the sixth paragraph should specify the Carbon Cemetery and the area within at least 100 feet of the exterior boundaries, as required by Section 522(e)(5) of SMCR.
- 16 | 8. (Page CA1-13): A broader discussion of the relationship between the Carbon Basin EIS and the Southcentral Wyoming Regional EIS is needed. The final EIS should specify how the regional EIS did or did not address issues presented in the Carbon Basin EIS. The final EIS should discuss the relationship between specific impacts described in the Carbon Basin EIS and those cumulative impacts discussed in the regional EIS.
- 17 | 9. (Page CA1-13): We recommend rewording the last paragraph as follows:
"OSM and, as appropriate, the Wyoming Department of Environmental Quality have the responsibility to jointly review mining and reclamation plans and to issue a mining permit. Such permit issuance must be accomplished with the concurrence of the BLM and GS."
- 18 | 10. (Page CA1-17), Overburden removal and dispositions: It is stated that the A, B, and C horizons are all topsoil and will be stockpiled together. This is incorrect as the C horizon is not considered topsoil and should not be stockpiled with the topsoil unless allowed by the regulatory authority.
- 19 | 11. (Page CA1-17), Coal removal: Discussion indicates that reclamation would proceed at the rate of 120 acres per year for ten years or 1,200 acres by 1990. Table CA3-1 indicates that reclaimed acres will amount to only 833 acres by 1990. Thus, reclamation progress is unclear.
- 20 | 12. (Page CA1-25), Underground mining - last paragraph: The sentence beginning, "while retreating . . ." tends to lead the reader to the conclusion that complete pillar recovery is possible. Considering the present state of mining technology in this country, 100 percent pillar recovery is not practiced.

- 21 | 13. (Page CA1-25 and 26), Underground mining: No provisions are given for contending with the range of coalbed thicknesses, as presented in Table CA1-1 on Page CA1-7, to be encountered by a planer of fixed cutting height or a continuous miner with a fixed range of cutting height capability. No data are presented on probable recovery rates or loss of reserves due to superposition of operations.
Also, the coalbed thicknesses given range from 5 feet in the Blue bed to 32 feet in the Johnson bed. Multiple pass mining is not mentioned, either by the longwall operation or the continuous miner operation, to achieve rates of recovery in this range of bed thicknesses.
No mention is made of how the potential for fires in underground-mine job areas will be handled. High-volatile bituminous and sub-bituminous coals of Wyoming and Montana have historically presented health and safety problems in underground mining operations because of spontaneous combustion in the mined-out, or job areas.
No mention is made of how underground mine waste rock brought to the surface will be deposited. Waste rock will result from the planned air shaft, rock splits in the coal, and mine roof rock from falls and underground construction. The draft EIS ignores the potential for additional associated problems from such disposal areas.
The interrelationship of underground operations and ground water is not fully explored. No mention is made of the effect on overlying aquifers by subsidence action following mining. Neither is consideration given to the effect of underclays softened by intercepted water in the coal, or broken overlying aquifers on the operation of self-advancing hydraulic support units on the longwall face. Water encountered in underground operations, whether from the coal bed or from overlying aquifers that are broken by mine subsidence after coal removal, must be pumped to the surface where it could cause handling problems that are ignored in the draft EIS. Also ignored is the effect on surface water flow and on ground water levels of subsidence caused by large-scale longwall mining over wide areas. The associated effect on vegetation over areas of large scale draw down should be considered.
- 26 | 14. (Page CA1-26), Subsidence - second paragraph, first sentence: The acceptability of subsidence should depend on the effects on overlying resources and not on relief of stresses that may also be relieved by leaving adequate pillars.
- 27 | 15. (Page CA2-20): Disturbed area - ". . . and will not support wildlife," should be deleted. The fact that it is used as a travel area indicates a supportive function of wildlife habitat.

- 28 | 16. (Page CA@-20), Wildlife - Birds: If there are enough eagle nests in the area to warrant further study, then it would not be acceptable for mining. Studies should be completed prior to leasing or mining.
- 29 | 17. (Page CA2-30 and 2-31): Significant potential impacts are indicated by the 19 percent survey.
- 30 | 18. (Page CA2-47): There appears to be a discrepancy between the statement that populations of prairie dogs and eagles would not be disturbed and Maps CA2-5 and CA2-6 which indicate that both prairie dogs and eagles would be disturbed.
- 31 | 19. (Page CA2-47): Second sentence: The statement that without approvals, the project would be more costly and no logical mining unit would be feasible, appears to be an attempt to justify or defend the leasing action. The statement is made without evidence of supporting comparative cost data and is inappropriate in a description of the future environment.
- 32 | 20. (Page CA3-1): The guidelines for complete reclamation are inadequate according to OSM permanent program performance standards 816.116(b)(ii).
A number of statements are made relative to reclamation success and time periods to achieve success. We cannot find the basis for these statements either in the draft EIS or referenced. In the absence of any demonstrated success, the quantitative basis for the finding needs to be presented or the statement needs to be qualified. Recognizing that demonstration of revegetation success will be dependent on more detailed measurements normally acquired at the time of submission of a mine plan, the basis for any preliminary statements should be presented in the final EIS. The Council on Environmental Quality regulations require such documentation of a decision.
- 33 | 21. (Page CA3-2), Table CA3-1: There is a discrepancy in the 1990 total acreage. It should read 2,323 instead of 2,232. The table would be more useful if the acres reclaimed were specified by the same categories as disturbed.
- 34 | 22. (Page CA3-2 and 303): Tables CA3-1 and CA3-2 do not include acreage affected by disposal of airshaft construction waste rock and underground mine waste rock. Acreage disturbed to produce crushed limestone used to reduce explosibility of coal dust in underground mining is also not included.
- 35 | 23. (Page CA3-4): The discussion of the effects of fugitive dust on ambient air quality standards should include an appraisal of compliance with State standards. The Wyoming Department of Environmental Quality presently includes fugitive dust emissions in its determination of compliance with the average annual ambient particulate standard. Also, because of the high winds in the area, the design of the final topography should consider measures for reducing fugitive dust.

- 36 | 24. (Page CA3-5): Table CA3-3 does not include fugitive dust emissions from the underground mine ventilation fans. These dusts include coal dusts as well as limestone dust required by Federal law to be applied to reduce explosibility of coal dust in underground mine workings.
Does stockpiling allude to only storage of overburden and topsoil or does it also include storage of coal awaiting shipment? This can be a major source of fugitive dust of a nature more objectionable than dust from natural soils.
- 37 | 25. (Page CA3-12), Visibility: The Isopeth's indicate that particulates will be carried in the general direction of Medicine Bow. We suggest adding Medicine Bow's location to the maps and adding a discussion of possible impacts on air quality in Medicine Bow.
- 38 | 26. (Page CA3-12), Geology - third paragraph: The assumption that subsidence will occur rapidly, because the method involves intentional collapse of the mined-out coalbed, assumes complete recovery of chain pillars between longwall panels, gob bleeder pillars, barrier pillars, etc. These pillars are not removed by longwall equipment and, in most cases in the United States, the chain pillars which become bleeder pillars on retreat of the longwall face are not removed. Thus, complete subsidence over longwall mining operations does not necessarily happen in the real world. Also, the statement that areas mined at depths greater than 300 feet would not necessarily show surface expression of subsidence is not necessarily so. Surface expression of subsidence in some areas has followed coal removal at depths greater than 1700 feet only after more than 40 years of mining had occurred.
- 40 | Fourth paragraph - Unless variances from MSHA regulations are obtained, gob bleeder pillars would be left to reduce methane accumulations in mined-out panels whether mined by longwall or continuous mining equipment.
- 41 | Sixth paragraph - The contention that pressure points do not occur in longwall mining is patently false. Pressure points occur at each corner of the face as it is being retreated. Pressure points occur at the barrier pillar corners left after the panel is mined. The extent of pressure build-up is a function of overburden depth, nature of overburden, mined-out panel dimensions, chain pillar dimensions, rate of recovery, nature of underlying strata, coal strength, interrelated joint patterns in the superjacent and subjacent strata, and coal strength. Also, the effect of freed ground water on the surrounding strata could be an influencing factor. Longwall mining does not provide carte-blanche assurance that coal bursts will not happen.
- 42 | 27. (Page CA3-12), Paleontology - first and third paragraphs: These two paragraphs overbalance the second paragraph statement that the fossils would not even be available to anyone, serious scientists and vandals alike, unless mining did not make them available.
- 43 | 28. (Page CA3-13), Topography: The post-mining topography description may not be permissible under SMCR. In particular, the description of the final cut depression of the surface mine may be inconsistent with the approximate original contour standards as well as the required reestablishment of the surface hydrology.

- 44 | Although the proposed lease would include only about 2,000 acres of surface disturbance (1,000 if the underground mining alternative is chosen), we note that reestablishment of a geomorphological configuration which would minimize wind erosion and maximize soil moisture retention has not been considered in this EIS. Such a mitigation measure would be critical in complying with SMCRRA, if a large area were to be surface mined.
- 45²⁹ | (Page CA3-13), Soils - first paragraph: Soils could be affected by the influence of subsidence on the water table by lowering and intersection by induced strata failure planes that tend to channel ground water movement.
- 46 | Also, the statement that subsidence is expected to be a gradually uniform process would be true if all the coal in the underground mine were removed. But, as stated previously, it is not. Panel entry, chain pillars, bleeder pillars and barrier pillar remnants would prevent attaining uniform subsidence.
- 47 | Acreages to be affected by airshaft construction waste, underground mine rock and coalbed parting rock disposal areas are ignored.
- 30. | (Page CA3-14), Water resources: We recognize that due to the presence of only ephemeral and intermittent streams on the lease site and the apparent isolation of the ground water resource from the Medicine Bow River, the effects of the mine on regional surface water resources may be minimal. However, the EIS should discuss the cumulative hydrological impacts associated with meeting municipal water requirements in adjacent communities. Both water quantity and quality aspects should be addressed. Mitigation of impacts from municipal and industrial uses should stress water conservation practices as a means of preserving water for future uses, in addition to protecting in-stream values, reducing water treatment and distribution costs, minimizing sewage collection and treatment investments and abating and preventing water quality problems.
- 48 |
- 49³¹ | (Page CA3-14), Ground water: Information should be presented to justify that aquifers are local and not regional.
- 32. | (Page CA3-14), Water resources - Ground water - third paragraph: The presence of water under sufficient pressure is not the only factor that would cause floor buckling, or heaving as the action is more prevalently described. Clay mineral characteristics of the strata immediately underlying the coalbed would determine whether the floor will "buckle" when water is present.
- 50 |
- 51³³ | (Page CA3-18), Groundwater: It is unrealistic to believe that springs in an area with such limited supplies of surface water are not primary water sources for some wildlife species.
- 52³⁴ | (Page CA3-18), Surface water: Water encountered in quantities that would impede underground mining normally is pumped to the surface as a matter of safety and mine economics. This fact is omitted in the discussions on both surface water and ground water.

- 53³⁵ | (Page CA3-18), Surface water: The statement that "channels would adjust to the amount of water they were required to carry" should be changed to reflect the requirements of SMCRRA. The Act mandates that channels not be deepened, thus requiring the maintenance of erosional balances. (Discharges must be adjusted, not the natural channels.)
- 54³⁶ | (Page CA3-18), Water use: Water use in dust suppression in surface coal storage and transloading in addition to underground usage in dust suppression on continuous or longwall machines at the mine face is ignored. In addition, the total water use analysis inadequately treats the long-term demand in relation to demands of other developments in the region.
- 55³⁷ | (Page CA3-22), Vegetation, Terrestrial: Influence of subsidence affected areas on ground water availability to terrestrial vegetation is omitted. This influence could occur for as long as 80 years, the period presented by the authors on pages CA3-14 and CA3-18 as the length of time for recovery.
- 56³⁸ | (Page CA3-22), Habitat losses and wildlife population losses: Influence of high-pitched noise from underground mine ventilation fans has been omitted, as stated previously. Also losses due to increased hunting pressure by increased population is not discussed.
- 57³⁹ | (Page CA3-22 and 3-23): There is no discussion of the impact of fencing or the railroad spur on wildlife movements, especially pronghorn antelope. The 15 miles of track will modify seasonal movements.
- 58⁴⁰ | (Page CA3-30), Livestock grazing: Suggest adding a discussion of the impacts of transferring 455 AUM's to adjoining lands as stated on page CA2-36.
- 59⁴¹ | (Page CA3-30), Socioeconomics: Off-site responsibilities of the Federal Government and the applicant should be explored in the EIS. Two areas in particular should be addressed. These are: (1) disruptive effects of increased rail transportation on community traffic systems, and (2) shortages of housing and other public services. The EIS states there will be severe impacts in these areas, but does not explore mitigative measures. The final EIS should identify Departmental and other Federal aid programs available, and include an assessment of the effectiveness of these programs toward mitigating problems. The final EIS should also discuss potential measures to be taken by the applicant to offset adverse impacts.
- 60⁴² | (Page CA3-34), Health care and safety: Data on fatality rates, disabling injury rates for bituminous mining, both surface and underground, are available from the same source as those for anthracite mining and should be used.
- 61⁴³ | (Page CA3-34), Attitudes and expectations: Page CA2-44 said that a local survey indicated local people preferred non-mining industries. Suggest adding a discussion of the community attitudes toward mining.

- 62⁴⁴ | (Page CA4-1), Lease stipulations to provide mitigation: This document was published prior to publication of the permanent regulatory program on March 13, 1979, and therefore, the first sentence in this section is incorrect. Also SMCRRA regulations pertaining to underground operations as well as MSHA regulations are not fully addressed.
- 63 | We recognize the effort to insure mitigation measures are employed by the lessee. However, we do not believe some of the lease stipulations directed at reclamation can be specified at the lease tract stage, nor do we believe reclamation stipulations should be specified at the lease tract stage. Only after the environmental details of a mine area are known can the exact revegetation techniques be specified.
- 64 | We strongly urge that in the final EIS the discussion of these kinds of mitigation measures should be deferred to the mine plan review stage or that the staff structure reclamation techniques as recommendations to be further tailored to the site at the mine plan review stage. If this area is offered, it is recommended that lease stipulations be oriented to influence the premining environmental studies that lead to mining and reclamation plan stipulations.
- 65⁴⁵ | (Page CA5-1), Chapter 5 - Adverse impacts which cannot be avoided: Increased loss of life in mining operations is not addressed. Other impacts such as underground mine waste, fan noise, dusting from coal storage and emissions from ventilating fan systems are not addressed. Neither are emissions from spontaneous combustion of coal underground and in coal storage piles or the addition of atmospheric moisture from mine ventilating air. The additional acreages that must be disturbed to provide underground mine coal dust suppressing limestone rock dust are not addressed.
- 66⁴⁶ | (Page CA7-1), Chapter 7: Other irreversible and irretrievable commitments of resources would include mine equipment and supplies including fuels, lubricants, limestone, etc. which should be addressed. The final EIS should also address whether development of coal in this area would preclude development of other resources, such as uranium mining, either directly or indirectly (water availability).
- 67⁴⁷ | (Page CA8-1), Alternatives: We believe there should be a much more rigorous discussion of alternatives in the final EIS. Based on the available information, there appears to be a great potential for disrupting "critical" habitats of golden eagles, sage grouse, and pronghorn antelope. The alternative of underground mining only should be further pursued, pending discussions with the U.S. Fish and Wildlife Service, in the final EIS. The underground mining alternative may be the most reasonable alternative. However, there may be other sites preferable to Carbon Basin (considering both coal recovery and environmental impacts) which should be discussed in the final EIS.
- 68 | Surface mining only: This conclusion is not true. Surface Mining in the Anthracite region of Pennsylvania and the Kemmerer Mine in Southeast Wyoming has proceeded to depths as great as 900 feet.

- 69 | The summary (page i) states that five alternatives were considered but we count only three.
- 70⁴⁹ | (Page CA9-1), Chapter 9: Recommend the consolidation and coordination group include a few independent mining consultants with actual experience with mine operations.

Letter 4 Responses

1. Neither the approval of an ES nor the issuance of a federal coal lease can assure the automatic approval of a mine and reclamation plan, because there are no provisions for automatic approval. The ES states that if the federal coal is leased, the lessee will submit a mine and reclamation plan for approval. This plan will not be approved until all state and federal regulations are met.
2. In the first paragraph of the Proposed Action section of Chapter 1, the components of the federal action are described. In subsequent paragraphs are descriptions of actions that would occur if the federal coal were offered for leasing. The analysis presented in the document is based on the events that would occur if the coal were leased and the mining project were developed. Also see Response 1.
3. The stipulations for reclamation of federal lands involved in this lease application administered by the BLM are considered minimum requirements under provisions of SMCRRA to achieve management during the post mining land use period. The adequacy of data available on soils, climate, and vegetation are of sufficient quality to permit determination of the reclamation stipulations stated in the ES.
4. Raw data are not included in this ES; only the results of the analysis are presented. Supporting data for the unsuitability determinations are available for public review at the Rawlins District Office, BLM.

There is no category in the unsuitability criteria listed as "potential unsuitable" for mining. The closest determination is "acceptable pending further study." Section 522(b) of SMCRRA concerns itself with areas which are unsuitable for surface mining. No such determination, unsuitable for surface mining, has been made for any of the criteria applicable to the Carbon Basin project area. A discussion of the Hanna MPP planning process is included in the Interrelationships section, Chapter 1 of the FEIS.
5. The extent of mining and the life of mining are estimates based on the best available data. Duration of impacts are also developed from existing data (see revised text, Chapter 1, Proposed Development section).

6. Existing available coal data were used to estimate the percent of recovery. Additional data on the coal deposits will be available this summer upon completion of a drilling program by USGS. This new data can be used by Department of Interior to evaluate efficiency of recovery on any subsequent mine and reclamation plan should a coal lease be issued.

7. It was felt that maps would be adequate for the purpose of this ES.

8. The text has been revised (see Chapter 1, Proposed Action).

9. The text has been revised (see Chapter 1, Authorizing Actions).

10. The text has been revised (see Chapter 1, Authorizing Actions).

11. The third test referred to in the comment was applied to the excluded lands shown on Map CA1-1. Sufficient data are available on these lands to make decisions on environmental protection requirements. The exclusions of these areas is based solely on the lack of information on the underlying coal.

12. The text has been revised (see Chapter 1, Proposed Development section).

13. The text has been revised (see Chapter 1, Background section).

14. Since a lease can be issued even though some criteria are listed as acceptable pending further study, it was decided that raw data would not be included in the ES. Only the results of the analysis are presented. Supporting data for the unsuitability determinations are on file at the Rawlins District Office, BLM.

15. The text has been revised (see Chapter 1, Preleasing Inventories and Analysis).

16. The text has been revised (see Chapter 1, Interrelationships section, Relation of Carbon Basin to Southcentral ES, and added Table CA1-3).

17. The text has been revised (see Chapter 1, Authorizing Actions).

18. Topsoil as presented in this document refers to any soil material suitable as a plant growing medium for reclamation purposes. This could include A, B, and C horizons of the soil profile. The C horizon of some of the soils is quite suitable as plant growing medium and needs to be utilized in order to have sufficient soil to spread over spoils during reclamation.

19. The text states that reclamation would be initiated at a rate of approximately 120 acres per year. It does not state that reclamation would occur for 10 years or 1,200 acres by 1990. This infers that reclamation would begin in 1980. The ES through Table CA1-3 indicates that reclamation would begin about 1983, and 833 acres would be reclaimed by 1990. The remaining acreage (1,319 acres) would be reclaimed after 1990 at a rate of approximately 120 acres per year or whenever it is available for reclamation.

20. The percentage of pillar recovery would be more properly addressed in an analysis of a mining and reclamation plan.

21. The methods of contending with variable seam thicknesses in the course of mining operations will be addressed in an analysis of any subsequent mining and reclamation plan.

22. This would be more properly addressed in an analysis of a mining and reclamation plan.

23. These subjects more properly belong in an analysis of a mine and reclamation plan.

24. Additional information is needed before the impacts identified in the comment letter can be analyzed. This information would be analyzed in the mine and reclamation plan approval process should the leasing be approved, the lease be let, and the reclamation plan be submitted.

25. Consideration of softened underclays is not necessary since the floor of most of the working faces would be either a competent sandstone or shale. Fire clays are not known to occur in the Carbon Basin area. The amounts of water that would be encountered in the conduct of mining operations have not been examined at this time. The amounts would be examined during the development of any subsequent mine plan. Geological Survey has published a report on the effects of subsidence caused by underground mining in Montana and Wyoming, entitled: "Effects of Coal Mine Subsidence in the Western Powder River Basin of Wyoming." The handling of the water at the surface is more properly examined once the amounts are estimated and considered in a mining and reclamation plan. The effects of draw down in vegetative communities would be nearly nonexistent since the communities depend on precipitation-derived soil moisture for water.

