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OPERATION AND RECLAMATION PLAN

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RECEIVED
MAY 28 1992
DIVISION OF
OIL GAS & MINING

Section 3

OPERATION AND RECLAMATION PLAN

3.1 Scope

This section outlines the scope operation and reclamation for the Blue Blaze Coal Mines. The proposed coal mining and reclamation activities will be conducted in compliance with the operation and reclamation plans. Activities at the site will be performed under MSHA Numbers 42-02074 (Blue Blaze No. 1 Mine) and 42-02075 (Blue Blaze No. 2 Mine).

3.2 Surface Facilities Construction Plans

The Blue Blaze No's. 1 and 2 Mine portals will be located in Gordon Creek Canyon, approximately 13 miles northwest of Price, Utah in Sec. 17, T. 13 S., R. 8 E. The mines will share common surface facilities. Construction of surface facilities is currently anticipated to begin in the summer of 1992.

Both mines will be underground with a common set of surface facilities. All coal and surface is privately owned, except for a coal lease with the U.S. Bureau of Land Management (Federal Coal Lease SL 063011).

3.2.1 Site Selection and Preparation

The general area in the vicinity of the proposed Blue Blaze No's. 1 and 2 Mines has long been used for coal mining. Four underground operations were formerly located on or within a short distance of the permit area. These mines were the Consumers, Sweets, National, and Beaver Creek Mines. Sweets, National, and Consumers were active from the late 1920s to the early 1950s and are presently closed. The Beaver Creek Mine was opened in 1969 and operated originally under the name of the Gordon Creek No. 3 Mine. The mine was purchased by General Exploration Co. in 1973 and then again by Beaver Creek Coal Company in January 1980. Much of the area to be occupied by the surface facilities has been disturbed by previous mining operations, with most of the major disturbances in this area occurring prior to 1950.

Due to past mining activities at the site of the proposed surface facilities, coal fines and other "waste" coal currently exists on the surface in areas that will be re-disturbed during construction activities. Waste coal will be segregated during construction, temporarily stockpiled, and blended with coal from the mine following start-up of mining operations as indicated in Section 3.3.2.7.

Roads and pads that will be constructed in support of the Blue Blaze No's. 1 and 2 Mines will be constructed with a cut and fill technique. Topsoil resources will be conserved as outlined in

Section 8. All surface facilities and disturbance will be sited on privately owned surface and subsurface.

3.2.2 Mine Portals

Mining operations will be conducted in the Hiawatha seam and the overlying Castlegate A seam. The No. 1 Mine will be constructed in the Hiawatha seam and will consist of three portals: one haulage, one intake air, and one return air. Four portals will be constructed in the Castlegate A seam at the No. 2 Mine: one haulage, two intake air, and one return air courses. Portal locations are noted on Plate 3-1.

The portals will consist of steel I-beam structures extending 20 to 100 feet underground and will be maintained to provide clear, safe access to the mines. Upon final abandonment, the structures will be removed, if possible, the portals sealed and the coal outcrop covered as described in Section 3.5.3.1 of this permit application.

3.2.3 Surface Buildings and Structures

Locations of proposed surface buildings and structures are shown on Plate 3-1. Upon termination of mining operations, all structures will be removed and the area reclaimed as outlined in Section 3.5.3

Major buildings and structures to be associated with this operation will include:

(a) Portals - As noted above, three portals will be placed at the No.1 mine and four portals at the no. 2 mine.

(b) Fan - An exhaust fan will be used to ventilate the mine.

(c) Mine Office and Lamp House - A 20-foot by 40-foot trailer will be located near the portals and used for a mine office and lamp house. An adjacent 14-foot by 60-foot bath house will be installed later.

(d) Conveyor - A 42-inch conveyor will bring the coal from the mine. The coal will be discharged into a stockpile as indicated on Plate 3-1.

(e) Supply Trailers - Two trailers will be located on the portal pad at the approximate location indicated on Plate 3-1. These trailers will be used as an on-sight warehouse for small items commonly needed in the mine.

(f) Substation - The substation will be located in the vicinity of the No. 1 Mine portals as indicated on Plate 3-1. This substation will receive power at 4160 volts and distribute it into the mine at 4160 volts, where it will be further transformed in 440 volts for the mining

machinery. The substation will be served and maintained in accordance with MSHA regulations.

(g) Diversions - Diversions will be located and constructed as outlined in Section 7 of this permit application.