26. This would be more properly covered in an analysis of a mine and reclamation plan.

27. The statement has been reviewed by BLM wildlife biologists and found to be correct within the meaning of support.

28. The text has been revised (see Chapter 4, Lease Constraints).

29. The text has been revised (see Chapter 2, Archeology).

30. Without issuance of federal coal lease in the Carbon Basin project area, there would be no disturbance to either prairie dogs or eagles. Text on page CA2-47 concerns only the future environment without the project.

31. Comparative cost data are not available. The lease applicant has stated that development of the project would not be feasible without the federal coal and the rights-of-way for ancillary facilities.

32. The text does not change the relationship of OSM and operator responsibilities. It only identifies the requirements needed for successful reclamation. The guidelines presented were developed by the ES team based on their experiences and observations in the area under consideration.

33. The total acreage figure has been revised in Table CA3-1 (see Chapter 3). The information submitted in the mine and reclamation report was detailed to the degree that would permit specifying the reclamation by categories.

34. See response 24 to this letter.

35. The final topography of the rehabilitated lands would be rolling terrain similar to that presently in the area to minimize fugitive dust emissions after mine abandonment. See revised text (Chapter 3, Air Quality Emissions from the Proposed Mine, and Chapter 4, Mitigation Measures).

36. The information on fugitive dust emissions from the underground mine ventilation fans was not available to include in the analysis. The need for this information is identified in Chapter 5.

37. The text has been revised (see Chapter 3, Table CA3-3).

38. The text has been revised (see Chapter 3, Impacts on Air Quality, Visibility).

39. This information will be considered when the mine and reclamation plan is submitted.

40. The use of gob bleeder pillars to reduce methane accumulations and possible variances from MSHA are more properly addressed in a mine and reclamation plan.

41. The text has been revised (see Chapter 3, Geology).

42. The text has been revised (see Chapter 3, Geology, Paleontology).

43. The surface water section of Chapter 3 does not identify any violation of required establishment of the surface hydrology.

44. The mining sequence and location and size of the mine pit areas would limit the manipulation of the surface configuration. Reclamation of the pit areas of this proposal would be to restore, as nearly as possible, the original configuration of the area.

45. This would be true only if the water table were in the root zone. In the Carbon Basin area, this is not the case.

46. This would be more properly addressed in the analysis of a mining and reclamation plan. With proper timing, based on geotechnical and rock mechanics data, subsidence could be designed to be uniform.

47. See response 34 to this letter.

48. Cumulative hydrologic impacts associated with communities meeting municipal water requirements are addressed as completely as possible in the ES using available data. See revised Chapter 2, Socioeconomics, Provisions for Revenue Sharing and Taxation, for added discussion on sources of revenue to municipalities. Also refer to response 51 to this letter for additional information.

Mitigation of impacts resulting from municipal and industrial uses is usually determined at the local level without direct federal influence.

49. The data in Chapters 2 and 3 concerning the aquifers is developed from available sources. Additional hydrologic and aquifer data will be provided with any future submission of a mine and reclamation plan.

50. The text has been revised (see Chapter 3, Water Resources, Ground Water).

51. The springs in the project area flow only in the spring and very early summer. Adequate water is available to the east from the Medicine Bow River and to the west from Sevenmile Lake. Therefore, the springs are not primary water sources for wildlife.

52. The text has been revised (see Chapter 3, Water Resources, Water Use, and revised Map CA3-5 for locating settling ponds).

53. In this case it should not be inferred from the phrase "channels would adjust to the amount of water they were required to carry" that there is an intention to allow a violation of the SMCRA requirements. There is no intent to allow a reopening of channels. Such concerns will be more closely considered when reviewing any subsequent mining and reclamation plan for approval.

54. The text has been revised (see Chapter 3, Water Resources, Water Use, and Chapter 1, Table 1-3).

55. With the limited data on subsidence presented in the preliminary mine and reclamation report, the influence of subsidence upon terrestrial vegetation could not be accurately projected. Additional data will have to be provided in the mine and reclamation plan for this determination.

56. Information received from the engineering department of Morrison-Knudsen Company indicated that while some noise would be produced by the ventilation fans, the noise would be a low rumble as opposed to high decible levels. No significant impacts are anticipated. Noise levels can be reduced by installing noise dampers inside the fan housings or deflectors can be placed to force the noise upward. These same measures have been successfully used in other areas, and no noise problems were evident to either wildlife or humans.

Looses resulting from increased hunting pressure would not occur as big game hunting in the project area is controlled by issuing limited permits for pronghorns, and the same controls are required for deer or other game species. Adjustments in permit numbers is based upon game population data, not from numbers of potential hunters.

57. Plans for the railroad spur do not include fencing; therefore, the 15 miles of track would have no effect upon pronghorn movements. Coal train speeds are not anticipated to be fast enough to be a hazard to wildlife.

58. This was considered; no impacts have been identified with the transferring of 455 ADUs to adjoining lands.

1404 West Lake Street
Fort Collins, Colorado 80521
4 April 1979

59. The intent of this environmental impact statement is to analyze the impacts of coal leasing in the Carbon Basin area. Identify committed mitigating measures and examine possible alternatives to the proposed action. The impacts caused by rail transportation on communities and the shortage of housing and other public services is recognized in Chapter 3, Socioeconomics section. There are no specific laws which would allow the federal government to commit monies toward mitigation of these impacts.

The ES recognizes the financing and related problems faced by rapidly expanding communities in meeting public service and housing needs. These are complex problems, and partial solutions are suggested. One way the federal government compensates the states which have mineral production from federal lands is to return 50% of the royalty to that state. In 1977, royalty payment to the federal government from Wyoming was \$5.3 million, and in 1978 it is expected to be approximately \$7 million, half of which will be returned to the State of Wyoming. Another way the federal government compensates local governments is through the payments in lieu of taxes. For fiscal years ending September 30, Wyoming received approximately \$6.4 million in 1977 and \$7.3 million in 1978.

Mitigating measures to reduce socioeconomic impacts could be proposed by a company or suggested by local communities for consideration by companies or agencies, if appropriate. The opportunity exists for community and company officials to attempt to work out problems created by increased development.

A section, Provisions for Revenue Sharing and Taxation, has been added to Chapter 2 Socioeconomics to explain sources of revenue from state and local levels.

60. The FES has been revised to use nationwide statistics relating injury and fatality rates to coal production.

61. Local attitudes to mining activities can be inferred to some degree from the attitudinal surveys presented in the ES. No other relevant surveys are known.

62. The text has been revised (see Chapter 4, Reclamation).

63. See response 3 to this letter.

64. See response 3 to this letter.

65. A discussion of the increased loss of life in mining operations has been added to Chapter 5, Adverse Impacts Which Cannot Be Avoided. Also see response 24.

The Wyoming DEQ requires control technology (BMP) be applied to all open coal stockpiles with emissions of less than 25 TPY. These measures included frequent wetting of the piles and for chemical stabilization of the piles to prevent wind erosion. Stockpiles with emissions greater than 25 TPY must be covered. The exact nature of the coal mine stockpiles in Carbon Basin is not known; no specific mining plan has been submitted because this ES was written to describe impacts from a typical mine.

Team Leader
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

At the request of the Morrison-Knudsen Company I have reviewed the section on Reclamation (Chapter 4) in the draft Carbon Basin ES, my comments on this section follow:

- 1 | A. Second paragraph under Reclamation. I assume these reclamation criteria will be revised to meet the criteria in the USDI coal mining regulations (13 March 1979).
- 2 | B. Under Lease Stipulations to Provide Mitigation: the numbers below relate to the sentences numbered in the report.
 - 1a. If unsuitable material is considered to be spoil that has a clay content in excess of 40% it is questionable if it has to be buried to a depth of 8 feet. A depth of 3 to 4 feet would be more realistic in this area with an average annual precipitation of about 10 inches.
 - 1b. In Tables CA3-7 the analytical data should be included so a reviewer can evaluate the magnitude of the limiting factors.
 - 2. With some soils a mixture of A, B, and C horizons will not be as productive as replacement of the A horizon over the subsoil material or even possibly over the spoil material.
 - 5. I question this annual cover crop concept in arid areas in that adequate stands may or may not be established depending on the precipitation. If there is an erosion hazard straw or hay mulching would be more effective.
 - 7. Crimping in mulch to a depth of 5" would bury much of it, a depth of 3" should be satisfactory and at the same time reduce burying of seed too deep.
 - 8. The rangeland drill usually refers to a specific type of drill developed by the U.S. Forest Service. There are other drills available that were developed for dispensing fluffy seed at proper depths. Unless the final surface is rocky or very rough, the drill used should not be restricted to the rangeland drill.

Team Leader
Page 2
4 April 1979

The emissions from the ventilating fans, which would include CH₄ (methane) water vapor and coal dust, would probably be minimal, and their effect would probably be very localized.

The emissions from the spontaneous combustion of coal would probably be of short term duration. These fires would probably be suppressed very quickly, and no long term emissions would result.

66. The commitments of mine equipment and supplies would be more properly addressed in a mining and reclamation plan prepared and submitted for approval. Such a plan would contain the detail needed to fully examine the irreversible and irretrievable commitment of resources.

There are no known mineral resources which would be precluded from development should the proposed action be followed other than those identified in Chapter 3, Minerals.

67. The Alternatives section is believed adequate for purposes of this ES. If a lease is issued and a mine and reclamation plan is submitted by the successful lessee, the Alternatives section could be expanded at that time. The underground mining alternative is included in the Final ES. Consultation and coordination is continuing with the Fish and Wildlife Service on matters required by regulation and on items pertinent to both agencies. Consideration of other alternate areas are not considered in this ES since the current restraining order in Civil Action 75-1749 prevents it. Refer to Chapter 1, Relation of Carbon Basin to Civil Action 75-1749.

68. The information for this area is correct based on best available data.

69. The text has been revised (see Summary, Item 4).

70. Independent mining consultants may obtain a copy of the DES upon request and submit comments. They are normally not included in the consultation and coordination lists because they seldom make comment on a DES and are normally not involved in preparing the DES. On several occasions in the past, consultants have requested and were provided copies of a FES, both regional and site specific.

- 8 | 9a. The seeding rate is high by some standards, even the low end of the rates suggested in Table CA4-1 gives about 30 pure live seeds per square foot. Cutting back on the wheat-grass seeding rates would give a better chance for the ricegrass and shrubs to establish.
- 9 | 9b. Yellow sweetclover is a questionable species to use in areas of limited precipitation. It is a biennial with good seedling vigor that can out compete more desirable species. However, after two growing seasons it dies and seldom reseeds enough to provide much cover. On sites that are topsoiled it is questionable if the nitrogen that sweetclover fixes can be balanced off against the competition that sweetclover offers to establishment of perennials.
- 10 | 9c. Big sage, rabbitbrush and bitterbrush should be added to the seeding mixture on sites where establishment of these species is desired.
- 11 | 10. The normal seed broadcasting rate is twice the drill seeding rate; however, since the drill seeding rate is already high the recommendation here is okay.
- 12 | 11. Mention should be made that broadcasting should be done on a roughened surface that is receptive to seed.
- 13 | 12. If shrubs can be established by seeding this should be attempted before the much more expensive alternative of planting is required.
- 14 | 13. I would think that it would be desirable to establish some shrubs on the south and west slopes.
- 15 | 14. It is doubtful that fertilizer will aid in establishment or growth of potted shrubs planted into topsoil.
- 16 | 16. The option should be left open to mulch or to seed a cover crop.
- 17. If the cottontail population approaches that mentioned in the report (5 per acre) severe rabbit damage could occur on the planted potted shrubs, control measures may have to be initiated.

Team Leader
Page 3
4 April 1979

Additional Lease Stipulations

- 17 | 2. Prilling would not be practical for seed of some species. On certain species prilling would help in distribution. It is questionable if prilling would help in germination of any of the species, and it could be detrimental to germination.
- 18 | 3. If drilled the seed does not have to be treated.
- 19 | 5. Slopes up to 4:1 (horizontal to vertical) can normally be handled with conventional revegetation techniques. Slope requirements should comply with the OSM regulations.
- 20 | 6. All topsoil placed over well-scarified overburden might be as advantageous as the proposed discing-in procedure for the first 4 inches of topsoil.

Sincerely yours,

William A. Berg
William A. Berg
Professor of Agronomy
Colorado State University

Letter 5 Responses

- The text has been revised (see Chapter 4, Reclamation).
- If the additional overburden analyses revealed that this clay material were not comprised of carbonaceous shales interbedded among the sandstones (where Electrical Conductivity (E.C.), pH, and Sodium Absorption Ratio (S.A.R.) were not also of limiting nature), the burial of the clay material to a minimum depth of 4 feet would be realistic.
- These data were not included in the FES. The data are on file at the BLM district office in Rawlins, Wyoming, and are available for review.
- The use of the A and 8 soil horizons as well as the upper portions of C horizon to come up to the minimum of 12 inches of soil material would in most cases be more productive in this area than the use of a few inches of topsoil over the spoil material.
- Mulching would possibly be more effective; however, under specific site conditions, the option of an annual cover crop has to be considered as an economical and practical alternative to mulching.
- Crimping to a depth of 3 inches would not provide sufficient anchorage to hold mulch in position due to the strong and persistent winds of the region. Mulching to a depth of 5 inches would bury some seed too deeply, but the seeding rate is adequate to withstand such loss.
- The text has been revised (see Chapter 4, Mitigation Measures).
- The seeding rate is not considered high because some seed would be lost as a result of mulching. The seed mixture and rates were developed by BLM personnel familiar with the area.
- Past seedings in the area have shown that sweetclover will provide a limited cover in a short period of time. The seeding rate in number of seeds per square foot is not sufficient to afford serious competition to other species but is high enough to afford limited cover. The die out characteristic is desired because once the grasses become established, the clover is not desired. The nitrogen fixing capabilities of the clover is a secondary, but desirable, consideration for selection of this species for a limited cover crop.
- Through conversations with plant specialists of the Soil Conservation Service, the Upper Colorado Environmental Plant Center, and the U.S. Forest Service Shrub Science Laboratory in Utah, it was determined that big sagebrush, rabbitbrush and bitterbrush could be best established by use of potted shrubs. Establishment of these species by the seeding method has been limited under present technology.
- The text has been revised (see Chapter 4, Mitigation Measures).
- See response 10 to this letter.
- The severe microclimate and drouthy soils would make the establishment of potted shrubs on south and west slopes marginal. Also, the increased costs of establishing them would be uneconomical. The shrubs included in the seeding mixture are considered to be adequate for initial establishment on these slopes. Other shrubs would eventually become established by natural regeneration.
- The application of water with a fertilizer-root stimulant added would assist the shrub in overcoming the shock of planting and in establishing a root system. Although the effect of the root stimulant would be short lived, the benefits received could mean the differences between success or failure of the shrub planting.
- The option to seed a cover crop is not considered viable because the cover crop and the desired species planted would compete for moisture on the reclaimed areas.
- Field observations in the vicinity of the project area disclosed no rabbit damage to young seedlings of native shrubs growing naturally. It is felt that the damage that would occur to planted shrub seedlings would not warrant the expense of requiring repellents or mechanical protection to the seedlings at this time.

17. Prilling can be of considerable help in getting proper seed distribution and can decrease the difficulty of getting seed through the drill. This measure would receive limited use, but it is provided for use at the discretion of the land manager to obtain desired results should other methods of seeding fail. Properly used, the benefits of prilling are greater than the possible detriment to germination.

18. Seed loss to rodents has been experienced on past seedings. Although the loss of seed on drilled areas is minimal, treatment is desirable as the benefits received exceed the nominal cost of treating. Treated seed on broadcast seeded areas is essential.

19. The slope provision ratio of 7:1 provides for the proper handling of fine-loamy or fine-surface textured soils which have a high erosion hazard; it is not necessarily provided for the convenience of conventional revegetation techniques. The stipulation is in compliance with OSM regulations as the 7:1 slope provision ratio is more stringent than the requirements of regulations 816.102 thru 816.105.

20. The discing-in of the first 4 inches of topsoil is more appropriate to placing topsoil over well scarified overburden as it would permit blending the transition zone from topsoil to overburden material. This would improve water infiltration, root penetration, and lessen compaction. Refer to Table CA3-6.

UNION PACIFIC RAILROAD COMPANY

1416 DODGE STREET
DENVER, NEB. 68013



VALERIE W. SCOTT
General Planning Counsel

April 5, 1979

Mr. Edward Coy,
Team Leader
Carbon Basin Area
Environmental Statement
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

Dear Mr. Coy:

Re: Extension of Written Comment Period
For One Month

On behalf of the Union Pacific Railroad Company I hereby request that the period for receipt of written comments on the Draft Environmental Statement covering Carbon Basin Area Coal Development in Southcentral Wyoming Region be extended from April 16, 1979, until May 16, 1979.

This extension of the comment period is requested so that Union Pacific may submit additional data on its Railroad line over which coal from the Carbon Basin Area would be transported. With submission of updated data, Union Pacific will also submit comments on those aspects of the Draft Environmental Statement dealing with transportation.

Very truly yours,

Valerie W. Scott
(Mrs.) Valerie W. Scott
(402) 271-4583

cc: Mr. Dan Baker
Mr. James Lambert



United States Department of the Interior
BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

RECEIVED
APR 09 1979

March 27, 1979

Memorandum

To: Team Leader, Coal ES Team, Rawlins, Wyoming
From: Director, Bureau of Mines
Subject: Draft environmental statement, Bureau of Land Management, Proposed Coal Leasing in the Carbon Basin Area, Wyoming

In this well-done environmental statement the necessity for Federal Government and private industry cooperation in developing mineral resources because of the checkerboard land ownership pattern is recognized. The figures and maps are particularly impressive.

- 1 Uranium, natural gas, and petroleum are also produced in Carbon County. This statement makes no mention of how development of the proposed coal lease would or would not affect utilization of these other mineral resources of the county.
- 2 On page CA-125, the statement is made that "... coal reserves dip at approximately 11 to 16 degrees" This would read better if it were "... coal beds dip at approximately 11 to 16 degrees"

Richard A. Straut
Director

Letter 7 Responses

- 1. Uranium, natural gas, and petroleum are discussed in the Southcentral Coal ES, Regional section, which is a support document to this ES. These resources are not discussed in this document as there are no ongoing or planned activities on the project area for these resources.
- 2. The text has been revised (see Chapter 1, Mine and Reclamation Description, Underground Mining).

CONTRACTORS
ENGINEERS
DEVELOPERS

MORRISON-KNUDSEN COMPANY, INC.

EXECUTIVE OFFICE
1300 MORRISON-KNUDSEN PLAZA / P.O. BOX 7808 / BOISE, IDAHO 83729 / U.S.A.
TELE: 366-9739
PHONE: (208) 343-5300

RECEIVED
APR 09 1979

April 4, 1979

Mr. Ed Coy
Bureau of Land Management
Southcentral E. S. Team
P. O. Box 670
Rawlins, Wyoming 83201

Dear Ed:

This letter concerns the recent Draft Environmental Statement on Carbon Basin. In that report on page CA3-18, the statement is made "The underground mines would use about 150 gpd (less than 1 ac.ft./yr.) for cooling equipment and suppressing dust where coal was transferred from one conveyor belt to another." This statement is attributed to me from "personal communication."

Through some misunderstanding, I have been misquoted in this matter. A single conveyor belt transfer point will require 150 gpd for dust suppression and this mine will require many such transfer points. In addition to the water required for transfer points, water will be used for cooling equipment and dust control at each working face. The total amount of water required for this underground mine operation will be approximately 300,000 gallons per day (220 ac.ft./yr.)

I hope this clears up any misunderstanding on this matter.

Respectfully,
William R. Fisher
William R. Fisher
Project Engineer

WRF/jls

cc: S. Y. Chi
R. N. Wiley

Letter 8 Response

- 1. The text has been revised (see Chapter 3, Water Resources, Water Use).



United States Department of the Interior
NATIONAL PARK SERVICE
ROCKY MOUNTAIN REGIONAL OFFICE
825 Park Street
P.O. Box 25287
Denver, Colorado 80225

IN REPLY REFER TO:

L7619 (RMR)PC

APR 5 1979

Memorandum

To: Team Leader, Coal ES Team, Bureau of Land Management, Rawlins, Wyoming
From: Associate Regional Director, Planning and Resource Preservation, Rocky Mountain Region
Subject: Carbon Basin Draft Environmental Statement

We have reviewed the subject draft environmental statement.

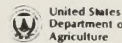
The proposed coal mining operation would not appear to impact any units of the National Park System. The increase in population of Carbon County from the labor force may result in some increase in relatively nearby areas of the System, such as Fort Laramie National Historic Site or Rocky Mountain National Park, but there is no way of quantifying what that impact might be. We expect it would be a rather small percentage of the thousands of people that visit these areas annually.

We urge that the lease require the best management practices be used that affect all environmental impacts, including air quality. On page CA3-4 we are pleased to note that fugitive dust is considered as an impact for purposes of cumulative impact assessment. We urge that this "worst-case" situation approach continue to be utilized in discussing all impacts in the final statement because we believe it will result in the best management practices to produce the least impacts.

Richard A. Straut
Richard A. Straut



Save Energy and You Serve America!



United States Department of Agriculture

Soil Conservation Service

P. O. Box 244D
Casper, Wyoming
82602

10

SUBJECT: ES - Carbon Basin Draft Environmental Statement

DATE: April 11, 1979

TO: Team Leader
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

RECEIVED
APR 12 1979

Pursuant to your request for comments on the Carbon Basin Draft Environmental Statement, we suggest that you make changes in Table CA2-2 as shown on the attached copies of the table.

Frank S. Dickson
Frank S. Dickson
State Conservationist

Attachments

cc: Director, Office of Federal Activities (5 copies)
Environmental Protection Agency
Room 537, West Tower
401 M Street, S.W.
Washington, D. C. 20460

Letter 10 Response

- 1. Table CA2-2 has been corrected. See revised table.





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER COLORADO 80203

Ref: 8W-EE

Mr. Ed Coy
Coal ES Team
P.O. Box 670
Rawlins, Wyoming 82301

Dear Mr. Coy:

The Region VIII Office of the Environmental Protection Agency has completed the review of the Carbon Basin draft environmental statement (DES), Wyoming. Generally, we have found both the air quality and water quality discussions to be adequate. Our preliminary concern is whether the reclamation effort would be successful. We also believe the alternatives section should be more detailed and comprehensive and discuss impacts on wildlife. Additionally, the application of the unsuitability criteria should be documented in the environmental statement. Please refer to our attached detailed comments for further discussion of our concerns.

According to the procedures EPA has adopted to rate the adequacy of draft environmental impact statements, the Carbon Basin DES will be listed in the Federal Register as ER-2. This means that we have significant reservations concerning the environmental effects of some of the discussed aspects of the draft EIS. Further, we believe the draft EIS does not contain sufficient information for either other agencies nor the public to fully assess environmental impacts. We are requesting that you provide EPA and others with the additional information requested in this letter and the attached detailed comments in the final EIS.

We appreciate the opportunity to review this draft EIS and request that you provide us with five copies of the final EIS for our review. If you have any questions, please contact Dennis Sobocki of my staff at (FTS) 327-4831.

Sincerely yours,

John Johnson
John Johnson
Regional Administrator

Enclosure

Detailed Comments

1. Generally, we find the air quality analysis to be adequate. However, the DES should have a discussion on compliance with Wyoming Department of Environmental Quality standards. Wyoming DEQ includes fugitive dust emissions in its evaluation of compliance with the average annual ambient particulate standard. Best management practices should be used to reduce fugitive dust.

2. The DES states that the area's "reclamation activity has generally been a trial and error basis and has not been very successful." (CA 2-17). Furthermore, the DES explains that "to date DEO has not released from bonding any area in the Hanna Basin area as being completely reclaimed," (CA 2-2D) and that preliminary reclamation success... "has been minimal and in some cases, a total failure." (CA 3-1). "This failure is attributed primarily to climatic conditions," and also to the reclamation methods used.

The short-term use of the mine site would "expose or disturb over 2,149 acres of land surface over the life of the mine." (CA 6-10.) Failure to completely reclaim the disturbed acreage would lead to long-term degradation of both air and water quality.

The DES states that because "successful reclamation has not been fully demonstrated in the existing coal mines in the Hanna Basin area, the company will provide data to prove that reclamation is feasible." (CA 4-1). This data will be provided along with the specific details of the reclamation plan. The DES seems to assume that reclamation is feasible in its choices of the words in the aforementioned sentence of "prove that" rather than "prove whether" in spite of the area's unsuccessfully reclamation history. Given that the DES does not show that reclamation is feasible in the Carbon Basin, the additional data which is to be provided by the company should be in the final ES in order to allow review of this material by the public and other agencies.

3. In general, we agree with the statements that sufficient groundwater data exists to back up the statements that the impact of the mining on the area's groundwater will not be significant. It would be helpful, however, to have a better description of the lithology of the Hanna formation and the various water-bearing units it contains. It would also be helpful to have a discussion of the relationship between the Carbon Basin aquifers and the occasional surface flows in First, Second, and Third sand creeks.

The section on impacts does not discuss the possible impacts on the various creeks due to the removal and impoundment of groundwater in the Hanna formation. Will this removal result in lowering groundwater in alluvium adjacent to the three major creeks? If so, will this reduction

4 result in reducing the amount of surface water? Would such a reduction affect local animal life?

5 A little more discussion on the potential groundwater quality impacts of having much higher permeability in the mined out zone would be in order. Will changes in groundwater quality eventually impact surface water and if so, will impacts be significant?

6 4. The DES's discussion of alternatives is inadequate. Given only the information contained in the one page alternative section, the reader cannot understand the implications and tradeoffs, both economic and environmental, of the alternatives, particularly the "Underground Mining Only" alternative.

7 5. As discussed on pages CA 2-2D, CA 2-28 and CA 3-23 of the DES, critical wildlife habitat, pronghorn farming areas, raptor nesting sites, and sage grouse strutting grounds would be adversely affected by the mining project. Although we defer to the U.S. Fish and Wildlife Service and the Wyoming Fish and Game Department, we believe that these impacts appear to be very significant and should be more fully addressed in the alternatives section.

8 6. Although unsuitability criteria is often mentioned throughout the DES, there is no documentation of the unsuitability criteria evaluation. We believe the unsuitability criteria evaluation should be done before leasing and contained in the final EIS.

Letter 11 Responses

1. The text has been revised (see Chapter 3, Air Quality section, Impact on Air Quality; and Chapter 4, Reclamation section, Mitigation Measures).

2. The ES states that all requirements of SMCRA will be met and that all disturbed lands will be reclaimed. The document also indicates in various sections that the desired vegetation can be established through proper handling of the topsoil, overburden and parting material and through application of proper mechanical and vegetative reclamation measures. The proof required of the company is to provide details of the reclamation measures and show applicability and expected results of the measures. This would be required prior to any mine and reclamation plan approved.

3. Additional data on water-related resources and other potential impacts is not available at this time. Additional data would be provided with any future mine and reclamation plan.

4. Any lowering of the ground water adjacent to the creeks on the project area would not have significant adverse effects on wildlife because there is an abundance of surface water both to the east (Medicine Bow River) and to the west (Eight Mile Lake) of the area.

5. See response 3 to this letter.

6. Chapter 8 has been reviewed. It is considered adequate for this analysis of a leasing proposal. When impacts of the alternative to selected environmental elements or socioeconomic were substantially the same as the impacts of the proposal, those impacts were not repeated in the alternative section.

7. It is felt that the impacts referred to are sufficiently discussed in Chapter 8, Underground Mining Only.

8. The application of unsuitability criteria discussed in this ES is the end result of complete documentation of the various criteria. The data used for the evaluations are filed at the Rawlins District Office, RLM, and are available for public review. The unsuitability criteria evaluation was done prior to or during the preparation of the DES.

April 11, 1979

Mr. Edward C. Coy
 Team Leader
 Coal ES Team
 P. O. Box 670
 Rawlins, Wyoming 82301

REGISTERED MAIL
 RETURN RECEIPT REQUESTED

Re: Carbon Basin Draft Environmental Statement
 Carbon County, Wyoming

Belco Petroleum Corporation Comments

Dear Mr. Coy:

Enclosed is a duplicate original of my letter dated April 11, 1979 which is to be verbally presented by an attorney from Mr. MacPherson's firm at the BLM April 11, 1979 hearing.

I regret that weather prevented me from attending the hearing to enter these comments and have an opportunity to visit with you.

I appreciate your cooperation and assistance in this matter.

Very truly yours,

ARNEX CORPORATION

Arnold D. Cunningham
 Arnold D. Cunningham

AOC/dlg

Enc.
 cc: Belco Petroleum Corporation w/enc.

Township 20N, Range 79W

Section 6 Lots 1, 2, 3, 4, 5E $\frac{1}{2}$

Township 20N, Range 80W

Section 2 A11 (Fee surface and minerals)
 Section 12 NE $\frac{1}{4}$ NE $\frac{1}{4}$, S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$

Township 21N, Range 79W

Section 16 W $\frac{1}{2}$, W $\frac{1}{2}$ E $\frac{1}{2}$
 Section 20 SE $\frac{1}{4}$
 Section 32 SW $\frac{1}{4}$ (Fee surface and minerals)

Township 21N, Range 80W

Section 16 SE $\frac{1}{4}$
 Section 28 NE $\frac{1}{4}$
 Section 36 A11 (Fee surface and minerals)

(2) The subject Draft Environmental Statement includes the proposed construction of certain surface facilities which ignore consideration of development of Belco Petroleum Corporation coal reserves in Section 20 (T21N, R79W) and Section 36 (T21N, R80W). In the case of the proposed diversion channel in Section 36 on DES Map CA 3-5, no consideration has been given to Belco Petroleum Corporation's surface ownership or the effect which the construction of the proposed diversion channel would have on ultimate development of the Belco Petroleum Corporation coal reserves in this section.

In summary, it is requested that the Bureau of Land Management consider expansion of the present boundaries of the DES to include other lands owned by our client, Belco Petroleum Corporation, as well as the United States and third party entities since these other lands are critical to other logical mining plans for development of the uncommitted Federal acreage within the present proposed site specific area.

The Belco Petroleum Corporation reserve position as it relates to development of uncommitted Federal coal reserves in the Carbon Basin area is such that it seems logical that these lands should be included in any environmental study of this area to determine maximum ultimate impact and development.

Respectfully submitted,

Arnold D. Cunningham
 Arnold O. Cunningham
 Authorized Agent for
 BELCO PETROLEUM CORPORATION

AOC/dlg

April 11, 1979

Mr. Edward C. Coy
 Team Leader
 Coal ES Team
 P. O. Box 670
 Rawlins, Wyoming 82301

Re: Carbon Basin Draft Environmental Statement
 Carbon County, Wyoming

Belco Petroleum Corporation Comments

Dear Sir:

On behalf of our client, Belco Petroleum Corporation, I have been authorized to call certain conditions in the Carbon Basin Draft Environmental Statement to your attention.

(1) The boundary of the proposed environmental statement has not been developed to give full analysis to the impact of potential development of coal reserves in the event Edison Development Company does not successfully acquire the Federal coal reserves in the subject area. The Draft Environmental Statement is based on a model mining plan that ignores certain other contiguous and surrounded lands containing coal reserves indicated by published United States Geological Survey maps which could and should be included in a logical mining plan resulting in maximum development of total potential reserves in the area. This includes certain other Federal lands which are presently not included and which would probably never be developed if the proposed plan is implemented.

It is felt that in order to achieve maximum development of all potential coal reserves, additional lands should be included in the environmental impact statement area since these lands form part of a logical mining plan to fully develop the coal reserves in the southern Carbon Basin.

The additional lands include, but are not limited to, specific lands owned or controlled by Belco Petroleum Corporation which are contiguous or surrounded by the DES area and which contain in excess of ten (10%) percent of the total reserves of the considered area including the uncommitted Federal acreage. The Belco Petroleum Corporation lands are described below.

Letter 13 Responses

1. This ES was prepared for site specific environmental impacts involved in the possible leasing of coal in an area contained in lease application H-50061, Edison Development Company. The reasons for this are discussed in Chapter 1, Relation of Carbon Basin to CIVIL Action 75-1749. By this same civil action, the Federal government is enjoined from implementing a new coal leasing program including calling for nominations for Federal coal leasing and issuing any new coal leases. The coal properties as identified by you have been included on map CAI-1 for information.
2. The text has been revised (see map CA3-5).

Advisory
Council On
Historic
Preservation

14

1522 K Street NW
Washington D.C.
20005

April 12, 1979

Team Leader
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

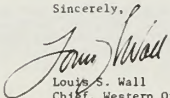
Dear Sir:

This is in response to your request for comments on the draft environmental statement (DES) for Coal Leasing in Carbon Basin Area, Wyoming.

The Council has reviewed the DES and notes that the Bureau of Land Management has determined that the proposed undertaking will not affect properties included in or eligible for inclusion in the National Register of Historic Places. Accordingly, the Council has no further comment to make at this time. It is suggested, however, that the final environmental statement contain the Wyoming State Historic Preservation Officer's concurrence in the BLM's determination of no effect.

Should you have any questions or require additional information regarding this matter, please contact Mrs. Jane King of the Council staff at P. O. Box 25085, Denver, Colorado 80225, or at (303) 234-4946, an FTS number.

Sincerely,



Louis S. Wall
Chief, Western Office
of Review and Compliance

Page 2 - Letter to Team Leader dated April 16, 1979

15

7 | 4. Will the standards for reclamation conservation be strictly enforced?

In the long run no study is of any value if the results are not adhered to and do not become a viable part of any environmental plan.

We do appreciate the opportunity to comment and urge that the conservation of the land be given a high priority in any mining considerations.

Sincerely,

LeRoy Jons, CED
Acting for the County Committee

Letter 15 Responses

1. The one failure indicates that results were less than satisfactory in that some portion or all of the reclaimed area failed to establish satisfactory vegetative cover. Corrective measures could range from some spot seeding or planting to a complete rejuvenation. The premise that one out of three seedings would fail is considered valid. Prior to any mine and reclamation plan approval, reclamation must be proved.

2. See response 1 (this letter) in regard to success expected.

Before reclamation was considered complete on an area, the criteria of Chapter 4 would have to be met. To accomplish this in 4 1/2 years is considered valid when considering the shrub establishment requirement. Grasses would be established in a much shorter time than shrubs and would control erosion to an acceptable level. For shrubs to become established through natural regeneration on non-planted areas between planting would require an additional 10 1/2 to 15 1/2 years, or a total of 15 to 20 years. This time period is not considered excessive when the objective is to establish a diverse and effective vegetative cover.

3. The projections of population given in the FES are lower than a number of other estimates made in the past several years. However, the projections are based on best available data. The borders placed on local communities as a result of anticipated growth are discussed in both Chapters 2 and 3 in the Socioeconomics section.

15



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE

Carbon County ASCS Office
P. O. Box 997
Rawlins, Wyoming 82301

April 16, 1979

Team Leader
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

Dear Sir:

In reviewing the draft environmental statement for the Carbon Basin Area, there are several areas which would indicate more study should be required. The first is in the area of reclamation found in Chapter 3, Page CA3-1. It is postulated that one out of three seedings would fail due to climatic conditions. The fragile environment of Carbon County cannot stand the luxury of a one out of three seeding failure ratio.

2 | Since ASCS is an agency which is delegated the responsibility for cost-sharing with Carbon County producers on conservation practices which includes vegetative cover establishment, a 66% success story for seeding is not good enough. Our record is closer to 80% or more. Because wind erosion is our greatest cause of soil loss, the potential for some stands to take from a 4-year time lapse to as long as 13 1/2 years to establish themselves is poor management. The potential for a maximum amount of soil loss certainly is a possibility.

3 | The second major area of concern is socio-economic one which has implications throughout the entire energy development occurring in Carbon County. The projected populations of Rawlins, Hanna/Elmo, Saratoga, Elk Mountain and Medicine Bow appear to be below that given by other surveys. With this in mind the projected population increases whether more or less than predicted would place an increased burden on the already strained facilities and resources of these areas.

Overall, we feel a lot of effort has gone into this survey, but there still appears to be a need for answers to the following questions:

- 4 | 1. Will the industry provide any help to the cities which will be absorbing the growth of 3,000+ people?
- 5 | 2. What will be the long-term effect on the wildlife in this area from such impact?
- 6 | 3. What will be the final effect of the development versus the agricultural use of the land?

4. There are no known commitments made by the industry to assist communities growing as a result of the proposed action. See revised text, Chapter 2, Socioeconomics, Provision for Revenue Sharing and Taxation.

5. With successful reclamation, application of all mitigating measures noted in Chapter 4, and completion of the Hanna MEP update, no long-term effects upon wildlife are anticipated.

6. During the life of the mine, livestock grazing would be suspended on the project area. With the completion of mining and reclamation of the disturbed areas, the premining uses (livestock grazing and wildlife habitat) would be resumed (Personal communications, Frank Kemp, Company representative, 1979).

7. As stated in the Authorizing Actions section of Chapter 1, the Wyoming Department of Environmental Quality (DEQ) has, through cooperative agreement, the responsibility of administering and enforcing the mining and reclamation requirements.



United States Department of the Interior

HERITAGE CONSERVATION AND RECREATION SERVICE
MID-CONTINENT REGION
DENVER, COLORADO 80225

APR 16 1979

16



MEDICINE BOW
Area
CHAMBER OF COMMERCE
P. O. Box 456
Medicine Bow, Wyo. 82329

April 20, 1979

Memorandum

To: Team Leader, Coal ES Team, Bureau of Land Management, Rawlins, Wyoming
From: Assistant Regional Director, Land Use Coordination
Subject: Review of Carbon Basin Draft Environmental Statement

We have reviewed the above document in accordance with your request, and have the following comments.

We believe the statement needs additional work to show compliance with Section 106 of the National Historic Preservation Act in its treatment of historic and archeological resources. Although the statement indicates that 19% of leasing area has been surveyed for archeological resources, it is unclear which areas were surveyed and which were not, and whether this was a statistically based sample or simply a judgment sample based on other factors.

Although the remaining 81% "will have to be surveyed by the lessee" prior to the issuance of the lease (p. CA 2-31), we are concerned this information may be gathered too late to have any effect on facility siting considerations. For example, the proposed West Portal and associated facilities are located in Section 32, near Sevenmile Lake. The East Portal, its associated facilities, and the railroad spur are located primarily in Sections 28 and 29, in an area within one mile of known springs (see map CA 3-5).

Team Leader
Southcentral Wyoming Coal ES Team
P.O. Box 670
Rawlins, Wyoming 82301

Dear Sirs:

Members of the Medicine Bow Area Chamber of Commerce support Commonwealth Edison's proposed mining operations that will be located 12 miles southwest of Medicine Bow.

Medicine Bow and the Chamber of Commerce, which represents numerous local businesses, are currently planning for the population growth which will result from the proposed mine, and wants to work with the mining company for the good of all of the people involved.

Sincerely,

John Isabel

John Isabel, President
Medicine Bow Area Chamber of Commerce
P.O. Box 456
Medicine Bow, Wyoming 82329

A Historic Past A Promising Future

16



MEDICINE BOW, WYOMING 82329

MEETS FIRST AND THIRD TUESDAYS

April 20, 1979

Larry Stolworthy
Medicine Bow Lions Club
Box 194
Medicine Bow, Wyoming
82329

BLM Office
Team Leader
Coal ES Team
P.O. Box 670
Rawlins, Wyoming 82301

Gentlemen:

This letter is in reference to the study and report on impact problems presented to the Commonwealth Edison Company. We, the members of Medicine Bow Lions Club, would like to bring to your attention the work and preparation that the people of Medicine Bow and Carbon County have done to prepare Medicine Bow for expected growth.

Medicine Bow started laying the groundwork to increase all public utilities about four years ago. Northern Gas Company, Medicine Bow Phone Company, and the REA have all made the necessary preparations to handle public utilities for approximately a 5,000 population.

Water and sewer systems, costing approximately 2 1/2 million dollars are being installed at the present time. These are expected to be in service by the 1st of July, 1979. Water meters will be installed for control of water usage by 1981.

A new municipal building has been built to house city offices, police, and a jail. The new city shop will house the equipment needed for service and protection of the community. This includes a new front-end loader, a new motor grader, a new 1000 gallon high pressure pumper fire truck, and a fully equipped 1976 ambulance unit provided by Carbon County. Other maintenance equipment will also be stored in this facility.

Medicine Bow has a planning zone commission to help organize the growth of this community. In the past year they have approved three housing additions, one 28 unit apartment complex, and one mobile home park. At this time they are working to interest businesses in building a shopping and entertainment center.

A new 400 capacity high school is to start construction this year for use in 1981. This will in turn increase the elementary and Jr. high school facilities.

13

3 The final statement should discuss these issues, indicate future courses of action which would take into account potential impacts on archeological resources by avoidance or appropriate mitigation, and include the views of the Wyoming State Historic Preservation Officer on these matters.

4 In addition, any plans for dealing with important paleontological localities that are discovered in either the Hanna or Lewis Shale geological formations during the course of project activities (see pp. CA 2-3, 2-4) should be discussed in the final statement.

Robert J. Arkins

Letter 16 Responses

- 1. The text has been revised (see Chapters 2, 3, and 4, Cultural Resources).
2. The text has been revised (see Chapters 2, 3, and 4, Cultural Resources).
3. The text has been revised (see Chapters 1, 2, 3, and 4).
4. The text has been revised (see Chapter 2, Paleontology).