(h) Main Road - Access to the mine and coal haulage from the mine will be provided via Carbon County Road 290 (formerly State Highway 139). Within the proposed disturbed area, that portion of the road that is currently unimproved will be gravel surfaced and will slope toward the inside for drainage control. As noted in Figures 3-1 and 3-1a, the road will be maintained by the Carbon County Road Special Service District. As indicated in Figure 3-1b, Carbon County has determined that "the interests of the public and affected landowners will be protected" even though mining and reclamation activities are planned within 100 feet of the road where it passes through the surface facilities.

As noted in Figure 3-1c, a public hearing was scheduled to discuss use of County Road 290 for access to and coal haulage from the mine. However, since no requests or statements of interest regarding the meeting were received form the public, the meeting was canceled. From the southern boundary of the permit area, the County Road extends eastward approximately 11.5 miles, ending at U.S. Highway 6 south of Helper. The western 8.5 miles of the County Road between the permit area and U.S. Highway 6 is gravel surfaced, while the eastern 3 miles is paved.

(i) Upper Portal Access Road - This will be a short ancillary road (approximately 600 feet long) from the main pad to the No. 2 Mine portals. The road will be used only for personnel and material access with no coal haulage. This road will be bermed on the west side for safety and runoff control.

(j) Water Supply System - As discussed in Section 3.2.6 of this PAP, water for non-culinary use will be obtained primarily from Gordon Creek Canyon. A sump or series of sumps will be provided underground to store water during periods of excess availability. Culinary water will be obtained from Price River Water Improvement District, hauled to the site, and stored in an above-ground storage tank (see Plate 3-1). All culinary water facilities will be designed in accordance with applicable Utah Department of Health (UDH) regulations. Plans will be submitted for approval by UDH prior to construction.

CARBON COUNTY
PRICE, UTAH 84501

February 6, 1989

William Roger Skaggs
P.O. Box 784
Price, Utah 84501

Dear Mr. Skaggs,

This is in response to your request concerning the impact your company would have in hauling coal down the Gordon Creek Road. It is our opinion that the impact would not be too severe, and your company hauling coal on that road would be permissible.

There is one problem, however, Beaver Creek Coal has been maintaining that road for the last few years and there would have to be an agreement between Beaver Creek Coal and Carbon County as to the upkeep of the road. If you need more information, please call me.

Very truly yours,

BOARD OF CARBON COUNTY
COMMISSIONERS,

Emma R. Kuykendall

Emma R. Kuykendall
County Commissioner

EK/rp

Figure 3-1. 1989 Road Letter.

CARBON COUNTY
PRICE, UTAH 84501

COMMISSIONERS
William D. Krompel
Emma R. Kuykendall
Lynda C. Varner

Wednesday, August 15, 1990

Mr. William Roger Skaggs
P.O. Box 784
Price, Utah
84501

RE: February 1989 Letter on Gordon Creek Road

Dear Mr. Skaggs:

Since my previous letter to you, Carbon County has turned the maintenance of all coal haul roads over to the Carbon County Road Special Service District. This District maintains these roads with royalties paid by the coal mines on Federally leased coal.. I believe this will relieve you of substantial burdens associated with the use of this road.

We wish you success in your endeavors of opening this mine because we need the employment very much. I feel there will be no problems in coming to a mutual agreement on the usage of this road at such time as your mine is ready to open.

Sincerely,

Emma R. Kuykendall

Emma R. Kuykendall
Carbon County Commissioner

Figure 3-1a. 1990 Road Letter.

CARBON COUNTY
PRICE, UTAH 84501

May 5, 1992

Mr. William Roger Skaggs
P.O. Box 784
Price, UT 84501

RE: Blue Blaze Coal Mine

Dear Mr. Skaggs:

Approval to use the Gordon Creek Road to haul Blue Blaze coal by truck is hereby granted.

Per Utah coal mining regulation R645-103-234.400, the interests of the public and affected landowners will be protected from the proposed coal mining and reclamation operation.

Sincerely,

Emma R. Kuykendall
Commission Chairman
Carbon County

ERK:lb

Figure 3-1b. 1992 Road Letter.