MEDICINE BOW, WYOMING 82329

MEETS FIRST AND THIRD TUESDAYS

The fire department is a volunteer organization of about 20 men. These men have raised monies to buy much new equipment to further their efficiency.

The Medical Emergency Volunteers consist of 16 people. Nine of these are EMT's (Emergency Medical Technicians) and 7 are BEC's (Basic Emergency Care). This crew is connected to the fire department by a ten phone emergency system. All volunteer systems cooperate with the others by this intercommunication.

This is by no means a complete list of our present and projected facilities but it is meant to show that we feel the BLM should re-evaluate their study and re-present it to all prospective companies that are planning to come into our area.

Sincerely,

Larry D. Stolworthy

Larry D. Stolworthy
First Vice President
Medicine Bow, Wyoming

Mr. Edward C. Coy
Carbon Basin Draft Environmental Statement
April 20, 1979
Page 2

19

You may wish furthermore, to avail yourself of additional reference material as well as private information which may be obtainable from third parties concerning their acreage in the area, to assume full economical recovery of coal reserves in the Carbon Basin.

Respectfully,

Arnold D. Cunningham
Arnold D. Cunningham
Authorized Agent for
BELCO PETROLEUM CORPORATION

ADC/dlg
cc: Belco Petroleum Corporation

Enclosure to Accompany letter to

Mr. Edward C. Coy
Coal ES Team
Belco Petroleum Corporation Supplemental Comments
April 20, 1979

From Arnold D. Cunningham

19

Selected References Justifying
Coal Occurrences in the Southern Carbon Basin
Carbon County, Wyoming

- Glass, G. B., 1972, Mining in the Hanna Coal Field: Geological Survey of Wyoming Miscellaneous Report, 45 p.
- Glass, G. B., 1978, Coal analyses and lithologic descriptions of five core holes drilled in the Carbon Basin of southcentral Wyoming: Geological Survey of Wyoming Report of Investigations No. 16, 97 p.
- Hausel, D. W., et. al., 1979, Wyoming mines and minerals map: Geological Survey of Wyoming, scale 1:500,000.
- Hettinger, R. D., 1978, Lithologic and geophysical logs of 24 coal test holes drilled during 1977 in the Carbon Basin, Carbon County, Wyoming: U. S. Geological Survey Open-File Report 78-702, 78 p.
- Hyden, G. J. and McAndrews, H., 1967, Geologic map of the T L Ranch quadrangle, Carbon County, Wyoming: U. S. Geological Survey map GQ-637, scale 1:24,000.
- Ryan, J. D., 1977 Late Cretaceous and early Tertiary provenance and sediment dispersal, Hanna and Carbon Basins, Carbon County, Wyoming: Geological Survey of Wyoming Preliminary Report No. 16, 17 p.
- U. S. Geological Survey, 1978, Coal resource occurrence and coal development potential maps of the Halfway Hill quadrangle, Carbon County, Wyoming: U. S. Geological Survey Open-File Report 78-43.
- U. S. Geological Survey, 1978, Coal resource occurrence and coal development potential maps of the Carbon quadrangle, Carbon County, Wyoming: U. S. Geological Survey Open-File Report 78-44.
- U. S. Geological Survey, 1978, Coal resource occurrence and coal development potential maps of the T L Ranch quadrangle, Carbon County, Wyoming: U. S. Geological Survey Open-File Report 78-53.
- U. S. Geological Survey, 1978, Coal resource occurrence and coal development potential maps of the Elk Mountain quadrangle, Carbon County, Wyoming: U. S. Geological Survey Open-File Report 78-51.

Letter 19 Responses

- In the ES, the area under consideration is that which appears in coal lease application W-50061, Edson Development Company. Please refer to Chapter 1, Relation of Carbon Basin to Civil Action 75-1749, for additional discussion.
- The text has been revised to eliminate reference to logical mining unit. Also refer to response 1 (letter 14).

ANNEX
Arnex Corporation
consulting geologists

TWO INVERNESS DRIVE EAST
SUITE 102
ENGLEWOOD, COLORADO 80112
OFFICE (303) 773-3588
TELECOPIER (303) 779-5809
ARNOLD D. CUNNINGHAM
PRESIDENT

April 20, 1979

Mr. Edward C. Coy
Team Leader
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

Re: Carbon Basin Draft Environmental Statement
Carbon County, Wyoming

Supplemental Belco Petroleum Corporation Comments

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Dear Sir:

Pursuant to our telephone conversation of April 11, 1979 and supplementing information in my letter to you of the same date, I call to your attention the following published data which confirms the existence of commercial coal reserves contiguous to the preliminary Carbon Basin DES project boundary and which allows the projection of reserves thru areas which you indicated have been excluded from the DES due to lack of information. This geological information substantiates the existence of commercial reserves and is further documented by previous mining operations in several of the areas in which I understand no geological control has been inferred. Such information needs to be taken into consideration in proper definition of a mining unit in the Southern Carbon Basin. These publications are covered in the enclosed reference sheet.

My client Belco Petroleum Corporation strongly objects to the definition of the LMU as shown in the preliminary DES project boundary and to the proposed construction of certain surface facilities which favors consideration of development of Belco's coal reserves. They have instructed me to inform you that they are prepared to release certain privately developed data which further confirms the existence of commercial coal reserves in the described lands referred to in my letter of April 11th which you have not requested to date and which would further support the inclusion of said lands in the proposed DES logical mining unit boundary. Belco understands that the release of such data would be subject to the same confidentiality conditions as that of other private information released to your agency for the preparation of the subject DES. Upon confirmation of the preceding, I will follow your instructions to communicate such data to you as I have been authorized by Belco to release.

19

UNION PACIFIC RAILROAD COMPANY

1416 DODGE STREET OMAHA, NEB 68179

VALERIE W. SCOTT
General Planning Counsel

April 20, 1979

Mr. Edward Coy
Team Leader
Coal ES Team
P. O. Box 670
Rawlins, WY. 82301

Dear Mr. Coy:

Enclosed are Comments of Union Pacific Railroad Company on the Draft Environmental Statement on proposed coal development leasing in the Carbon Basin Area of Wyoming as well as updated data on Union Pacific Railroad line over which coal from the Carbon Basin Area would be transported.

I hope the comments and data will be of assistance.

Very truly yours,



(Mrs.) Valerie W. Scott
(402)271-4583

Enclosure

cc: Mr. Daniel Baker
Mr. James Lambert
Mr. George Rifakes
Mr. A. D. Weissman

5 should be incorporated by specific reference in the Final Environmental Statement. After all, an important purpose of regional statements, such as Southcentral Wyoming, is to allow later site specific projects, like the Carbon Basin Area development, to be considered in environmental perspective. Incorporation by reference of relevant parts of the regional statement, with revisions necessary to show significant developments, if any, since production of the regional statement, provides such environmental perspective.

6 Page CA1-19, Map CA1-3. The map or a textual reference should indicate that the proposed thirteen mile rail spur connects with Union Pacific main line east-southeast of Medicine Bow, Wyoming. The Union Pacific main line is not shown on this map.

7 Maps in Chapter 2. When comparing the general access and utility map (Map CA1-3 at Page CA1-19) with the maps in Chapter 2, question could arise as to whether effects of the proposed railroad right-of-way have been considered in relation to a number of environmental factors, e.g., raptor nests and habitat. See for example Map CA2-5. The maps in Chapter 2 do not extend out to the spur connection with Union Pacific main line track. Since the Bureau of Land Management has, in fact, examined the effects of the proposed railroad spur on such subjects as raptor nest habitat, it should so indicate either on the map or in accompanying text.

8 Page CA2-44, section entitled Transportation and Utilities. This section contains only one paragraph of two sentences discussing the existing environment along Union Pacific main line. The description is made in very general terms. The treatment of and data on railroad operations from the mine site to the eastern gateways of Council Bluffs and Kansas City contained in the Southcentral Wyoming ES and the Southwestern Wyoming ES should be incorporated by reference in the text of this site specific statement. Union Pacific agrees that the Carbon Basin Area coal development may be considered as a part of the larger Southcentral Wyoming region. However, this should be stated clearly at all points in the Carbon Basin Area statement so that decisionmakers may be reminded of the place of the site specific project in the broader regional context.

9 Page CA2-44, section entitled Transportation and Utilities. In the second paragraph it is stated that 1977 freight traffic through Rawlins averaged 50 trains per day. This figure is not consistent with data submitted to the BLM

2

April 20, 1979

Comments of
Union Pacific Railroad Company
Draft Environmental Statement on
Carbon Basin Wyoming Coal Development

1 Page i Number 4, Alternatives Considered. It is said that five alternatives are assessed in Chapter 8 whereas the language indicates only three alternatives have been considered. What happened to the other two? The Chapter 8 discussion includes only three alternatives rather than five.

2 Page CA1-1 top of the right-hand column. Here it is stated that the mine life is expected to be beyond the 40 years stated in the Mine and Reclamation Report. What basis is there for this statement.

3 Page CA1-1 right hand column. There is no mention here of a formal application filed for right-of-way from Union Pacific main line near Medicine Bow to the Carbon Basin Site. This should be corrected. Refer to Page CA1-14 where right-of-way application W-57224 is acknowledged.

4 Page CA1-1 over to CA1-11. The analysis contained in this draft environmental statement is necessarily preliminary, because only preliminary reports on the issue of suitability of leasing have been presented to the agency. This means that data in certain subject matter areas is less exact at this time than later. Nevertheless the entire scope of the project, and ancillary activities, must be considered. While discussions with staff have indicated that the full scope has been considered as this particular project relates to the greater Southcentral Wyoming region, the fact of this consideration is not explicitly clear in the text at this point. The relationship of this draft environmental statement to the regional environmental statement for Southcentral Wyoming should be set forth at this point and other places in the DES.

5 Page CA1-13, section entitled Relation of Carbon Basin to Southcentral ES. The reference to the Southcentral Regional Environmental Statement is helpful. However, this is the only place where the relation of this DES and the regional statement is set forth. The analysis in the Southcentral Wyoming ES and, for that matter, the Southwestern Wyoming ES concerning impacts of transportation of coal by railroad

9 by Union Pacific in connection with the Southwestern Wyoming Environmental Statement. That data indicated that, as of October 1977, traffic per day was between 44 and 45 trains, through freight only. Updated traffic and capacity figures covering Union Pacific main line segments from the Carbon Basin Area to the eastern gateways of Council Bluffs and Kansas City are submitted with these comments as an appendix. The small magnitude in change from similar figures in Southcentral and Southwestern Wyoming analyses indicates that conclusions drawn in those studies remain generally valid. At this preliminary stage, it is not possible to state with any substantial degree of certainty which routes or carriers would continue movement of proposed action coal to the Chicagoland area beyond those eastern gateways. As to movement of proposed action coal to the gateways from Wyoming, it is still too early to state with confidence how much might move to each gateway although some would probably move to each. It is certain that all would move from Wyoming to Gibbon where the main line divides to the gateways.

Chicago and Northwestern Transportation Company (C&NW) and Union Pacific are presently collaborating on a possible movement of coal from the Eastern Powder River Basin. If the plans become a reality, Union Pacific main line in Nebraska over which Carbon Basin Area coal would move would also experience increased volumes from Eastern Powder River Basin. Since this is presently speculative and, at the most, only very indirectly related to Carbon Basin, and since the Federal Railroad Administration is presently developing an Environmental Impact Statement in connection with review of a C&NW loan guarantee application (See 44 F.R. 5041), further detailed environmental analysis at this time by the BLM is not warranted.

10 Page CA3-3, Table CA3-2. The figures for New Rail Spur appear to be in error. First of all, there is question as to whether figures given are in miles or in acres. Some may be in miles, others may be in acres. Secondly, there is ambiguity as to what is covered by the numbers given for New Rail Spur. That is, does this table relate only to the Carbon Basin project or to other mines, as may be inferred from the column entitled Existing Mines and non-coal development and from the title of the table. This should be examined closely and corrected if necessary.

11 Page CA3-3, Table CA3-2 in footnote 7 indicates that data on new power lines, new rail spur, new pipelines and new access roads is "future estimates based on past occurrences." A more specific reference should be made to data on which these figures are based.

- 11. Page CA3-4, first full paragraph in the left-hand column. While it is not a major source of fugitive dust, every unit coal train may be considered a minor source of fugitive dust as it moves from the mine site to its ultimate destination. Even this minor dispersal of dust seems to occur mainly in the initial miles of a trip. These facts should be mentioned in this text.
- 12. Page CA3-4 and related Table CA3-4 at Page CA3-6. The type of emissions from major sources should be identified. Although there is an implication that the figures in the table are fugitive dust emissions, this is not clear in either the text or the table. The type of emissions should be identified also for Tables CA3-3 and CA3-4.
- 13. Page CA3-4, the second to last paragraph prior to the section entitled Impact on Air Quality. It must be recognized that exhaust emissions are also produced by diesel-powered locomotives.
- 14. Page CA3-5, Table CA3-3. Please state the source of the dust emission factor for train loading of 0.0002 lb/ton loaded given at the bottom of the table. Apparently, the source may be PedCo Environmental Inc. 1978, however, this is not clear. This figure has appeared without citation to its source in other environmental statements and the specific source should be explicitly stated.
- 15. Pages CA3-8 through CA3-11, Maps CA3-1 through CA3-4 seem to indicate a dispersal of ambient particulate concentrations more to the northeast than would be apparent from the wind star at page CA2-2. While this, admittedly, is a wind star for the Rawlins area far to the west, these maps should be checked and verified.
- 16. Page CA3-12, subsection entitled Scoria. Union Pacific will not need any scoria in its fill material.
- 17. Page CA3-23 and Map CA3-6 at Page CA3-25. The statement that thirty acres of critical nesting habitat for sage grouse would be destroyed by construction of the railroad spur is probably an exaggeration. In our opinion critical nesting habitat may be disturbed but not destroyed. However, it is more troublesome that the railroad right-of-way is not shown on the map. Please refer to a previous comment on this subject. The agency should correct this deficiency by suitable comments in the text.

4

Traffic and Capacity Data
Carbon Basin Area Environmental Statement
ESTIMATED CAPACITIES OF IDENTIFIED LINE SEGMENTS

Segment	No. of Tracks	Signaling	Length (Miles)	Estimated Capacity (trains per day)	Current Traffic (trains per day)
Kansas City to Topeka	2	ABS	68	55-60	38
Topeka to Gibbon	1	CTC	203	25-30	24
Gibbon to Council Bluffs to Council Bluffs to Gibbon	2	ABS	176	55-60	39
Gibbon to North Platte	2	ABS	100	55-60	61
North Platte to Cheyenne	2	CTC	8	70-80	54
Cheyenne to Cheyenne to Hanna	3	CTC	98	55-60	53
Hanna to Rawlins	2	CTC	35	100-115	45
Rawlins to Rawlins	2	CTC	40	70-80	45

* Capacity for a given segment of track is greatly influenced by factors other than simple arithmetic train count. Factors such as grades, numbers and lengths of sidings, running speeds, competition in the yards or terminals at segment ends, and the mix of box trains, manifest trains, and unit trains, which vary in speed and length, are also important characteristics. The two most important factors in determining traffic capacity along a given line segment are the number of tracks and type of signaling. Manual and double track systems have the highest capacity, followed by automatic block signaling systems. CTC systems have the lowest capacity. Current traffic is through freight only. The figures indicated are general averages and may vary substantially on any given day. There are also seasonal changes in traffic which are not directly reflected in these figures. Union Pacific Railroad Company, April, 1983.

- 18. Page CA3-32, Table CA3-12. The table indicates there would be no employment impact of the proposed action on the railroad. This is not true. A Union Pacific study indicated a need for four or five permanent employees due to operation along the spur.
- 19. Page CA3-34, section on Transportation and Utilities. This section on the impacts of the proposed action on transportation and utilities should incorporate by reference material in the Southcentral and Southwestern Wyoming Regional Statements as well as give updated figures on traffic and capacity on Union Pacific line segments east of Medicine Bow to Council Bluffs and Kansas City.
There was a claim in the Southcentral Regional Environmental Statement that severe burdens would be placed on communities of Sidney and Grand Island, Nebraska, and Julesburg, Colorado, if grade separations were not constructed. Union Pacific objected to that claim in the previous statement and objects at this time. In addition, Union Pacific challenges the conclusion that an increase of 3.8% of the total train volume due to the proposed action will result in air pollution, noise emission and traffic delay increasing significantly. 2.7 trains per day simply will not have a significant environmental effect on Union Pacific main line traffic nor will that small increase in traffic level degrade the environment in any significant way along the main line right-of-way.
- 20. Pages CA6-2 and CA7-1. Scoria is not needed for railroad road bed.

Letter 20 Responses

1. The text has been revised (see Summary, items 3A and 4).
2. The mine and reclamation report stated that recoverable reserves are approximately 200 million tons and that mining would be at a rate of 5 million tons per year; therefore, it would take 40 years to mine the reserves. However, geological data indicate that there are approximately 400 million tons of coal reserves. It is estimated that the recoverable reserves exceed 200 million tons, but that estimate needs to be confirmed. With a recoverable reserve in excess of 200 million tons, the mine life would extend beyond 40 years at a rate of 5 million tons per year.
3. The discussion in the Proposed Action section is intended to identify the action for which the EIS is written. As a part of the possible development of the lease, certain other actions are necessary such as the issuance of needed rights-of-way. The rights-of-way are identified as needed and are summarized on Table CA1-3. It is felt that the existing identification in the EIS is sufficient.
4. The total impacts of the Carbon Basin Project in relation to the Southcentral Regional Environmental Statement are discussed in text and tables in Chapter 3.
5. The impacts in relation to coal transportation from the proposed project, southcentral region and southwest region, are identified in the text in Chapter 3 and specifically shown in Tables CA3-13 and CA3-14.
6. The map has been revised in the FES (see Chapter 1).
7. The text has been revised. See discussions concerning nongame birds, game birds, and nongame mammals in the Fish and Wildlife section of Chapter 2.
8. The text has been revised (see Chapter 3, Socioeconomics, Transportation and Utilities).
9. The text has been revised (see Chapter 2, Socioeconomics, Transportation and Utilities).
10. This table has been revised and moved to another part of the text. See Chapter 1, Interrelationships, Relation of Carbon Basin to Southcentral ES).
11. The estimates given were derived from unpublished data and through consultation with others familiar with impacts of the kinds of rights-of-way discussed.
12. As noted in the comment, the majority of the coal dust lost from the coal cars would occur in the first few miles of travel at top speed by the train.
13. All figures include fugitive dust and TSP emissions. Tables CA3-3 and CA3-4 have been revised. They have been renumbered CA3-2 and CA3-3, respectively.

14. The text has been revised (see Chapter 3, Air Quality, Emissions from the Proposed Mine).

15. Table CA3-3 has been revised.

16. The isopleth analysis shown in Figures CA3-1 through CA3-4 are worst case and average dispersion conditions computed using the STAK (stability array) Data Deck for Rawlins which incorporated the information shown in Figure CA2-1. The figures represent the highest possible concentrations for each situation; therefore, the direction of the isopleth may not coincide with the prevailing wind direction of the wind rose.

17. The text has been revised (see Chapter 3, Geology, Minerals, Sand and Gravel).

18. The estimated 30 acres of critical nesting habitat that would be destroyed was derived by estimating the length and width of the area disturbed by the railroad spur inside the nesting area (Map CA3-6). Should the railroad be constructed, no nesting would be possible where tracks, ties and ballast are located.

19. The projections of railroad employment were provided by local UP representatives during preparation of the DES. At that time figures were not available to estimate the employment increases attributable to individual mining activities. While this new information is appreciated, the resulting changes in Table CA3-12 would be insignificant (less than a 0.6 percent change in 1985 employment and a 0.4 percent change in 1990 employment). Accordingly, this table has not been altered.

20. Chapter 1, Interrelationships, Relation of Carbon Basin to Southcentral FES, discusses the relation between the proposed action and the regional assessment of coal development in southcentral Wyoming. It is the intent of this section to incorporate all information in the Southcentral FES into the Carbon Basin FES. The Southcentral FES derives transportation information from the Southwestern FES as appropriate in discussing traffic on the DP line in the region. Receipt of the updated traffic and capacity figures (corresponding to Table R2-33 of the Southcentral FES) is acknowledged.

21. The FES has been modified to indicate that local officials of Sidney and Grand Island, Nebraska, and Julesburg, Colorado, feel that severe burdens would be placed on their communities, respectively, if grade separations were constructed. Use of the word "significantly" has been dropped from the FES in discussing impacts from air pollution, noise emission and traffic delay. These impacts would increase commensurately with the increase in total train volume.

22. The text has been reviewed and found to be adequate.

The following is a summary of issues raised by Commonwealth Edison in their comment letter concerning the adequacy of the DES. A complete copy of the comment letter is on file at the BLM, Rawlins District Office. Copies of the Commonwealth Edison letter may be obtained from Andrew D. Weisman, representative for Commonwealth Edison, 815 Connecticut Avenue, N.W., Washington, D.C. 20006. Some issues (under the heading "Summary of Issues") are paraphrased and others are presented verbatim from the comment letter. A response follows each issue presented. Each response has been given a number to correspond with the numbered issue which precedes it.

Letter 22 Summary of Issues

1. Commonwealth Edison believes the DES should be expanded to include a statement concerning the demonstrated need to develop the Carbon Basin Reserves.
2. Commonwealth Edison expressed the following concerns in regard to BLM authority on private lands and to land reclamation:

"3. A statement also should be added to the description of the proposed federal action in Chapter 1 of the DES, emphasizing the extremely limited nature of the surface impacts associated with the proposed project, especially on the lands which overlay the federal reserves....

"For a mining operation of the expected size of the Carbon Basin project, therefore, the predicted surface impacts are unusually limited in scope. In addition, most of those impacts are expected to occur principally on the private tracts, with only minimal disturbance on the surface overlaying the federal reserves. The DES should be revised to reflect these facts.

"4. The fact that surface mining will be restricted entirely to the private tracts also raises serious questions concerning the extent of BLM's authority to propose lease stipulations pertaining to the manner in which the surface mining will be conducted....

"The question of whether the surface mine should be included within the scope of the DES, however, is an entirely different question from whether it is subject to BLM control.

"Before developing the surface reserves, Edison Development intends to apply for all required permits under state and federal law. In addition, the company of course will comply with any necessary restrictions imposed by the State of Wyoming or OSM in order to insure that surface mining proceeds in an environmentally sound matter....

"Under these circumstances, we see no apparent justification for BLM imposing additional conditions with respect to the surface mine, especially since Edison Development Company fully intends to comply with any restrictions imposed by OSM or the State of Wyoming, which clearly have primary jurisdiction in this matter....

"...we question whether BLM has the authority to impose any reclamation requirements with respect to the planned surface mine, other than the requirement that Edison Development Company comply with the applicable requirements of the Surface Mining Control and Reclamation Act, and with any requirements imposed by Wyoming authorities pursuant to Wyoming or federal law...."

3. Commonwealth Edison also stated they believe "that many of the proposed reclamation requirements directing the use of specific techniques are premature at this early stage of planning for the project when a detailed mining and reclamation plan has not yet been prepared...."

4. A question was raised "...whether it is appropriate to insist upon reclamation requirements for the surface mine which are more stringent than those which apply under the Surface Mining Act...." Commonwealth Edison stated that "SMCRA now is the law of the land, and we intend to abide by it in any mining operations we conduct...."

"We do believe, however, that the limited benefits to be obtained from reclamation in this case are quite pertinent in determining the extent to which additional reclamation requirements should be imposed....

"...we believe that the relative costs and benefits of the requirements which have been proposed argue strongly in favor of a more moderate approach. We, therefore, urge the Bureau to modify its proposed stipulation, to conform to the requirements of SMCRA...."

The primary concerns regarding wildlife problems focus on the following points:

5. Restrictions on power line construction standards.
6. Effects of the project on raptors and their nests.
7. Buffer zones around sage grouse leks.
8. Vehicle restriction provisions.
9. Definition of critical as used in this document.
10. Commonwealth Edison is also concerned about the manner in which the coal unsuitability criteria were determined and applied in the DES. Other concerns were with the definition of an active eagle nest and whether alternatives were considered on eagle nest sites.

Letter 22 Response

1. The Carbon Basin area has been identified for coal development without considering any individual or company need. If the Secretary determines that there are resulting impacts to other resources in the area, he may decide not to lease or grant the right-of-way. The lease, if issued, will be a competitive lease awarded under competitive bid procedures (FCLAA of 1976) and criteria contained in the U.S. District Court Order and its amendment. The ES is a treatise on the environmental aspects of the proposed action only.

REC'D
APR 23 1979

The Medicine Bow Jaycees
P.O. Box 100
Medicine Bow, WYO.

Dear Sirs;

The Medicine Bow Jaycees would like to please their support for the Edison Coal Mine Operations proposed by the Edison Coal Co. We feel it would greatly help economy of Medicine Bow and Weston County to provide jobs for many people.

We feel that the impact of people would give businesses the incentive to invest in Medicine Bow and provide some of the services needed here such as; doctors, dentists, and more stores for shopping.

As a coal miner myself I don't think the impact will hurt the wild life primarily the deer and antelope as we have them around our mine all of the time and their not frighter of the equipment.

This opportunity would not only benefit the growth of Medicine Bow but also the economy of the Nation.

Sincerely,
The Medicine Bow Jaycees
The President;

Hallam D. ...



Game and Fish Department

Cheyenne Wyoming 82002

EARL M. THOMAS
DIRECTOR

April 25, 1979

ED HERSCHLER
4/27/79
FD
NO
L-10
L-11
L-12
L-13
L-14
L-15
L-16
L-17
L-18
L-19
L-20
L-21
L-22
L-23
L-24
L-25
L-26
L-27
L-28
L-29
L-30
L-31
L-32
L-33
L-34
L-35
L-36
L-37
L-38
L-39
L-40
L-41
L-42
L-43
L-44
L-45
L-46
L-47
L-48
L-49
L-50
L-51
L-52
L-53
L-54
L-55
L-56
L-57
L-58
L-59
L-60
L-61
L-62
L-63
L-64
L-65
L-66
L-67
L-68
L-69
L-70
L-71
L-72
L-73
L-74
L-75
L-76
L-77
L-78
L-79
L-80
L-81
L-82
L-83
L-84
L-85
L-86
L-87
L-88
L-89
L-90
L-91
L-92
L-93
L-94
L-95
L-96
L-97
L-98
L-99
L-100

Mr. Daniel P. Baker, State Director
Bureau of Land Management
2515 Warren Avenue
Cheyenne, Wyoming 82001

DIS 247, Carbon Basin Area

Dear Mr. Baker:

We offer the following comments on the Draft Environmental Statement (DES) on the proposed coal leasing in the Carbon Basin Area, in order that the FES can be more complete and accurate in considering the wildlife resource.

Page CAI-11 - Preleasing Inventories and Analysis.

Game and Fish Department inventories were conducted in 1977. The lease area was surveyed for raptors by this Department under contract to Bureau of Reclamation in 1978. We are not certain these data were used. The 1978 survey area was a little over 2,000 square miles and the southwest corner of the study area included the coal areas in T21N, R79W, and T21N, R80W. Seven areas of crucial nesting habitat for raptors were delineated in this raptor survey. Two of those crucial nesting areas delineated on the attached map overlap the Carbon Basin coal area. These two areas of nesting habitat make up less than 3% of the total area surveyed, yet, they contribute significantly to the nesting raptor population in the area (Table 1). Foraging raptors were observed heavily using the large flat between the town of Medicine Bow and crucial nesting habitat "B".

Significant raptor population declines in the Medicine Bow area can be expected if coal mining activity results in any of the following occurring in crucial nesting areas A & B:

1. Increase in human activity, especially from March through July.
2. The physical structure of the area is altered, especially rimrocks, cliffs, or escarpments.
3. Vegetation mosaic is altered, especially ponderosa pine, riparian and mountain mahogany.
4. Reduction of the prey base occurs, especially prairie dogs, jack-rabbits and cottontails.

Mr. Daniel P. Baker
April 25, 1979
Page 2

- 1 Destruction of a significant portion of habitat in the area south of Medicine Bow and north of crucial habitat B would negatively impact raptors by reducing available foraging habitat.
- 2 A large variety of nongame birds were observed in these areas. Important habitats contributing to the faunal diversity included rimrocks, stands of ponderosa pine, mountain mahogany, and riparian habitat.

Page CAI-13 - Preleasing Inventories and Analysis.

- 3 We support the development constraints mentioned on Page CAI-13. The only problem we have with these is that there is a great deal of leeway in interpreting the constraints. For example, Constraint 3 says "...critical antelope winter habitat will be managed to support the existing antelope population in the planning unit." Does this mean that critical antelope habitat will be preserved, or that it will be sacrificed if the total number of antelope in the planning unit does not decrease? The number of antelope in the planning unit may not change while the number of antelope in the herd is decreasing. There are similar problems with Constraints 2, 5, and 6.

Page CAI-14 - Ancillary Facilities.

- 4 The railroad spur should not be fenced.

Page CAI-17 - Topsoil Removal and Disposition.

- 5 What species of quick-growing grasses will be used to temporarily seed the topsoil stockpiles? Crested wheatgrass should not be used.

Page CA2-17 - Water Use.

- 6 How many livestock reservoirs will be removed? Will the livestock reservoirs be replaced after mining?

Page CA2-17 - Riparian.

- 7 "There is no riparian vegetation on the proposed project area." This is not correct. Figure CA2-2 shows willows and cottonwoods along Third Sand Creek. These constitute riparian vegetation, albeit not well developed.

Page CA2-20 - Terrestrial.

- 8 The Uinta ground squirrel, according to C.A. Long (1965) Mammals of Wyoming, is not found east of Rock Springs.

Mr. Daniel P. Baker
April 25, 1979
Page 7

The provisions for a buffer zone along the Medicine Bow River indicate a positive consideration for the fisheries resource in regulating the mining activities.

If we can be of further help on this project do not hesitate to contact us.

Sincerely,

W. DONALD DEXTER, ASSISTANT DIRECTOR
WYOMING GAME AND FISH DEPARTMENT

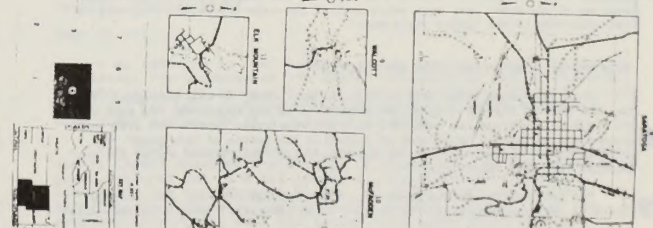
WDO/HBM/mlr
attn. (2)
cc: State Planning Coordinator
Fish & Wildlife Service Coal Coordinator
Coal ES Team Leader, BLM Rawlins
Game Division
Fish Division



Table 1. Number of nesting pairs of diurnal raptors in a crucial nesting habitat and Medicine Bow Survey Area, 1978.

Species	Area		Totals of A and B	Total of Study Area
	A	B		
Red-tailed Hawk	1	2	3 (27.3) ¹	11
Swainson's Hawk			0 (0)	9
Ferruginous Hawk	1	3	4 (16.7)	24
Golden Eagle	4	6	10 (25.0)	40
Prairie Falcon	3	5	8 (38.0)	21
All species combined	9	16	25 (23.9)	105

¹ Number in parenthesis is the percentage of the total number of nesting pairs documented in the 2,000 + square mile study area.



- 9 Ferruginous hawks occur on this site. They nested on this site in Section 21, T21N, R80W, in 1976 and 1977. The project area is undoubtedly also hunted by great horned, long-eared, and screech owls. There are great horned owls nesting on-site. Buteo nest occupants were not identified in the text--which species used those nests? Whether these nests were active or inactive was not mentioned in the text.
- 10 We do not agree with the "best estimates" of small bird densities. There should be some published data on which this estimate can be based. Were there reports produced by Mr. Schroeder during his studies of the area near Saratoga? If so, the reports should be cited.
- 11 There seem to be a rather large number of raptor nests on this site. Is this site suitable for mining only because it is largely an underground mine? Many of the raptors on this site are using the riparian habitat along the Medicine Bow River, so the buffer zones around these nests are inappropriate.
- Page CA2-24 - Game Birds.
- 12 Stockponds on this lease are used for nesting by mallards, gadwall, and wigeon, and for resting by migrating waterfowl and shorebirds.
- Page CA2-24 - Mammals.
- 13 Burt and Gossenheider's mammal field guide was published in 1964, not 1976. Why not use C.A. Long's publication which is state-specific?
- 14 Several of the nongame species which should occur here do not because the habitat is the wrong type. Although the range of the red squirrel, porcupine, and beaver overlap this area, there are few on-site because of lack of habitat.
- 15 The final report of the 1978 ferret survey conducted by the Fish and Wildlife Service noted that trenching was seen on Carbon Basin. A ferret skull was found during a Bureau of Reclamation-funded ferret search in 1978 about six miles east of this site, along the McFadden-Medicine Bow Road. The identity of the skull was verified by the Smithsonian Institution. Yet, the Fish and Wildlife Service feels there is little likelihood of ferrets occurring on this lease. With 2,744 acres of prairie dogs on the lease and the recent finding of a ferret skull nearby, we believe that there is a very good chance of ferrets occurring on this site. Certainly the occurrence of the species cannot be discounted.
- Map CA2-6 - Bird and Small Mammal Distribution.
- 16 A great deal of the critical sage grouse habitat for the strutting ground in Section 20, T21N, R79W, has been deleted from this map. This

- 16 would increase the acreage of critical nesting habitat destroyed by the railroad spur (CA3-23). Since much of the critical habitat for two strutting grounds overlap in the area to be surface mined, impacts should be very large.
- Page CA3-18 - Water Use.
- 17 We note in Table CA3-2 that yearly water use by this mine will be nearly as great as that by all other proposed mines in the region. The phrase "relatively inexpensive" is used to describe the additional cost required to enlarge water systems to include this mine and the people drawn to the region because of the mine. How much extra cost of the water projects is related to the existence of the Carbon Basin mine?
- Page CA3-22 - Vegetation, Fish and Wildlife.
- 18 What vegetation types will actually be disturbed, in what acreages? That is, how much of the 2,149 acres disturbed will be big sagebrush, how much will be birdfoot sagewort, how much will be other vegetation types? How will underground mining disturb vegetation as stated on the bottom of this page? We presumed that, except for some surface facilities, underground mining did not disturb very much vegetation.
- 19 "As provided for in the Hanna Area MFP, critical habitats will be regulated to the degree necessary to protect these habitats." What does this mean?
- 20 Raptors, state-listed rare species, and other game species, including migratory game birds are species of high state interest. What impacts will occur to those species?
- Page CA3-23 - Birds--Game.
- 21 It apparently is acceptable to mine 5.5% of the critical sage grouse habitat on this site, but public access to the rest of the habitat will be restricted to protect the critical habitat. There has previously been little restriction of public access to this area with little documented effect on sage grouse or sage grouse habitat. We do not believe that restrictions should be placed upon the public as a result of problems caused by mining. Perhaps company-funded mitigation in the form of habitat improvement is a better alternative.
- 22 Much of the sage grouse brood rearing habitat along Third Sand Creek associated with the strutting grounds in Sections 19 and 20 will be destroyed. Brood-rearing habitat near water sources is important to the survival of sage grouse.

- Page CA3-23 - Mammals--Game.
- 23 What data support the assumption that loss of 468 acres of critical winter range for pronghorn would have "little or no detrimental effects upon the herd"? Is surrounding habitat able to absorb displaced animals? Is this true every year regardless of weather and snow patterns?
- 24 Sources of wildlife water are important to livestock and most species of wildlife. Loss of these water sources could significantly affect wildlife. Sedimentation ponds may offset or enhance this situation. Poaching and harassment of raptors, sage grouse, and big game all occur in areas of high human activity. Aside from keeping everyone off this site, what impact-reduction methods are possible?
- 25 Again, measures are proposed to restrict public access to protect wildlife in response to loss of habitat due to mining. What literature documents detrimental effects of public access on pronghorn fawn survival? Throughout Wyoming in past years, pronghorn have exhibited very good fawn survival without restrictions on public access. Restriction of the activity of mining vehicles and personnel, both of which are on-site continually, may be a good idea, however. It is extremely inconsistent to restrict access on all areas except those where mining will occur.
- Page CA3-27 - Hunting.
- 26 Impact of this project on hunting on this site is neither clear nor quantified. Will public access for hunting be restricted on the lease? There will undoubtedly be decreases in both quality and quantity of hunting as a result of population increases. A finite number of hunters can be accommodated, and beyond that number, there is no further hunting. Increased demand for hunting in permit-only areas (and this is a permit-only area for both antelope and deer) results in decreased chance of hunting for all potential participants.
- Page CA4-1 - Reclamation.
- 27 All of the mitigating measures mentioned here should be included in the mine plan. Use of an annual plant mulch, because of the decreased expense yet similar effect on soil moisture and soil stability, might be considered. Details can be obtained from the High Plains Agricultural Research Station in Cheyenne. We support designating these mitigating measures as mandatory because present technology makes reclamation questionable, and elevation of standards is justifiable so that adequate reclamation is ensured and environmental disturbance is minimized.

- Pages CA4-1 through CA4-7 - Lease Stipulations To Provide Mitigation.
- 28 (12) Cottonwoods and willows should be replaced on-site.
- 29 (17) What types of fences will be used to exclude wildlife and livestock from reclamation plots and livestock from the permit area? Details should be included here.
- 30 Additional Lease Stipulations - We have problems with restrictions of public access, as mentioned above.
- Page CA5-2 - Unavoidable Adverse Impacts.
- 31 What increase in poaching and animal-vehicle collisions is expected?
- 32 Mitigation of the 10% increase in recreational demand might be accomplished through company-funded leases or easements on private lands in the region, or easements through private lands to public lands. Although increased recreational demand is unavoidable, it might be mitigated.
- General Comments.
- 33 Vehicle-animal collisions will increase as a result of this project. Collisions of antelope with trains on the main Union Pacific line were severe in the past winter. We presume that coal train traffic from this mine will be slow enough not to accentuate that problem.
- 34 All fences on the project area should be constructed to ELM and Game and Fish Department specifications. Fences constructed to exclude antelope and cattle from newly-planted reclamation sites should be built in such a way that entrapment does not occur.
- 35 In the Hanna Basin Coal Unsuitability Study, an area of 1/4 mile radius around sage grouse strutting grounds was unsuitable for mining. Criterion 15 should be applied in a similar manner to the lek on Section 20, T21N, R79W.
- 36 Do burrowing owls occur on this site? If so, will they be impacted by the project?
- 37 We believe that actual impacts of this mine have been minimized in this EIS, especially cumulative impacts of this and all of the other mines in the Hanna area. The cumulative impact of mining and related urban development and population growth on wildlife and wildlife-related recreation have not been considered.
- 38 All of the assumption of impact mitigation is based upon reclamation, yet we have no assurance that it will succeed. If not, wildlife will not be reestablished on this minesite.

Letter 23 Responses

1. In November 1976, the BLM contracted the Wyoming Game and Fish Department to study wildlife in the southcentral Wyoming coal regional area of which Carbon Basin is a part. This contract, number YA-512-RFP7-3, for \$62,067.00 was completed in late 1977. These data were used in the preparation of the Carbon Basin ES wildlife sections. In addition, BLM and Fish and Wildlife Service biologists surveyed the Carbon Basin area according to existing laws and regulations concerning protection of raptors. The Bureau of Reclamation data provided with this comment is used in impact analysis in concert with all other data available to BLM. Significant reductions in the prey base for raptors should not occur as the bulk of the Carbon Basin area would be mined by underground methods and not by surface mine procedures. Also see response 7 to letter 20.
2. Nongame birds are discussed in Chapter 2, Fish and Wildlife section. The various habitats mentioned in the comment are present only in limited areas, except for riparian habitat which is nonexistent.
3. The guidelines for the constraints are presented in the Hanna MFP (the BLM land use plan). The analyses presented in this FES are based upon these guidelines. The details in the Hanna MFP are available for public inspection at the Rawlins, Wyoming, District Office of the BLM.
4. There are no plans to fence the railroad spur, though not stated in the text. Negative declarations are not presented in the FES unless they concern a critical issue or are absolutely necessary for clarification.
5. Mitigation measure 3 (Chapter 4) provides for seeding fall rye and sodar streambank wheatgrass on topsoil piles.
6. Based upon the mine and reclamation report, no livestock reservoirs would be removed.
7. There is no riparian vegetation on the proposed project area. The riparian vegetation shown on Figure CA2-2 occurs off the project area on Third Sand Creek just east of the project boundary.
8. The Uinta ground was deleted from the list of mammals (see Chapter 2, Fish and Wildlife section, Habitat Types).
9. The ferruginous hawk nest mentioned is identified on Map CA2-5 as is a great horned owl nest. The buteo nests were located by FWS biologists who identified them only as buteo nests and did not state whether or not they were active.
10. Mr. Schroeder's work is in press.
11. The site is considered acceptable for further consideration for coal development pending further studies of the golden eagle and falcon nests. The site is not listed as suitable for further consideration under Unsuitability Criteria 11 and 13.
12. The ES has been reviewed and found to be adequate.
13. The date is correct as we used the 3rd edition published in 1976. Long's publication was not available at the time the ES was written.
14. None of the species mentioned in the comment are mentioned in the ES.
15. The Fish and Wildlife Service, in a letter dated September 27, 1978, stated that no observations or signs of black-footed ferrets were found on the Carbon Basin area. To the best of their knowledge the ferret does not occur on site.
16. Map CA3-6 indicates portions of the critical sage grouse nesting habitat that would be destroyed by the railroad spur. This totals about 30 acres of critical nesting habitat outside the project area that would be destroyed.
17. Water systems in all towns are going to have to be enlarged to accommodate the natural population increases effected. In relation to the whole, increased water use resulting from Carbon Basin is less than 7% of the total use in the county. It is expected that the cost increase involved in providing water needed under the proposal would be less than 7% of total expenditures.
18. The text has been revised (see Chapter 3, Vegetation, Terrestrial).
19. The statement means that all multiple use activities within critical wildlife habitat will be evaluated and regulated to protect that habitat.
20. Significant impacts to all avian species are discussed in Chapter 3.
21. Public access to this area has not yet been restricted. However, with the influx of more than 1,000 miners into the area, harassment would increase measurably. Restriction of public access from March 1 through June 30 would not inconvenience hunters and would reduce excessive harassment from indiscriminate use by mine personnel after shift changes.
22. As the areas in Sections 19 and 20 are above underground coal mining areas, it is not felt that any habitat would be destroyed.
23. The text has been revised (see Chapter 3, Fish and Wildlife, Mammals).
24. See response 43 to letter 4 for an answer on water concerns. Chapter 4 details mitigation measures designed to reduce harassment by expanded human populations to the wildlife resource.
25. See response 21 to this letter.
26. Hunting would not be restricted over the entire lease area. It would be limited in those areas of the project where safety problems would arise, where access could be blocked by actual mining, where surface facilities would be located, and where increased traffic would tend to drive wildlife away. In addition, hunters generally prefer to spend their leisure time hunting in an area where human activity and surface disturbance are limited. It is not anticipated that a significant number of permits would be reduced from the present number; however, it is likely that a portion of the proposed

lease areas would not be desirable for hunting purposes (Frank Kemp 1979 Personal Communication).