AFFIDAVIT OF PUBLICATION

STATE OF UTAH)
ss.
County of Carbon,)

I, Dan Stockburger, on oath, say that I am the Publisher of the Sun Advocate, a twice-weekly newspaper of general circulation, published at Price, State and County aforesaid, and that a certain notice, a true copy of which is hereto attached, was published in the full issue of such newspaper for Two (2) consecutive issues, and that the first publication was on the

24th day of September, 19 91

and that the last publication of such notice was in the issue of such newspaper dated the

1st day of October, 19 91

Subscribed and sworn to before me this

1st day of October, 19 91

Notary Public

My Commission expires January 10, 1995

Residing at Price, Utah

Publication fee, $ 22.80

Notary Public
LINDA THAYN
611 North 10th East
Price, Utah 84501
My Commission Expires
January 10, 1995
State of Utah

NOTICE OF PUBLIC MEETING

Blue Blaze Coal Company announces that a public meeting, in accordance with Utah Coal Mining Regulation R614-103-134.200 is scheduled for 3:00 pm, October 9, 1991, at the Carbon County Court House. This meeting is to address public issues relating to the road usage for the mining operations.

This project will require the upgrade of the County Road 290 (070060) for 1200 ft. It is located within 100 ft. of the proposed surface facilities.

Anyone interested in attending this meeting should contact the Division of Oil, Gas and Mining at 3 Triad Center, Suite 350 Salt Lake City, Utah before 3:00 pm, October 7, 1991. If no meeting requests are received before this time the meeting will be cancelled.

Published in the Sun Advocate September 24 and October 1, 1991.

FIGURE 3-IC. PUBLIC HEARING LETTER.

(k) Bath Houses - Two trailer-type bath house units will be placed at the mine site. These bathhouses (one for men and one for women) will serve the needs of the miners over the term of this permit. Both bath houses will be equipped with lockers, showers, and lavatories.

(l) Sedimentation Pond - A sedimentation pond will be located at the downstream edge of the mine yard as indicated on Plate 3-1. Design of this pond is discussed in Section 7 of this PAP.

(m) Sewage System - Chemical toilets will be used during initial development and construction of mine facilities. A service contract will be entered for maintenance of the chemical toilets and disposal of waste therefrom. All sewage facilities required for normal operation of the mine (after development) will be designed in accordance with UDH regulations. Plans for sewage facilities will be submitted for approval by UDH prior to construction of said facilities. Construction will proceed upon approval of plans by UDH. It is anticipated that sewage facilities will consist of a collection system and holding tank. An approximate location for the holding tank is presented on Plate 3-1.

(n) Fuel Tank - An above-ground 5,000-gallon diesel fuel tank will be located between the coal stockpile and the truck turnaround as indicated on Plate 3-1. The tank will be surrounded by a berm of adequate size to contain any spill.

(o) Shop - A maintenance area will be located above ground next to the mine office building, as indicated on Plate 3-1.

3.2.4 Coal Handling

Coal will be brought out of the mine on a 42-inch belt and discharged onto a 2000-ton capacity storage pile located as indicated on Plate 3-1. Coal will be loaded into trucks from the pile using a front-end loader or stacking belt. Temporary storage of excess coal will be provided within the interior of the truck turnaround as noted on Plate 3-1. Coal from this temporary storage area will be moved using a front-end loader.

3.2.5 Power System

Power will be obtained from Utah Power and Light Company. The main transmission lines are 46KV and feed into an existing substation located near the point where the county road turns into the proposed surface facilities. From this existing substation, a 4160-volt line will feed a smaller transformer at the mine portal. This

transformer will convert 4160 volts to 480 volts for equipment usage.

3.2.6 Water Supply

Water for non-culinary use will be pumped with a 5 HP pump from Gordon Creek through a 2-inch diameter pipe to the mine. The water rights which will be used (W.U.C. Nos. 330 [mining, usage from January 1 to December 31], 94 [industrial, usage from September 1 to May 1], and 353 [industrial, usage from May 1 to September 1]) are secondary rights. Therefore, water will be stored in underground sumps during periods of excess water for usage during the low water season.

Culinary water will be obtained from the Price River Water Improvement District and hauled via truck to the site. All culinary water facilities will be designed in accordance with applicable UDH regulations. Plans will be submitted for approval by UDH prior to construction. Construction of culinary water facilities will proceed upon approval of the plans.

3.2.7 Sewage System

Chemical toilets will be used during initial development and construction of mine facilities. A service contract will be entered for maintenance of the chemical toilets and disposal of waste therefrom. All sewage facilities required for normal operation of the mine (after development) will be designed in accordance with UDH regulations. Plans for sewage facilities will be submitted for review by UDH prior to construction of said facilities. Construction will proceed upon approval of the plans. It is anticipated that sewage facilities will consist of a collection system and holding tank.

3.2.8 Water Diversion Structures

Diversions will be installed to direct disturbed-area runoff to sediment-control facilities. Runoff from undisturbed areas will be diverted away from the disturbed areas to the extent practical. Detailed discussions of the design of diversion structures is provided in Section 7 of this PAP.

3.2.9 Sedimentation Control Structures and Water Treatment Facilities

All runoff from the disturbed area is directed into the sedimentation ponds located directly below the area of disturbance. The pond has been designed to contain runoff resulting from the 10-year, 24-hour precipitation event. The pond spillway has been designed to safely pass the peak flow resulting from the 25-year, 6-hour precipitation event.

The location of the pond is shown on Plate 3-1. Design, construction, maintenance and operation of the pond are discussed in detail in Section 7.2.3.2.

3.2.10 Transportation, Roads, Parking Area, Railroad Spurs

Transportation

Coal will be transported from the mine via a conveyor and discharged onto the coal storage area. Coal handling is discussed in Section 3.2.4. Transportation to and from the mine site (coal, personnel, and materials) is discussed below.

Roads

Both primary and ancillary roads will exist within the permit area. A discussion of the main roads to be used by Blue Blaze is provided in Section 3.2.3 of this PAP. Road alignments, widths, gradients, and other design details are shown on Plates 3-2, 3-2a and 3-2b. A plan view of the roads is shown on Plate 3-1. Appendix 3 presents Static Safety Factor calculations for the road embankments.

Parking Areas

A parking area will be established adjacent to the bathhouse. This area will be graveled and sloped to drain to the sedimentation ponds. Location of the parking area is shown on Plate 3-1.

Railroad Spurs

There are no railroads in the Gordon Creek area.

3.2.11 Total Area for Surface Disturbance During Permit Term

The total area to be surface-disturbance during the permit term is 10.3 acres.

3.2.12 Additional Areas for Surface Disturbance for Life of Mine

There are no plans to disturb any additional surface area for the life of the operation beyond that to be initially disturbed.

3.2.13 Detailed Construction Schedule

Much of the area to be included in the surface facilities has been previously disturbed. Construction of the surface facilities is planned to begin in the early summer of 1992 and be completed by the end of the summer of 1992. With the exception of the bath houses, construction of all surface facilities noted on Plate 3-1 is planned for the summer of 1992. A detailed reclamation schedule is presented in Section 3.5.7.

3.3 Operation Plan

The Blue Blaze No. 1 Mine will be constructed in the Hiawatha seam and the No. 2 Mine will be constructed in the overlying Castlegate "A" seam (located a minimum of 150 feet above the Hiawatha seam). Coal will be extracted using continuous miners, loaded into shuttle cars, and hauled to an underground feeder breaker. The feeder breaker will reduce the coal to a maximum size of 8 inches, after which the coal will be fed onto a rope-hung conveyor to be carried to the surface. A crusher on the surface will further reduce the size of the coal, whereupon the coal will be transferred by conveyor to the raw coal storage pile. Coal from the storage pile will be loaded onto coal trucks with a short belt or front-end loader.

Hydrogeologic investigations of the area (see Section 7) have concluded that significant amounts of groundwater should not be encountered in the Castlegate "A" seam (the No. 2 Mine). Insufficient data are currently available to assess the potential for groundwater to be encountered in the underlying No. 1 Mine. As a result, the No. 2 Mine will be opened first, with monitoring wells being installed concurrently with the opening of the No. 2 Mine to allow potential impacts of mining in the Hiawatha seam to be more accurately predicted. Data will be collected from the monitoring wells for a period of one year prior to development of the No. 1 Mine. Details of the groundwater monitoring program are presented in Section 7.

Coal will be produced from each mine at an anticipated rate of approximately 220,000 to 360,000 tons per year. Thus, when both mines are fully operating concurrently, total production from the operation is expected to be 440,000 to 720,000 tons per year.

All development and non-coal waste rock will be disposed of in underground "gob" areas which consist of entries and cross-cuts no longer needed for the operation of the mine. The Division and MSHA will be notified and plans submitted at least 30 days prior to use of these areas.

During initial mine development and on other occasions during mining, gob areas may not be sufficiently available to store all of the development and non-coal waste rock. In these cases, this waste material will be temporarily stored on the surface for a maximum of 90 days in an area that drains to the sedimentation pond. The beginning dates of temporary storage and approximate quantities of materials will be recorded in a log book kept at the mine office. This book will be available for DOGM review to verify the period of storage. A berm will be constructed around this temporary storage pile for added sediment control. The temporarily-stored waste material will be sampled at a frequency of one sample for every 5,000 yd^3 of material. These samples will be analyzed for acid and toxic-forming potential and the other appropriate tests recommended by the Division in their "Guidelines for Management of Topsoil and Overburden". The results of these tests will be sent to the Division as soon as possible. Following receipt of the test results and upon availability of underground gob areas, the waste rock will be permanently disposed underground.