27. The use of a crimped-in mulch is preferred over an annual plant mulch.
28. There are no cottonwoods or willows on site.
29. The text has been revised (see Chapter 4, Mitigation Measures).
30. See response 21 to this letter.
31. Impacts from poaching and from animal-vehicle collisions have been added to the FES text in Chapter 3, Fish and Wildlife section).
32. There is no authority to require the company to purchase leases or easements to open up private or public land. It is possible for other governmental entities (federal, state and local) to enter into a cooperative agreement with the company to insure that all private land under their control, especially areas outside the proposed mine, would be opened and would remain open to public use.
33. Wildlife/vehicle collisions would increase in this area. Coal trains would be moving so slowly (an estimated 30 MPH or less) that pronghorn collisions would be rare.
34. The fences that would be constructed under measures 25 and 26 (Chapter 4, Mitigation Measures) would meet the specifications of BLM and Wyoming Game and Fish Department.
35. Unsuitability Criteria 15 does not apply to the sage grouse lek in Section 20, T. 21 N., R. 79 W., as the mining operations on the surface are at least 3/4 mile from the lek, and the underground mining in Section 20 occurs more than 700 feet below the surface.
36. No signs of burrowing owls were detected during the intensive white-tail prairie dog survey during the summer of 1978.
37. See Final Environmental Statement, Development of Coal Resources in Southcentral Wyoming, High Level Table R8-16.
38. Chapter 4 requires the company to provide data to prove that reclamation is feasible prior to approval of the mine and reclamation plan. One of the requirements of SMCR is that disturbed areas will be reclaimed.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

April 25, 1979

Mr. Edward Coy
Team Leader
Coal ES Team
P. O. Box 670
Rawlins, Wyoming 82301

Dear Mr. Coy:

I am replying to your request to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the Leasing of Federal Coal in the Carbon Basin, Wyoming. This Draft EIS has been reviewed by appropriate FERC staff components upon whose evaluation this response is based.

The staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involved with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken. There are, however, several technical areas where modifications or additions are needed:

1. As indicated in your analysis, the proposed action would increase the total water use in the region by a maximum 960 acre-feet per year by approximately 1986 and then drop to 360 acre-feet per year for the remainder of the mine's 40 years of production. Our staff has estimated that this increase in water consumption would amount to an average of approximately 370 Mwh of electric energy annually if the water ran instead through the six hydroelectric generation plants downstream. In turn, this 370 Mwh would save approximately 614 barrels of oil per year. This loss of hydro-energy should be recognized in your analysis of the impact of the proposed action.

Mr. Edward Coy

2

- 2. A proposed 33-inch natural gas line and a 22-inch jurisdictional pipeline owned by Colorado Interstate Gas Company (CIGC) are both located within the general area of the proposed action. In order to avoid any possible interruption of natural gas supplies, the mine operator should be advised to contact CIGC directly for the exact location of these pipelines during the proposed coal mine operations.
- 3. Many geologic provinces in Wyoming are currently experiencing high levels of successful drilling activity with a market shift towards exploration for natural gas reserves. However, our examination of the information we received as of August 1978 has indicated that such exploration effort in the vicinity of the proposed action (Hanna-Laramie Basin) has not experienced similar success.

After discussing our difficulties in meeting the April 16, 1979 deadline for submitting written comments with Mr. John Lowell, the EIS Coordinator of your Bureau in Washington, D. C., the deadline was extended to April 27, 1979.

Thank you for the opportunity to review this statement. If you have any question about our comments, please don't hesitate to contact my office.

Sincerely,

Carl M. Heintz
 Mr Jack M. Heinemann
 Advisor on Environmental Quality

cc: Mr. John Lovell, BLM/DOI

Letter 24 Responses

- 1. Such an impact may or may not be a reality in light of the many probabilities of change which would reduce or not allow the water to reach even one of any of the six hydroelectric generation plants downstream. Because of this uncertainty, this impact is not considered within the scope of this FES.
- 2. Such an action would be a normal part of preparation of a mine and reclamation plan. In addition, any agreements reached would be discussed in the plan.

*Team Leader
 EIS Coal
 Box 670
 Nat. Use Com.
 Rawlins, Wyo.*

4/19/79

25

To Whom It May Concern

We, Olsen's Enterprises, fully support the operation of Commonwealth Edison Co. of Chicago, Illinois, in this area. We welcome and look forward to their coming to our town of Medicine Bow, Wyo. We can clearly see that this will greatly help the economy of this area.

*Sincerely,
 Arnold, Francis & A. J. Olsen
 Olsen's Enterprises.*

REFERENCES

- Abt Associated 1976. Technical report: socioeconomic profile of Carbon County and local areas.
- Bay, Rodger R. 1976. Rehabilitation potentials and limitations of surface mined lands. Transactions of the 41st North American Wildlife and Natural Resources Conference: Wildlife Management Institute, Washington, D.C.
- Becker, C.F., and Alyea, J.D.
1964a. Precipitation probabilities in Wyoming:
University Wyoming Agriculture Exp. Station Bull. 416.
- Bickert, Browne, Coddington, and Associates, Inc.
1976. A study of the social, economic and public effects of four proposed coal mines: Red Rim, China Butte, Cherokee, Atlantic Rim. Denver, Colorado (December).
1977. An analysis of alternative socioeconomic impact mitigation approaches for the Rawlins area. Denver, Colorado (December).
- Brady, N.C. 1974. The nature and properties of soils. 8th ed. New York: MacMillan Publishing Company, Inc.
- Browne, Robert T. 1977. Endangered and Threatened Plants. 4510 Memo with attached listing, dated February 11, 1977.
- Burt, W.H., and Grossenheider, R.P. 1964. A field guide to the mammals. Boston: Houghton Mifflin Company
- Carbon County Commissioners 1972. The Carbon County Zoning Resolution of 1972. Carbon County, Wyoming.
- Carbon County Council of Governments 1978. Carbon County Land Use Plan, Rawlins, Wyoming, (March).
- Carbon County Mental Health Center 1976. Drug abuse study. Rawlins, Wyoming.
- Carbon County Planning Office 1977. 1985 population projections, Carbon County and incorporated municipalities. Rawlins, Wyoming (June 30)
- Centaur Management Consultants, Inc. 1978. Final technical reports on socioeconomic conditions in southcentral Wyoming. Washington D.C.
- Dobbin, C.E.; Bowen, C.F.; and Hoots, H.W. 1929. Geology and coal and oil resources of the Hanna and Carbon Basins, Carbon County, Wyoming Washington D.C.: U.S. Government Printing Office.
- Dollhopf, D.J.; Jensen, I.F.; and Hodder, R.L. 1977. Effects of surface configuration in water pollution control on semiarid mined lands. Bozeman, Montana: Agriculture Experiment Station. Research Report 114, (April).
- Elk Mountain Planning Commission 1976. Elk Mountain general plan, draft. Elk Mountain, Wyoming.

Federal Register

1971. National primary and secondary ambient air quality standards.
Volume 36, No. 84, April 30, 1971, Part II.
1977. Surface mining Reclamation and Enforcement Provisions.
Volume 42, No. 239, December 13, 1977, Part II.
- Frison, George C. 1978. Prehistoric hunters of the high plains. New York:
Academic Press Inc.
- Gill, J.R.; Merewether, E.A.; and Cobban, W.A. 1970. Stratigraphy and
nomenclature of some Upper Cretaceous and Lower Tertiary rocks in
southcentral Wyoming. U.S. Geological Survey Prof. Paper 664.
- Gilmore, J.S. and Duff, M.K. 1974. Sweetwater County boom: challenge to
growth management. Denver, Colorado, University of Denver Research
Institute.
- Hitchcock, A.S. 1950. Manual of grasses of the United States. Washington,
D.C.: U.S. Government Printing Office.
- Hyden, H.J.; McAndrews, H.; and Tschudy, R.H. 1965. The Foote Creek and
Dutton Creek Formations, two new formations in the north part of the
Laramie Basin, Wyoming. USGS Bulletin 1194-K.
- Insurance Services Offices 1974. Grading schedule for municipal fire
protection. New York, N.Y.
- IntraSearch Inc. Denver, Colorado, 1976. Environmental inventory of a
portion of the Union Pacific Land Grant, Carbon and Sweetwater
Counties, Wyoming
- Keenlyne, K.D. 1977. Endangered or threatened species in Wyoming. Spec.
Rept. No. 3, U.S. Fish and Wildlife Service, Denver.
- Larsen, Ralph I. 1977. A mathematical model for relating air quality
measurements to air quality standards. Environmental Protection
Agency, Research Triangle Park, North Carolina.
- Leistritz, F.L. and Hertsgaard, T.A. 1973. Coal development in North
Dakota: effects on agriculture and rural communities. North Dakota
Agricultural Experiment Station, Reprint No. 807 from Sept-Oct 1973
Farm Research, Vol. 31, No. 1, pp. 3-9.
- Lowers, A.R. 1960. The climate of Wyoming. National Oceanic and Atm.
Ad., Climates of the States, U.S. Department of Commerce. Vol. 2,
pp. 961-975.
- Lowham, H.W. 1976. Techniques for estimating flow characteristics of
Wyoming streams. U.S. geological Survey Water Resources Investiga-
tions.

- May, Morton; Lang, Robert; Lujan, Leando; Jacoby, Peter; and Thompson, Wesley 1971. Reclamation of strip mine spoil banks in Wyoming. Agricultural Experiment Station, University of Wyoming, Laramie, Wyoming, (September).
- Metcalf, M.D. (ed) 1977. An Archeological Sampling Survey of the Sweetwater-Kemmerer and Hanna-Atlantic Rim Coal ES Areas. Western Wyoming College. Occasional Papers No. 10, Rock Springs.
- McGrew, P.O. 1961. The Rawlins mammoth. In, Wyoming Geological Association 16th Annual Field Conference Guidebook.
- Mesilla Valley Engineers 1978. Hydrologic Report for the Medicine Bow Project. Mesilla Valley Engineers, Mesilla Park, N.M.
- Midwest Research Institute 1975. Development of emission factors for fugitive dust sources. Prepared for: U.S. Environmental Protection Agency, Office of Air and Waste Management, and Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. Contract No. 68-02-0619.
- Monsen, Stephen B. 1975. Selecting plants to rehabilitate disturbed areas. Forest Service, Intermountain Forest and Range Experiment Station.
- National Climatic Center
 1968. Wind distribution by Pasquill stability classes, STAR program for selected U.S. cities. Asheville, North Carolina.
 1975. Surface meteorological tapes for various U.S. cities--TDF 1440 DATA FORMAT. Asheville, N.C., various dates through 1975.
- National Oceanic and Atmospheric Administration 1974. Climate of the United States, 2 Vols. Vol. 1: Eastern States, Puerto Rico, U.S. Virgin Islands,; Vol. 2: Western States, Alaska, Hawaii. Port Washington, N.Y., Weather Information Center, Inc.
- Nuclear Resources 1976. Carbon Basin environmental report, development of coal resources in Carbon County, Wyoming.
- PEDCo - Environmental Specialists, Inc.
 1976a. Evaluation of fugitive dust emissions from mining, task 1 report. In, Identification of fugitive dust sources associated with mining. Contract No. 68-02-1321, Task No. 36. Cincinnati, Ohio.
 1976b. Modification of the climatological dispersion model. Prepared for: U.S. Environmental Protection Agency, Region V, Program Support Branch, Chicago, Illinois. Contract No. 68-02-1375. Task Order No. 21.
 1978. Survey of fugitive dust from coal mines. Prepared for: U.S. Environmental Protection Agency, Region VIII, Air Planning and Operations Section, Denver, Colorado. Contract No. 68-01-4489.

- Russell's Railway and Motor Bus Guide Company 1977. The official bus guide. (September)
- Singleton, P.C. and Cline, A.J. 1976. Detailed soil survey basic to sound rehabilitation planning. Agricultural Experiment Station, University of Wyoming, Laramie, Wyoming, (November).
- Union Pacific Railroad Company 1978. Data on transportation of coal by railroad from southwest Wyoming, (Map).
- United States Government 1976. Wyoming registry of sites enrolled in the National Register of Historic Places.
- U.S. Congress
 1970. Clean Air Act, Public Law 91-604. 91st Congress as amended December 21, 1970.
 1972. Noise Control Act, Public Law 92-574. 92nd Congress.
 1977. Clean Air Act, Public Law 95-95. (5th Congress as amended August 7, 1977.)
- U.S. Department of Agriculture, Forest Service
 1976. Green River Basin type IV recreation study. Portland, Oregon. Prepared by USDA Economic Research Service, Forest Service, Soil Conservation Service, and the Wyoming State Engineer. (August)
- U.S. Department of Agriculture, Soil Conservation Service
 1971b. Guide for interpreting uses of soils.
 1978. Unpublished Order III Soil Survey, Hanna and Red Rim area, Carbon County, WY.
- U.S. Department of Agriculture, Soil Survey Staff.
 1951. Soil survey manual. USDA Handbook No. 18.
 1975. Soil taxonomy. USDI, SCS Handbook No. 436.
- U.S. Department of the Interior
 1976. Northwest Colorado coal environmental statement
- U.S. Department of the Interior, Bureau of Land Management
 1975a. Hanna Basin study site. EMRIA report no. 2.
Public lands guide. Rawlins District
 1975b. The Overland Trail in Wyoming. Paula Venudry, Denver Service Center.
 1975c. Visual resource management (Manual 6300).
 1976b. Unit resource analysis, Hanna-Medicine Bow planning unit. Rawlins, Wyoming.
 1978. Bureau of Land Management. Draft Environmental Statement - Development of Coal Resources in Southcentral Wyoming. USDI, Bureau of Land Management, Cheyenne, Wyoming.
- U.S. Department of Labor, Bureau of Labor Statistics
 1976. Occupational injuries and illnesses in the United States by industry, 1974. Bulletin 1932.

U.S. Environmental Protection Agency

- 1975a. Supplement no. 5 for compilation of air pollutant emission factors. Office of Air and Waste Management, Office of Air Quality Planning and Standards Research, Triangle Park, North Carolina, Second Edition, Section 11.2
- 1975b. Interstate motor carrier noise emission standards. Federal Register, Friday, September 12, 1975.
- 1975c. Portable air compressor noise emission standards. Office of Noise Abatement and Control, Washington, D.C.
- 1978a. Air quality control regions, criteria, and control techniques. Federal Register, 40 CFR 81, p. 8,962.
- 1978b. Motor vehicle emission factors, final document. Office of Transportation and Land Use Policy. Washington, D.C.

VTN Colorado, Inc. 1978. Final environmental baseline report for Commonwealth Edison and Morrison-Knudsen Company, Inc.'s Carbon Basin project. (January 20). (High level scenario).

Wallestad, R. 1975. Life history and habitat requirements of sage grouse in central Montana. Game Mgmt. Div. Montana Dept. of Fish and Game and USDI, Bureau of Land Management.

Wyoming Department of Education

- 1974-1975. Statistical report series #1, Statistical report series #2, and Statistical report series #3.
School facility analysis questionnaire
- 1977a. The Wyoming school foundation program. Cheyenne, WY.
- 1977b. School district property valuations, mill levys and bonded debt. Division of Planning, Evaluation and Information Services, Statistical Report Series, No. 1. Cheyenne, Wyoming. (Reports for 1974-75 and 1977-78)
- 1977c. Fall report of staff/teachers/pupils/school enrollments. Division of Planning, Evaluation and Information Services, Statistical Report Series, No. 2. Cheyenne, WY. (Reports for 1974-75 and 1977-78).
- 1977d. Wyoming public schools fund accounting and reporting. Division of Planning, Evaluation and Information Services, Statistical Report Series, No. 3. Cheyenne
- 1977e. Wyoming Education Directory, 1977-78. Cheyenne, WY.

Wyoming Department of Environmental Quality

- 1976a. Platte River Basin, water quality management plan.
- 1976b. Green River Basin, water quality management plan.
1977. Air quality data reports.

Wyoming Department of Health and Social Services

- 1974, 1975, 1976 Annual statistical reports.
- 1976, 1978. Wyoming health profiles.

Ziemens, G.M. 1977. Cultural Resource Inventory Proposed Union Pacific Rail Spur Carbon County, Wyoming. Office of the Wyoming State Archeologist, Laramie, WY.

APPENDIX A

RESOURCE DATA

AIR QUALITY APPENDIX

With application of the best management practices (see Chapter 4), major reductions in TSP impacts result, as discussed in Chapter 3. Table CA A-1 shows the total annual TSP emissions for each study year, as well as the total reduction in annual emissions and the total annual emissions expected if the alternatives were employed (Chapter 3). An average control effectiveness of 62.2% for chemical stabilization was used in making the calculations.

The reduction in annual emissions as shown in Table CA A-1 would result in a significant decrease in air quality impact. Maps CA A-1 through CA A-4 show the annual and 24-hour worst case predicted and resulting particulate concentrations that would be expected for each study year if the best management practices were employed. As can be seen from the maps, air quality impact would be significantly less than that predicted in Chapter 3. There still would be a significant impact from overburden removal in 1990 because of the substantially greater volume to be removed than is normally economically feasible for a strip mine (2,594 tons/year). Access road impacts would be comparable to those of shovel/ truck loading and exposed areas (690, 671, and 631 tons/year respectively for 1990). At the end of mine life, the major sources of TSP impact would be the access road and exposed areas (552 and 217 tons/year respectively).

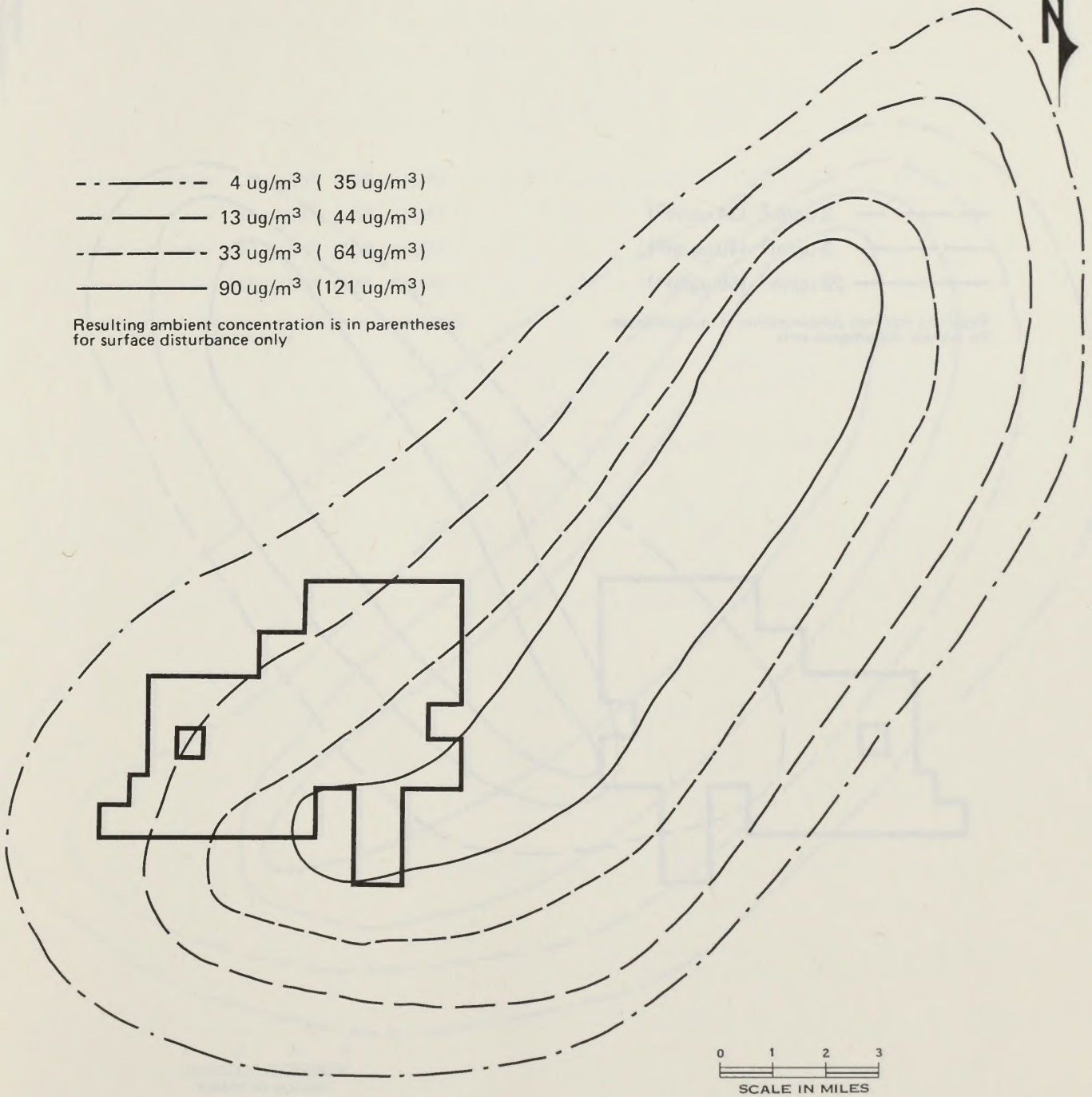
Table CA A-1

TOTAL ANNUAL EMISSIONS PREDICTED AS A RESULT OF CHEMICAL
STABILIZATION OF HAUL ROADS, PAVED ACCESS ROAD,
AND ENCLOSED COAL STORAGE

Study Year	Annual Chapter 3 TSP Emissions (tons/year)	Annual Best Management TSP Emissions	Reduction in TSP Emissions (tons/year)	Reduction in TSP Emissions (%)
1990	13,349	4,872	8,477	64
End of Mine Life	4,147	778	3,369	81

- - - - - 4 ug/m³ (35 ug/m³)
- - - - - 13 ug/m³ (44 ug/m³)
- - - - - 33 ug/m³ (64 ug/m³)
- 90 ug/m³ (121 ug/m³)

Resulting ambient concentration is in parentheses
for surface disturbance only

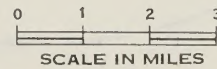
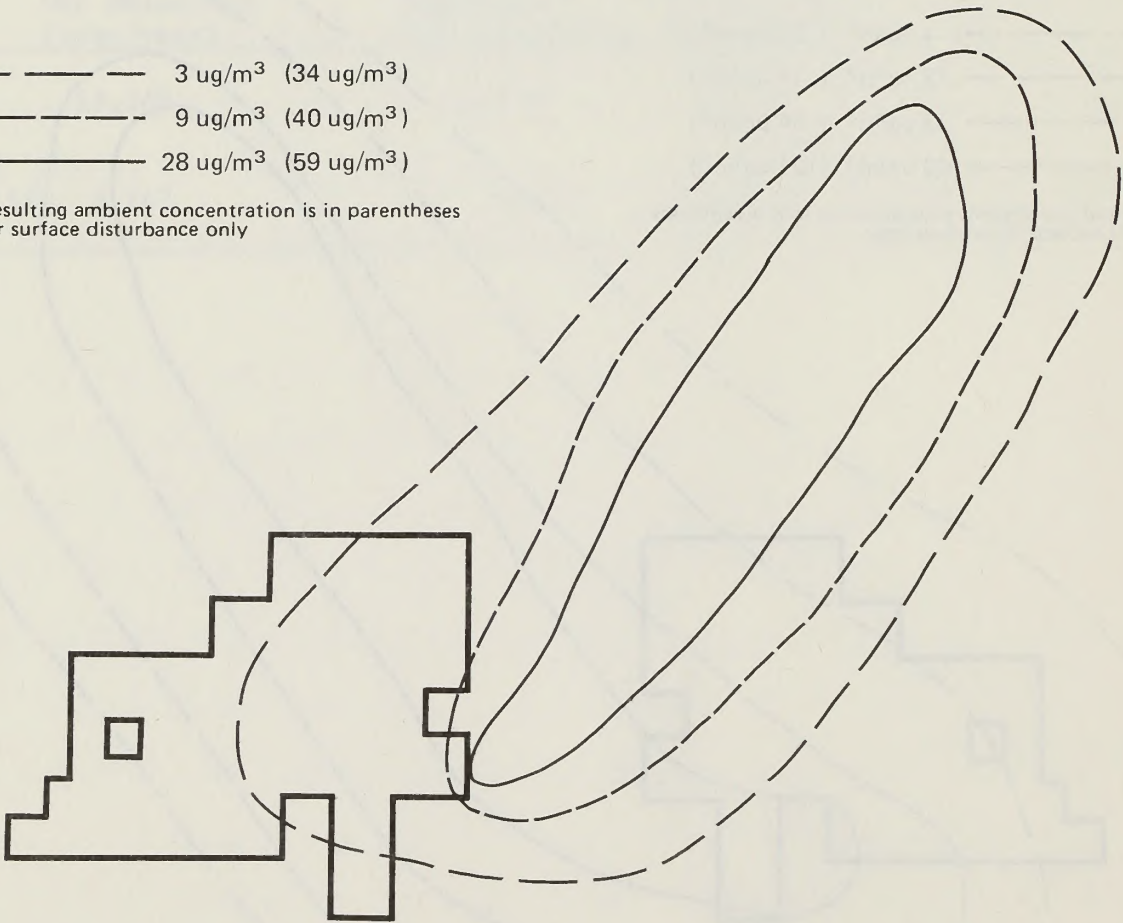


Map CA A-1
ISOPLETH MAP SHOWING THE ANNUAL PREDICTED AND RESULTING AMBIENT PARTICULATE CONCENTRATIONS EXPECTED FOR 1990 IF THE DESCRIBED BEST MANAGEMENT PRACTICES WERE EMPLOYED



- — — — — 3 ug/m³ (34 ug/m³)
- - - - - 9 ug/m³ (40 ug/m³)
- 28 ug/m³ (59 ug/m³)

Resulting ambient concentration is in parentheses
for surface disturbance only

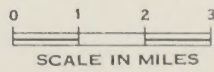
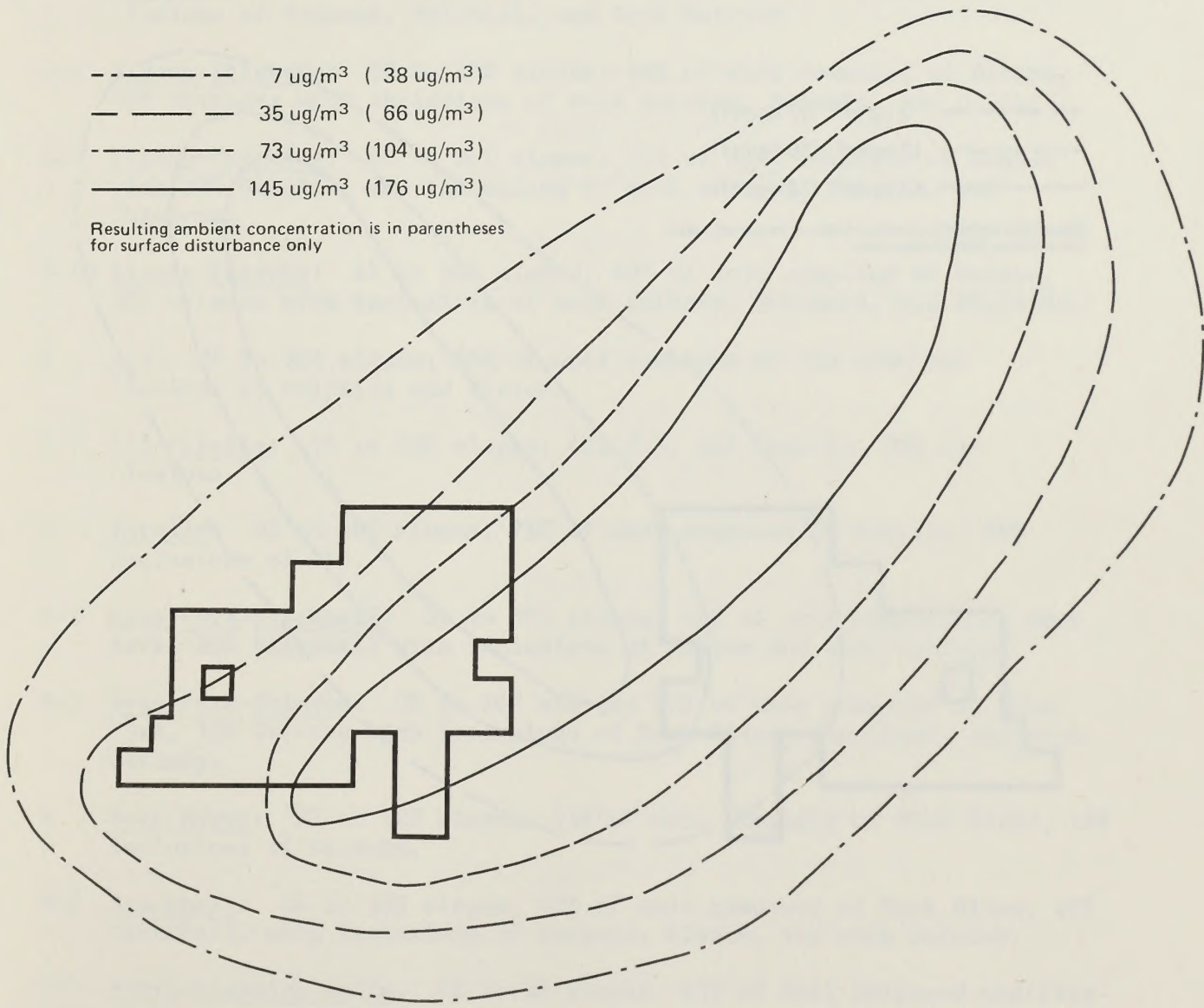


Map CA A-2
ISOPLETH MAP SHOWING THE ANNUAL PREDICTED AND RESULTING AMBIENT PARTICULATE CONCENTRATIONS EXPECTED FOR THE END OF MINE LIFE IF THE DESCRIBED BEST MANAGEMENT PRACTICES WERE EMPLOYED



- 7 ug/m³ (38 ug/m³)
- - - - - 35 ug/m³ (66 ug/m³)
- · - · - 73 ug/m³ (104 ug/m³)
- 145 ug/m³ (176 ug/m³)

Resulting ambient concentration is in parentheses
for surface disturbance only

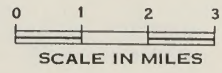
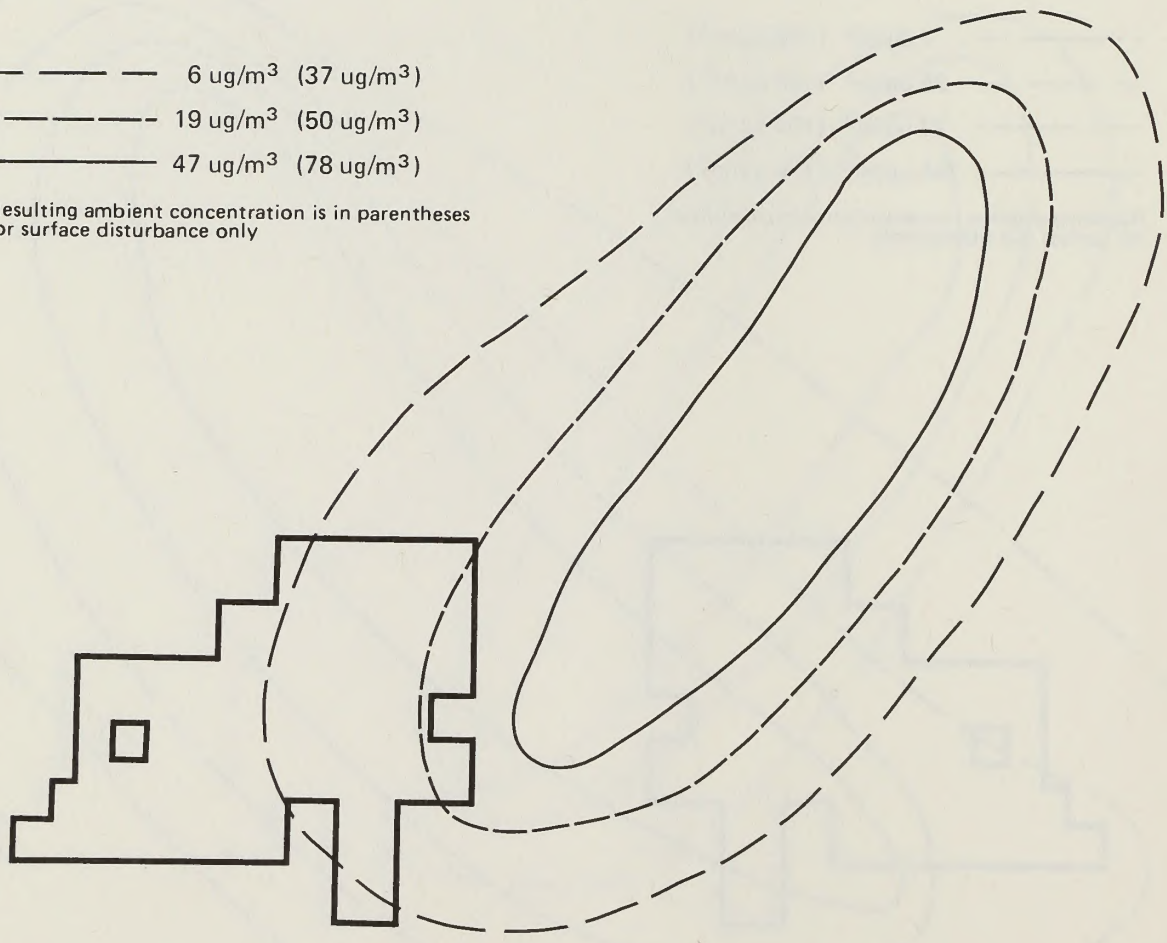


Map CA A-3
**ISOPLETH MAP SHOWING THE 24-HOUR WORST CASE PREDICTED AND RESULTING
AMBIENT PARTICULATE CONCENTRATIONS EXPECTED FOR 1990 IF THE
DESCRIBED BEST MANAGEMENT PRACTICES WERE EMPLOYED**



- 6 ug/m³ (37 ug/m³)
- - - - - 19 ug/m³ (50 ug/m³)
- 47 ug/m³ (78 ug/m³)

Resulting ambient concentration is in parentheses for surface disturbance only



Map CA A-4
ISOPLETH MAP SHOWING THE 24-HOUR WORST CASE PREDICTED AND RESULTING AMBIENT PARTICULATE CONCENTRATIONS EXPECTED FOR THE END OF MINE LIFE IF THE DESCRIBED BEST MANAGEMENT PRACTICES WERE EMPLOYED

SOILS

CARBON BASIN ORDER II

- 2-3 Blackhall-Blazon: 3% to 30% slope; 50% of unit composed of Blackhall, 30% Blazon with inclusions of rock outcrop.
- 3 Blazon: 6% to 30% slopes; 75% of unit comprised of Blazon, 25% inclusions of Satanka, Delphill, and Rock Outcrop.
- 3-1 Blazon-Shinbara: 2% to 30% slopes; 40% of unit composed of Blazon, 30% Shinbara with inclusions of rock outcrop, Satanka, and Delphill.
- 3-4 Blazon-Delphill: 6% to 30% slopes; 50% of unit composed of Blazon with 30% Delphill and inclusions of rock outcrop, Satanka, and Shinbara.
- 3-10 Blazon-Satanka: 6% to 30% slopes; 40% of unit composed of Blazon, 30% Satanka with inclusions of rock outcrop, Shinbara, and Delphill.
- 6 #15: 0% to 30% slopes; 75% of unit composed of #15 with inclusions of Delphill and Blazon.
- 6-7 #15-Forelle: 0% to 30% slopes; 40% #15, 40% Forelle, 20% inclusions.
- 7 Forelle: 0% to 30% slopes; 75% of unit composed of Forelle, 25% inclusions of #15.
- 8-2 Ryan Park-Blackhall: 3% to 30% slopes; 40% of unit composed of Ryan Park, 30% Blackhall with inclusions of Blazon and rock outcrop.
- 8-5 Ryan Park-Grieves: 0% to 20% slopes; 40% of unit composed of Ryan Park, 30% Grieves with inclusions of Rock River, Blackhall, and rock outcrop.
- 9 Rock River: 0% to 12% slopes; 75% of unit composed of Rock River, 25% inclusions of Satanka.
- 9-2 Blackhall: 2% to 30% slopes; 40% of unit composed of Rock River, 20% Blackhall, with inclusions of Satanka, Blazon, and rock outcrop.
- 257 Havre-Glendive soils: 0% to 3% slopes; 85% of unit composed undifferentiated components with inclusions of #15 soils.
- 401 Torriorthents-Rock Outcrop Complex: 30% to 60% slopes; Torriorthents compose 75% of unit and rock outcrop 25%.

CARBON BASIN ORDER III

38B--Rock River sandy loam, 2% to 6% slopes

This is a deep, well drained, loamy soil that occurs throughout the survey area. It developed in alluvium derived mainly from calcareous sandstone on alluvial fans. Though the slopes range from 2% to 6%, they are mostly about 4%. Small areas of Ryan Park and Satanka soils were included in mapping. The Rock River soil is a deep-well drained soil. Typically the surface layer is brown sandy loam about 2 inches thick. The subsoil is brown sandy clay loam about 10 inches thick. The substratum is calcareous, yellowish brown sandy loam to a depth of 60 inches.

38C--Rock River sandy loam, 6% to 12% slopes

This is a deep, loamy soil that occurs throughout the survey area. It developed in alluvium derived mainly from calcareous sandstone. Though the slopes range from 6% to 12%, they are mostly about 8%. Small areas of Ryan Park and Satanka soils were included in mapping.

78B--Ryan Park sandy loam, 2% to 6% slopes

This is a deep, well drained, sandy soil that occurs throughout the survey area. It developed in alluvium mainly from sandstone on alluvial fans. Though the slopes range from 2% to 6%, they are mostly about 4%. Small areas of Rock River and Grieves soils were included in mapping. The Ryan Park typically has a surface layer that is brown sandy loam about 1 inch thick. The subsoil is yellowish brown sandy loam about 16 inches thick. The upper part of the substratum is pale brown sandy loam about 25 inches thick. The lower part of the substratum is yellowish brown sandy loam to a depth of 60 inches.

90B--Blazon loam, 5% to 15% slopes

These gently sloping to moderately steep soils occur throughout the survey area. The slopes range from 5% to 15%, but are mostly about 10%.

Small areas of Shinbara and Satanka soils and rock outcrop are included in this mapping unit.

The Blazon series is a shallow, well drained soil. It is formed in shallow loamy deposits weathered from interbedded sandstone and shale. Typically the surface layer is a brown, moderately alkaline clay loam about 5 inches thick. The substratum is a pale brown, moderately alkaline clay loam about 11 inches thick. Interbedded sandstone and shale deposits occur at 16 inches.

210--Ravalli-Forelle-15 complex, 0% to 6% slopes

These nearly level and gently sloping soils are on alluvial fans, terraces, and drainageways. The Ravalli soil makes up about 30% of the mapping unit, the Forelle soil about 30% and the 15 soil about 25%. The Ravalli soil differs from the Forelle and 15 soils by having a higher sodium content in the subsoil. The Forelle soil differs from the 15 soil by having a distinct clay accumulation in the subsoil. About 15% of the unit is Bullock and Rock River soils.