Non-coal non-rock waste (trash) will be temporarily stored in a metal trash receptacle within a fenced area on site. This dumpster will be unloaded on an as-needed basis (by a local contractor) and the trash will be hauled to the Carbon County Landfill located northeast of Price (see Figure 3-2). The volume of the waste will be variable. Additional dumpsters will be provided as needed.

Snow removed from the pad areas will be stored in sites that will drain directly to the sedimentation ponds.

3.3.1 Mining Plans

All mining and reclamation operations will be conducted in accordance with the approved permit and the requirements of R645-301-510 through R645-301-553.

Mining plans for the term of the proposed permit are shown on Plates 3-3 and 3-4. These maps show the location and extent of known, existing, adjacent workings as well as projections for mining within the Blue Blaze No. 1 and No. 2 Mines. Cross-sections, drill hole elevations, coal seam and overburden stratigraphy, and other geologic data are addressed in Section 6. A mine workings map will be kept current from the time of opening and these updated maps will be supplied to the Division yearly or when requested.

A comparison of Plates 3-4 and 4-1 indicates that initial development of the NO. 2 Mine will occur in fee (private) coal. This comparison further indicates that mining in federal coal will first occur approximately 8 to 9 months after mining begins.

3.3.1.1 Orientation and Multiple Seam Considerations

Seam separation in the area ranges from approximately 150 feet to 230 feet. With this distance and land structure indicated by drill logs, it is considered neither necessary nor feasible to columnize these workings.

3.3.1.2 Portals, Shafts, and Slopes

There will be three portals in the lower Hiawatha seam: one air intake, one belt (or haulage), and one air return. There will be four portals in the upper Castlegate "A" seam: two air intakes, one belt, and one air return. Exhaust fans will be installed in both mines.

The No. 2 Mine will be accessed from a mine bench that will be higher in elevation than the primary mine yard (Plate 3-1). Slope stability analyses of this mine bench are presented in Appendix 3.

City Sanitation

Box 374 • 741 North 9th East
PRICE, UTAH 84501
637-3785

January 12, 1989

Mr. Roger Skaggs,
P.O. Box 784
Price, Utah 84501

Dear Mr. Skaggs,

It is my understanding that you may be involved with the opening of a new mine. Since we are hauling garbage or refuse from other mines we would like you to know that we would be available to serve you in the event that you are successful in completing the requirements necessary to open a mine.

If the mine is in Emery County, we haul only to the Emery County Landfill or in Carbon County to the Carbon County Landfill that is an approved landfill.

We will be looking forward to being able to serve you and wish you success with your endeavor.

Respectfully,

Jaselene Williams
Sec./Treas.

Figure 3-2. Waste Haulage Letter.

3.3.1.3 Mining Methods, Room and Pillar, Longwall

All mining will be done with a continuous miner/shuttle car haulage. Main entries will be developed to the protective barrier pillars (Section 3.3.2.3) on the property boundaries, with sub-mains and panels developed off the mains. In second-mining, a standard room-and-pillar method will be used to maximize coal recovery. Recovery within a room-and pillar panel is estimated to be about 60 percent. Longwall mining is not planned at the present time. Figures 3-2a and 3-2b present a pillar extraction plan for areas that do not underlie surface buffer zones. Figures 3-2c and 3-2d provide a pillar reduction plan for areas where surface buffer zones will be protected. The location of these buffer zones is provided on Plates 3-3 and 3-4.

3.3.1.4 Projected Mine Development, Mains, Sub-Mains, Panels, Etc.

The main entries will consist of a five-entry system on 80-foot centers driven to the protective barrier pillars (Section 3.3.2.3) at the property limits. Sub-mains consisting of three entries on 80-foot centers will be driven off the mains and room-and-pillar panels will be developed off the sub-mains. As the panel retreat is completed, the sub-mains will be pulled back to the barrier pillars left along the mains. The mains will be pulled upon final retreat of the mining operation. All information will be submitted to the Division. Safety factors for roof conditions using uniaxial compression data are presented in Appendix 3.