The Ravalli series is a deep, well drained soil. It formed in alluvium from sedimentary uplands. Typically the surface layer is yellowish brown, mildly alkaline sandy loam about 2 inches thick. The upper part of the subsoil is yellowish brown, moderately alkaline loam about 3 inches thick. The center part of the subsoil is brown, moderately alkaline loam about 9 inches thick. The lower part of the subsoil is very pale brown, very strongly alkaline clay loam about 6 inches thick. The upper part of the substratum is pale brown, very strongly alkaline loam about 5 inches thick. The lower part of the substratum is pale brown, very strongly alkaline very fine sandy loam to 60 inches or more.

The Forelle series is a deep, well drained soil. It formed in alluvium from sedimentary uplands. Typically the surface layer is grayish brown, mildly alkaline loam about 4 inches thick. The upper part of the subsoil is yellowish brown, mildly alkaline clay loam about 11 inches thick. The center part of the subsoil is yellowish brown, mildly alkaline clay loam about 14 inches thick. The lower part of the subsoil is pale brown, moderately alkaline clay loam about 16 inches thick. The substratum is pale brown, moderately alkaline loam extending to 60 inches or more.

The 15 series is a deep, well drained soil. It formed in alluvium from sedimentary uplands. Typically the surface layer is pale brown, moderately alkaline loam about 2 inches thick. The subsoil alkaline loam about 2 inches thick. The subsoil is light yellowish brown, moderately alkaline loam about 6 inches thick. The upper part of the substratum is pale brown, moderately alkaline loam about 37 inches thick. The lower part of the substratum is brown, moderately alkaline sandy loam to a depth of 60 inches or more.

251--Grieves-Blackhall association 2% to 20% slopes

This association consists of sloping to moderately steep upper slopes and ridge crests. Grieves sandy loam makes up about 55% of the mapping unit and Blackhall sandy loam makes up about 30%. Grieves soils occur on alluvial fans and gently sloping uplands. Blackhall soils occur on sloping to moderately steep upper slopes and ridge crests. Included in this unit are areas of Carmody soils and rock outcrop. These inclusions make up about 15% of the total acreage.

The Grieves soil is a deep, well drained, soil forming in alluvium. Typically, the surface layer is brown sandy loam about 5 inches thick. The subsurface layer is brown sandy loam about 6 inches thick. The substratum is pale brown sandy loam to a depth of 60 inches.

The Blackhall soil is a shallow, well drained, soil forming over soft sandstone residuum. Typically, the surface layer is brown sandy loam about 2 inches thick. The substratum is light yellowish brown sandy loam to a depth of 17 inches. Soft, pale yellow, calcareous sandstone occurs at 17 inches.

252--Shinbara-Blazon-Rock Outcrop complex, 6% to 30% slopes

These sloping to steep soils are on bedrock controlled uplands. The Shinbara soil makes up about 35% of the mapping unit, the Blazon soil about 30% and Rock outcrops about 25%. The Shinbara soils differ from the Blazon soils by being shallower to bedrock. About 10% of the unit is Delphill and Tasselma soils.

The Shinbara series is a very shallow, excessively drained soil. It formed in a very shallow loamy deposits weathered from shale interbedded with sandstone. Typically the surface layer is brown, strongly alkaline loam about 3 inches thick. The substratum is strongly alkaline silty clay loam about 3 inches thick. Soft fractured shale and coal occurs at 6 inches.

The Blazon series is a shallow, well drained soil. It formed in shallow loamy deposits weathered from interbedded sandstone and shale. Typically the surface layer is brown, moderately alkaline clay loam about 5 inches thick. The substratum is pale brown, moderately alkaline clay loam about 11 inches thick. Interbedded sandstone and shale deposits occur at 16 inches.

253--Blazon-Satanka association 2% to 15% slopes

This association consists of gently sloping to moderately steep residual uplands. Blazon loam makes up about 40% of the mapping unit and Satanka sandy loam makes up about 35%. Blazon soils occur on ridge crests and

upper slope areas. Satanka soils occur on concave midslope and lower slope areas. Included in this unit are areas of Delphill and Shinbara soils and rock outcrop. These inclusions make up about 15% of the total acreage.

The Satanka soil is a moderately deep, well drained, soil forming over interbedded sandstone, siltstone, and shale residuum. Typically, the surface layer is brown sandy loam about 3 inches thick. The upper part of the subsoil is brown sandy clay loam about 7 inches thick. The lower part of the subsoil is pale brown loam about 3 inches thick. The upper part of the substratum is very pale brown loam about 14 inches thick. The lower part of the substratum is gray silty clay about 8 inches thick. Soft, calcareous, interbedded sandstone, siltstone, and shale occurs at 35 inches.

254--Bullock-Blazon complex, 0% to 6% slopes

These nearly level and gently sloping soils are adjacent to upland drainageways. The Bullock soil makes up about 45% of the mapping unit and the Blazon soil about 35%. The Bullock soil differs from the Blazon soil by being deeper to bedrock and having distinct structure in the subsoil. About 20% of the unit is Ravalli and 15 soils. The Bullock series is a moderately deep, well drained soil. It formed in loamy deposits weathered from shale interbedded with sandstone.

Typically the surface layer is light gray, moderately alkaline sandy loam about 3 inches thick. The upper subsoil is yellowish brown, moderately strongly alkaline silty clay about 13 inches thick. The substratum is dark grayish brown, moderately alkaline silty clay about 6 inches thick. Soft shale and coal occurs at about 32 inches.

255--Playa Land Type

The flat-floored bottom of an undrained desert basin that becomes at times a shallow lake.

256--McFadden-Rock River complex, 0% to 20% slopes

These nearly level to moderately steep soils are on high river terraces and slope breaks on alluvial fans. The McFadden soil makes up about 50 percent of the mapping unit and the Rock River soil about 30 percent. The McFadden soil differs from the Rock River soil by having more carbonates and coarse fragments in the soil profile. About 20 percent of the mapping unit is 15 soils and soils that are moderately deep to bedrock.

The McFadden series is a deep well drained soil. It formed in gravelly calcareous alluvium. Typically the surface layer is brown, moderately alkaline gravelly sandy loam about 4 inches thick. The subsoil is brown, moderately alkaline gravelly sandy loam about 9 inches thick. The substratum is pale brown, strongly alkaline sandy loam to a depth of 60 inches or more.

257--Havre and Glendive soils, 0% to 3% slopes

This undifferentiated unit consists of soils in narrow flooding drainage-ways. Each component of this mapping unit may occur in each delineated area, or they may occur separately. Included in this unit are areas of 15 soils. The inclusions make up about 15% of the total acreage.

The Havre soil is a deep, well drained, soil forming in stratified alluvium. Typically the surface layer is grayish brown loam about 3 inches thick. The substratum is brown, silty clay loam to a depth of 60 inches.

The Glendive soil is a deep, well drained, soil forming in stratified alluvium. Typically, the surface layer is brown fine sandy loam about 4 inches thick. The substratum is pale brown fine sandy loam to a depth of 60 inches.

258--Rock River-Satanka association, 0% to 12%

This association consists of level to sloping alluvial fans and adjacent uplands. Rock River sandy loam makes up about 45% of the mapping unit and

Satanka sandy loam makes up about 35%. Rock River soils occur on alluvial fans and narrow drainages. Satanka soils occur on the sloping ridges and concave upperslopes. Included in this unit are areas of Blazon and Blackhall soils and rock outcrop. These inclusions make up about 20% of the total acreage.

The Rock River soil is a deep, well drained, soil forming in alluvium. Typically, the surface layer is brown sandy loam about 2 inches thick. The subsoil is brown sandy clay loam about 10 inches thick. The substratum is calcareous, yellowish brown sandy loam to a depth of 60 inches.

260--Ryan Park-Rock River association, 2% to 20% slopes

This mapping unit consists of gently sloping to moderately steep alluvial fans. Ryan Park sandy loam makes up about 45% of the mapping unit and Rock River sandy loam makes up about 30%. Ryan Park soils occur on the middle and upper portions of alluvial fans. Rock River soils occur on the lower portions of alluvial fans and alluvial bottoms. Included in this unit are areas of Grieves and Blackhall soils. These inclusions make up about 25% of the total acreage.

The Ryan Park soil is a deep, well drained, soil forming in alluvium. Typically, the surface layer is brown sandy loam about 1 inch thick. The subsoil is yellowish brown sandy loam about 16 inches thick. The upper part of the substratum is pale brown sandy loam about 25 inches thick. The lower part of the substratum is yellowish brown sandy loam to a depth of 60 inches.

401--Torriorthents-Rock Outcrop complex, 30% to 60% slopes

This complex consists of very steep rough broken lands. Torriorthents make up about 70% of the mapping unit and rock outcrop makes up about 30%. The torriorthents are intermingled in with the rock outcrop, but usually

occur immediately below rock outcrops. This mapping unit is typically composed of Shinbara, Spool, Tassleman, and Blazon soils; however, none or all of them may occur in any one delineation.

C.F. Cut and Fill (Disturbed Land)

M.D. Mine Dump (Disturbed Land)

CARBON BASIN APPENDIX

SOIL INTERPERTATION (CLASSIFICATION AND ENGINEERING)

SOIL SERIES	MAPPING UNIT #s	CLASSIFICATION SOIL TAXONOMY	PARENT MATERIAL	CLASSIFICATION 3			DEPTH TO BEDROCK 4 (INCHES)	PREMEABILITY LEAST PERMEABLE LAYER (IN/HR)	POTENTIAL FROST ACTION 6	SHRINK/SWELL POTENTIAL 7
				DEPTHS (INCHES)	USDA	UNIFIED				
Blackhall	251 2-3	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthent	Residuum from soft sandstones	0-12 0-12	FSL, VFSL GR-VFSL	SM, SM-SC SM	10-20	0.6-2.0	Low	Low
Blazon	252, 253, 254, 2-3, 3, 3-4 3-10	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthent	Interbedded sandstone, loam stone and sandy shales	0-14 0-14 0-14	CL L GR-CL	CL ML, CL-ML GM	10-20	0.2-2.0	Low	Moderate Low Moderate
Bullock	254	Fine-loamy, mixed Borollic Natrargid	Residuum from interbedded soft sandstone and silty and clayey shales	0-4 0-4 4-9 9-22	FSL SIL, L SCL, CL, L SL, L, CL	SM, SM-SC, ML ML, CL-ML SC, CL SC, SM-SC, CLA-4, A-6	20-40	0.6-2.0	Low	Low Low Moderate Moderate
Delphill	3-4	Fine-loamy, mixed (calcareous), frigid Ustic Torriorthent	Residuum from loamstone and sandy shales	0-2 3-27	L L, CL	CL-ML, CL, ML CL-ML, CL	20-40	0.6-2.0	Moderate	Low
Forelle	210, 6-7 7	Fine-loamy, mixed Borollic Haplargid	Alluvium from sandstones and shales	0-4 4-20 20-60	L CL, L GR-SCL	CL-ML, ML CL GC, SC	>60	0.6-20	Moderate	Low Moderate Moderate
Glendive	257	Coarse-loamy, mixed (calcareous), frigid Ustic Torrifluent	Sandy alluvium on flood plains	0-16 16-60	L, SIL, FSL SR-FSL-LFS	ML, CL-ML SM	>60	0.6-2.0	Moderate	Low
Grieves	251, 8-5	Coarse-loamy, mixed (calcareous), frigid Ustic Torriorthent	Alluvium from calcareous sandstone	0-14 14-60	FSL FSL	SM, SM-SC SM, SM-SC	>60	0.6-2.0	Low	Low

CARBON BASIN APPENDIX
(continued)

SOIL INTERPERTATION (CLASSIFICATION AND ENGINEERING)

SOIL SERIES	MAPPING UNIT #s	CLASSIFICATION 1 SOIL TAXONOMY	PARENT MATERIAL 2	CLASSIFICATION 3			DEPTH TO BEDROCK 4 (INCHES)	PREMEABILITY LEAST PERMEABLE LAYER (IN/HR) 5	POTENTIAL FROST ACTION 6	SHRINK/ SWELL POTENTIAL 7
				USDA	UNIFIED	AASHO				
Harve	257	Fine-loamy, mixed (calcareous), frigid Ustic Torrifluent	Stratified alluvium on flood plains and stream terraces	0-8 0-8 8-60	L SICL L,FSL	ML,CL,CL-ML CL ML	A-4 A-6 A-4	0.2-0.6	Moderate	Low Moderate Low
McFadden	256	Coarse-loamy, mixed Borollic Calciorthid	Alluvium from gravelly sandstones	0-4 4-13 13-25 25-60	GR-SL GR-SL SL SL	GM,SM GM,SM SM SM	A-2 A-2 A-2, A-4 A-2, A-4	--	--	--
Ravalli	210	Fine-loamy, mixed Borollic Natrargid	Alluvium from alkaline shales	0-2 2-14 14-20 20-60	SL L CL L, VFSL	SM ML CL ML	A-4, A-2 A-4 A-6 A-4	0.06-0.2	Low	Moderate
Rock River	258, 9 260, 9-2 256	Fine-loamy, mixed Borollic Haplargid	Alluvium from sandstone	0-3 3-19 19-60	SL SCL SL	SM SM, SM-SC SM	A-2 A-4 A-2	0.6-2.0	Low	Low
Ryan Park	260 8-2 8-5	Coarse-loamy, mixed Borollic Haplargid	Alluvium from sandstone	0-4 4-18 18-60	LFS,SL,LS SL,FSL SL,LS	SM SM-SC SM	A-2 A-2, A-4 A-2, A-4	2.0-6.0	Low	Low
Satanka	258, 253, 3-10	Fine-loamy, mixed Borollic Haplargid	Residuum from soft sedimentary rocks	0-4 0-4 4-35	FSL GR-FSL SCL GR-SCL	SM GM, SM SC,GC	A-4 A-2 A-2, A-6	0.6-2.0	Low	Low
Shinbara	252, 3-1	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthent	Residuum from siltstone and loamstone	0-8 0-8	L GR-L	CL-ML, ML CM-GC, GM	A-4 A-4	0.6-2.0	Low	Low

CARBON BASIN APPENDIX
(continued)

SOIL INTERPERTATION (CLASSIFICATION AND ENGINEERING)

SOIL SERIES	MAPPING UNIT #s	CLASSIFICATION SOIL TAXONOMY ¹	PARENT MATERIAL ²	CLASSIFICATION ³		DEPTH TO BEDROCK ⁴ (INCHES)	PREMEABILITY LEAST PERMEABLE LAYER (IN/HR) ⁵	POTENTIAL FROST ACTION ⁶	SHRINK/SWELL ⁷ POTENTIAL
				USDA	UNIFIED AASHO				
#15	210,6 6-7	Fine-loamy mixed Borollic Camborthid	Alluvium	0-45 45-60	L SL	>60	---	---	---

1. Classification: Classification of each soil series (and tentative series) according to Soil Taxonomy USDA 1975.
2. Parent Material: Geologic material that soil developed from.
3. Classification: Depths are of soil profiles, USDA classification is the soil textural classification system, the unified and AASHO classifications are used by engineers unfamiliar with the USDA textural classification system.
4. Depth To Bedrock: Refers to the soil range in depth to bedrock.
5. Permeability: Refers to the rate at which water and air may move through the soil.
6. Potential Frost Action: Refers to the probable effects on structures resulting from the freezing and thawing of soils.
7. Shrink/Swell Potential: Refers to the quality of a soil that determines its volumetric changes resulting from wetting and drying of soil profile.

CARBON BASIN APPENDIX

SOIL INTERPERTATION (AGRICULTURAL)

SOIL SERIES	DEPTH OF EFFECTIVE ROOTING ZONE (IN) ¹	DRAINAGE CLASS ²	AVAILABLE WATER CAPACITY ³ (INCHES)	HYDROLOGIC ⁴ SOIL GROUP	POTENTIAL ⁵ PRODUCTION (#/AC. DRY WT)	SOIL REACTION (pH) ⁶	SALINITY (mmhos/cm) ⁷	INHERENT ⁸ FERTILITY	WIND ERODIBLE GROUP	SURFACE RUNOFF ⁹
Blackhall	10-20	Well to excessively drained	Very low 1.2-1.8	D	350-700	7.8-8.6	<2.0	Low	3	Medium to Rapid
Blazon	10-20	Well drained	Very Low to Low 2.7-3.1	D	500-1000	7.9-9.0	2.0-4.0	Low	4L	Rapid
Bullock	20-26	Well drained	Very Low to Low 2.14-3.52	D	420-720	6.6-9.0	<2.0-8.0	Low	6, 3	Slow
Dephill	27	Well drained	Low 4.3-5.4	C	600-1400	7.4-9.0	2.0-4.0	Moderate	3	Medium
Forelle	>60	Well drained	High 9.25-11.75	B	500-1000	7.0-8.8	<2.0	High	5	Slow
Glendive	>60	Well drained	High 8.4-10.24	B	900-1800	6.6-9.0	2.0-8.0	Moderate	5	Slow
Grieves	>40	Well drained	Moderately High 7.2-8.4	B	700-1500	7.4-9.0	<4.0	Moderate	3	Medium
Havre	>60	Well drained	High 8.4-12.0	B	700-1600	7.4-8.4	2.0-12.0	Moderate	3	Slow
McFadden	13-20	Well drained	Moderately High	B	700-1500	8.0-8.8	<2.0-4.0	Low	3	Medium
Ravalli	>60	Well drained	Moderately High	C	400-750	7.6-9.6	<4.0	Low	5	Slow
Rock River	>60	Well drained	Moderately High 7.0-8.3	B	700-1500	6.6-9.0	<2.0-4.0	Moderate	3	Slow

CARBON BASIN APPENDIX
(Continued)

SOIL INTERPERTATION (AGRICULTURAL)

SOIL SERIES	DEPTH OF EFFECTIVE ROOTING ZONE (IN) ¹	DRAINAGE CLASS ²	AVAILABLE WATER CAPACITY ³ (INCHES)	HYDROLOGIC SOIL GROUP ⁴	POTENTIAL PRODUCTION ⁵ (#/AC. DRY WT)	SOIL REACTION (pH)	SALINITY (mmhos/cm) ⁷	INHERENT FERTILITY ⁸	WIND ERODIBLE GROUP	SURFACE RUNOFF ¹⁰
Ryan Park	>60	Well drained	Low 3.6-4.9	B	700-1500	6.6-9.0	<4.0	Moderate	2	Medium
Santanka	35	Well drained	Low 3.5-5.5	B	600-1400	7.4-9.0	<2.0	Moderate	3	Medium
Shinbara	5-10	Somewhat excessively well drained	Very Low 0.75-2.0	D	250-600	8.2-8.8	2.0-4.0	Low	4L	Medium to Rapid
#15	>60	Well Drained	Moderately High	B	700-1200	8.0-8.4	----	Moderate	--	Medium

1. Depth of Effective Rooting Zone: Is an indicator of the depth to which plant roots would penetrate soil profile.

2. Drainage Class: Is an indication of soil profile-moisture relationships.

3. Available Water Capacity: Refers to the soil profiles potential water holding capacity for utilization by plants.

4. Hydrologic Soil Group: This grouping places soils to their potential to yield runoff; Group A being low and Group D being high.

5. Potential Production (#/ac. Dry Wt.): Refers to SCS Form 5 Potential Vegetative Production calculations from unfavorable to favorable years for each series.

6. Soil Reaction (pH): The degree of acidity or alkalinity of a soil expressed as a pH value. Descriptive terms commonly associated with certain ranges in pH are: slightly acid, 6.1-6.5; neutral, 6.6-7.3; slightly alkaline, 7.4-7.8; moderately alkaline 7.9-8.4; strongly alkaline, 8.5-9.0; and very strongly alkaline, 9.1.

7. Salinity (mmhos/cm): Refers to the soluble salts in a soil, based on the electrical conductivity of the saturation extract, as expressed in millimhos per centimeter (mmhos/cm) at 25 C. Salinity rating

Low	4
Moderate	4-8
High	8

8. Inherent Fertility:

The following criteria were used for rating the soils.

Low Soils low in available P or K, or with pH below 5.0 and above 9.0 in the A and upper B horizons, or soils having levels of moisture (A.W.H.C.), or growth of plants is severely limited.

Moderate Soils intermediate between low and high in inherent fertility.

High Soils high in available P and K, with pH of 5.5 or less than 8.4 in the A and upper B horizons, levels of moisture (A.W.H.C.), or alkalinity are such that choices or growth of plants are not limited.

9. Wind Erodible Group: Refers to the erodibility of soil surface; rate 1-8 with 1 being the most erodible and 8 being non-erosive.

10. Runoff: Refers to the relative rate that water flows off soil surface 6 classes: Pondered, very slow, medium, rapid, very rapid.

Form 1279-3
(June 1984)

BORROWER

TD 195 .C58 C37 1
Proposed coal lease
Carbon Basin area

DATE LOANED	BORROWER

USDI - BLM