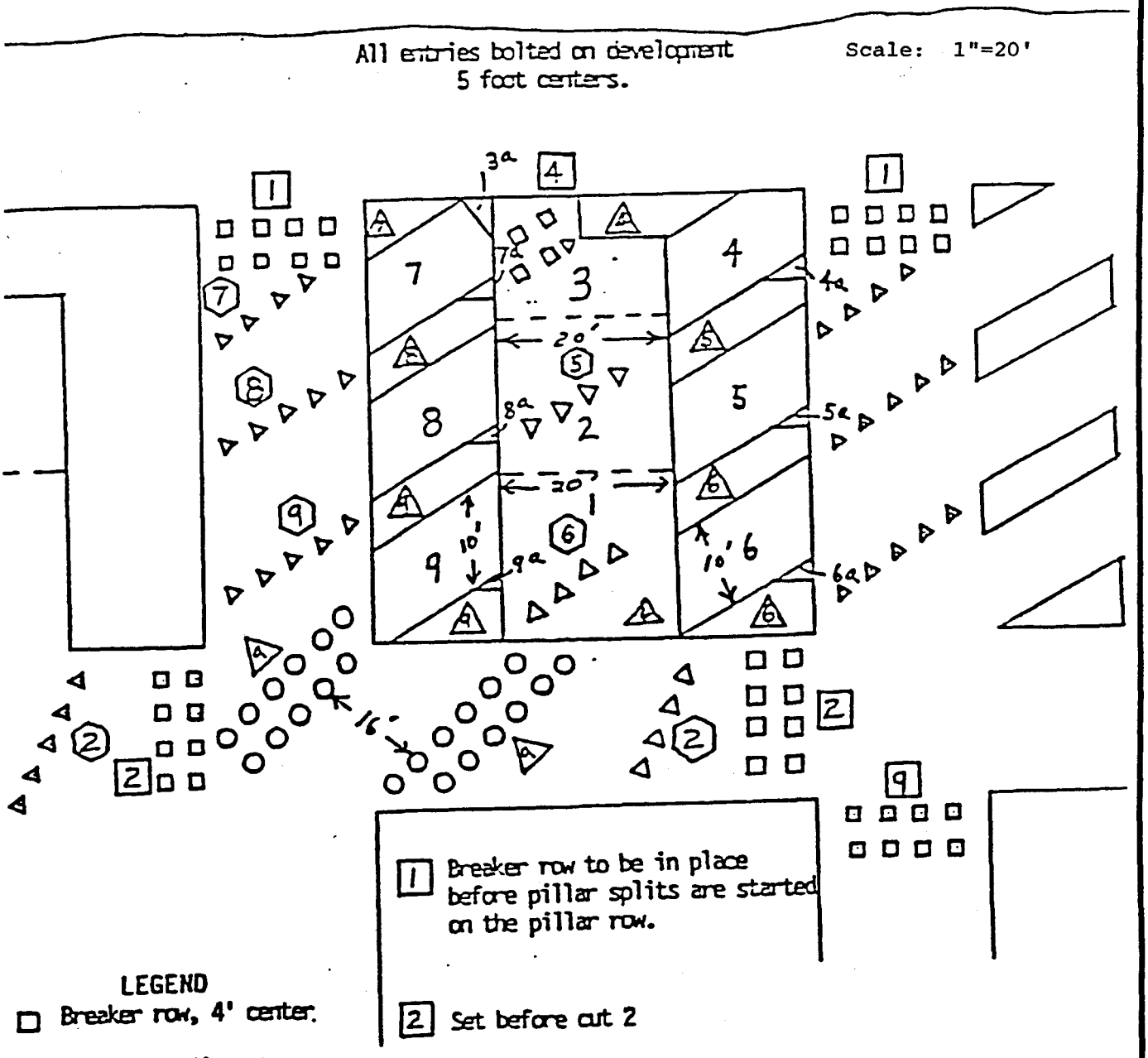
3.3.1.5 Retreat Mining

Rooms will be developed within the panels on 60- to 80-foot centers. The pillars will then be split, leaving two fenders with sizes of approximately 20 feet x 60 feet. These fenders will then be removed one at a time by successive cuts with the miner. Timbers will be installed to support the roof and provide for breaker control on caving roof. It is estimated that retreat mining of this type will provide a recovery rate of 60 percent.

3.3.1.6 Roof Control, Ventilation, Water Systems, Dust Suppression, Dewatering, Electrical

A copy of the approved Roof Control, Ventilation and Dust Control Plans will be included upon approval.

As indicated in Section 7, it is not currently anticipated that groundwater will be encountered within the No. 2 Mine. An



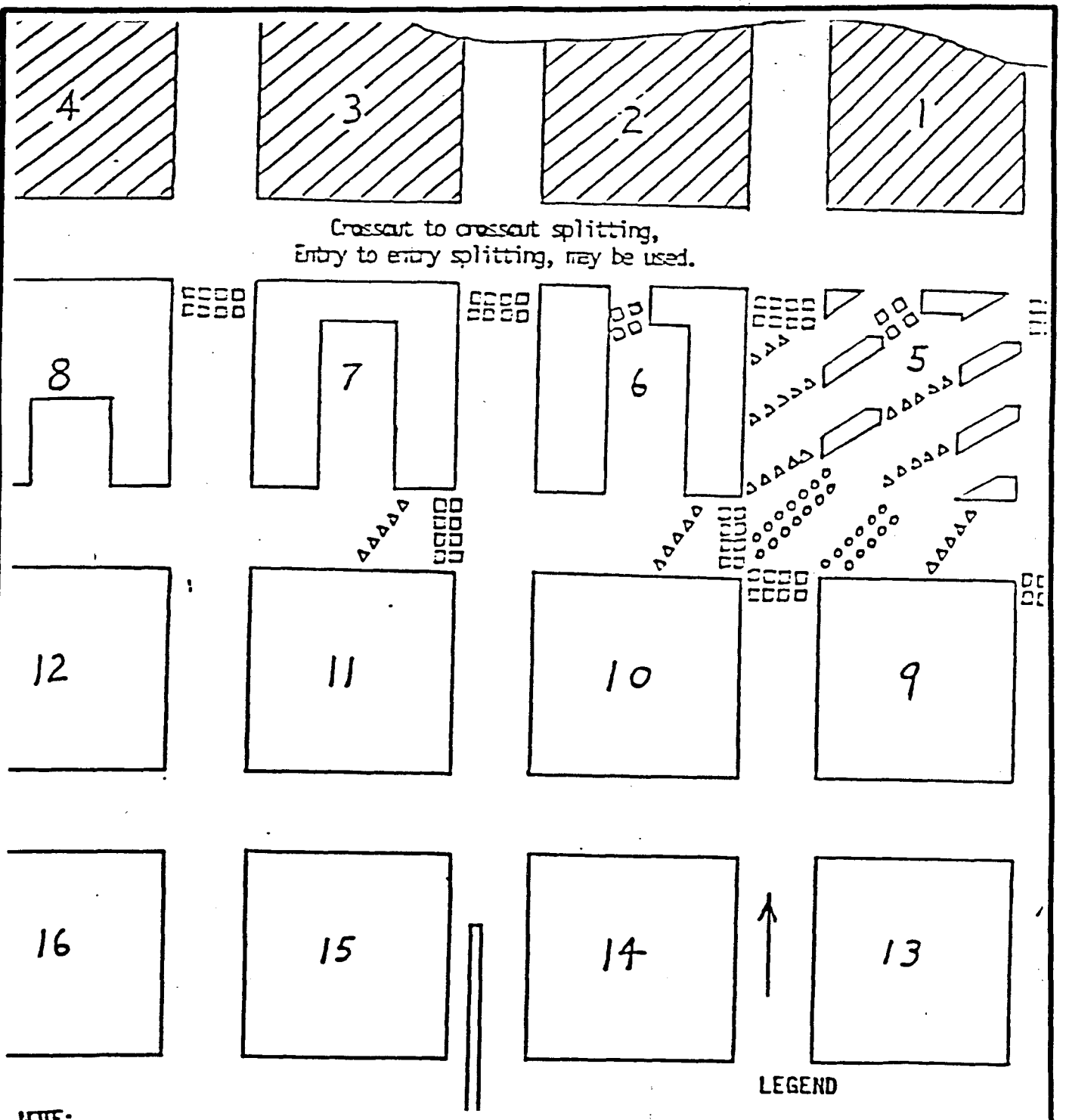
LEGEND

- □ Breaker row, 4' center.
- △ Turn post, 4' center
- [1] Cut for which breaker row is set.
- 2 Cutting sequence
- ○ Final pushout props, 4' center
- △4 No. of cut after which stump may be reduced.
- (2) Cut for which turn row is set.

NOTES:

1. Normal sequence represented. Unusual conditions (water, adverse roof, pillar size, etc.) may dictate a change in the sequence.
2. Cut No. 1 and 2, 21 ft max. Bolted on 5-ft centers before next cut is made. Stumps, feeders, and/or blocks may be mined as much as possible to induce caving. The roadway to the final pushout shall not exceed 16 ft. Cuts may be 30 ft when remote control is used.

Figure 3-2a. Pillar Extraction



NOTE:
.This is the normal pillar sequence. Unusual conditions such as water, adverse roof or pillar size may dictate a change in the sequence to protect miners. A pillar row may be started from the return side provided a complete row is pulled in the same direction. Stumps, fenders or blocks may be mined as much as possible to induce caving.

LEGEND

- □ Breaker row
- △ Turn timber
- ○ Pushout prop

Scale: 1"=40'

Figure 3-2b Pillar Sequence.

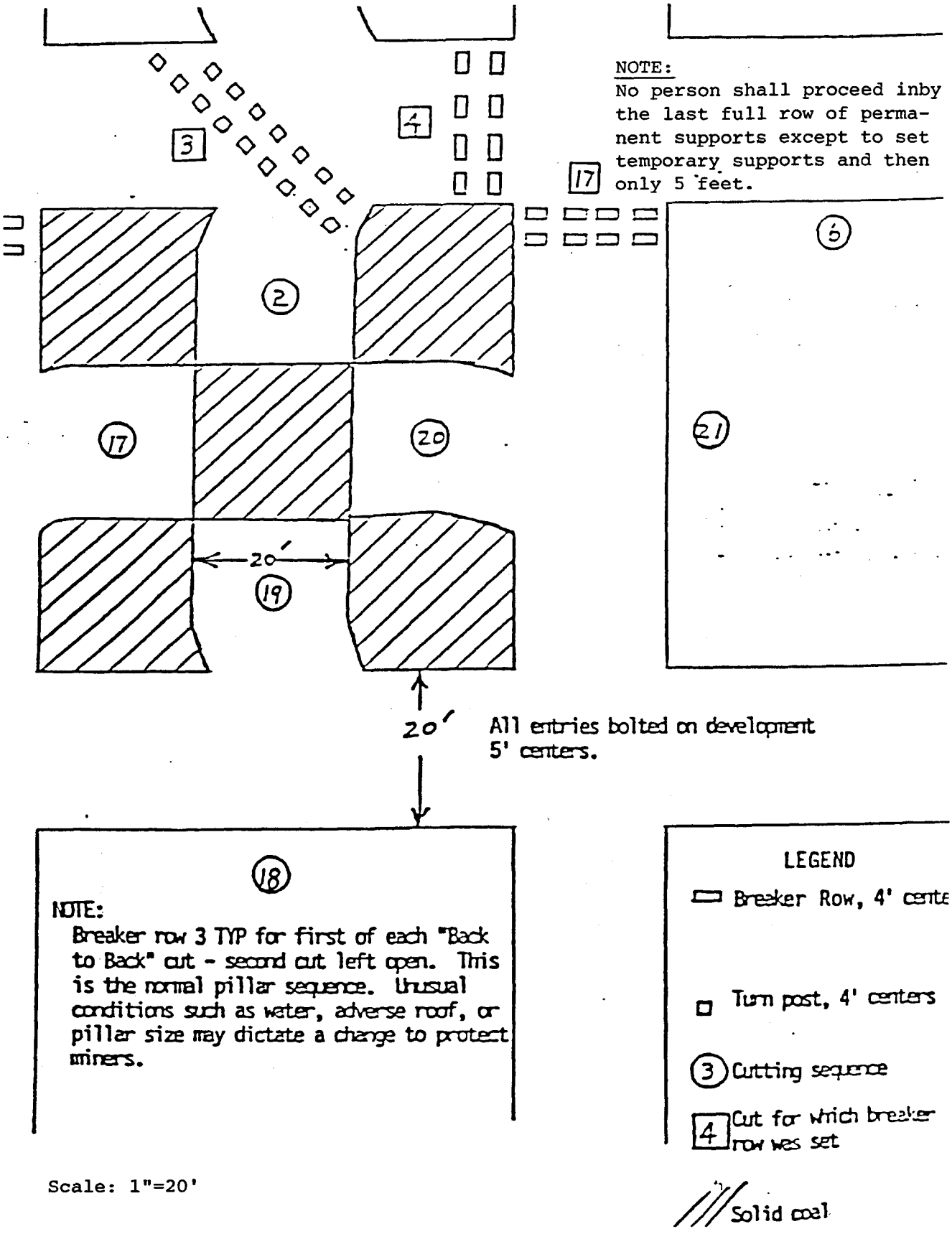
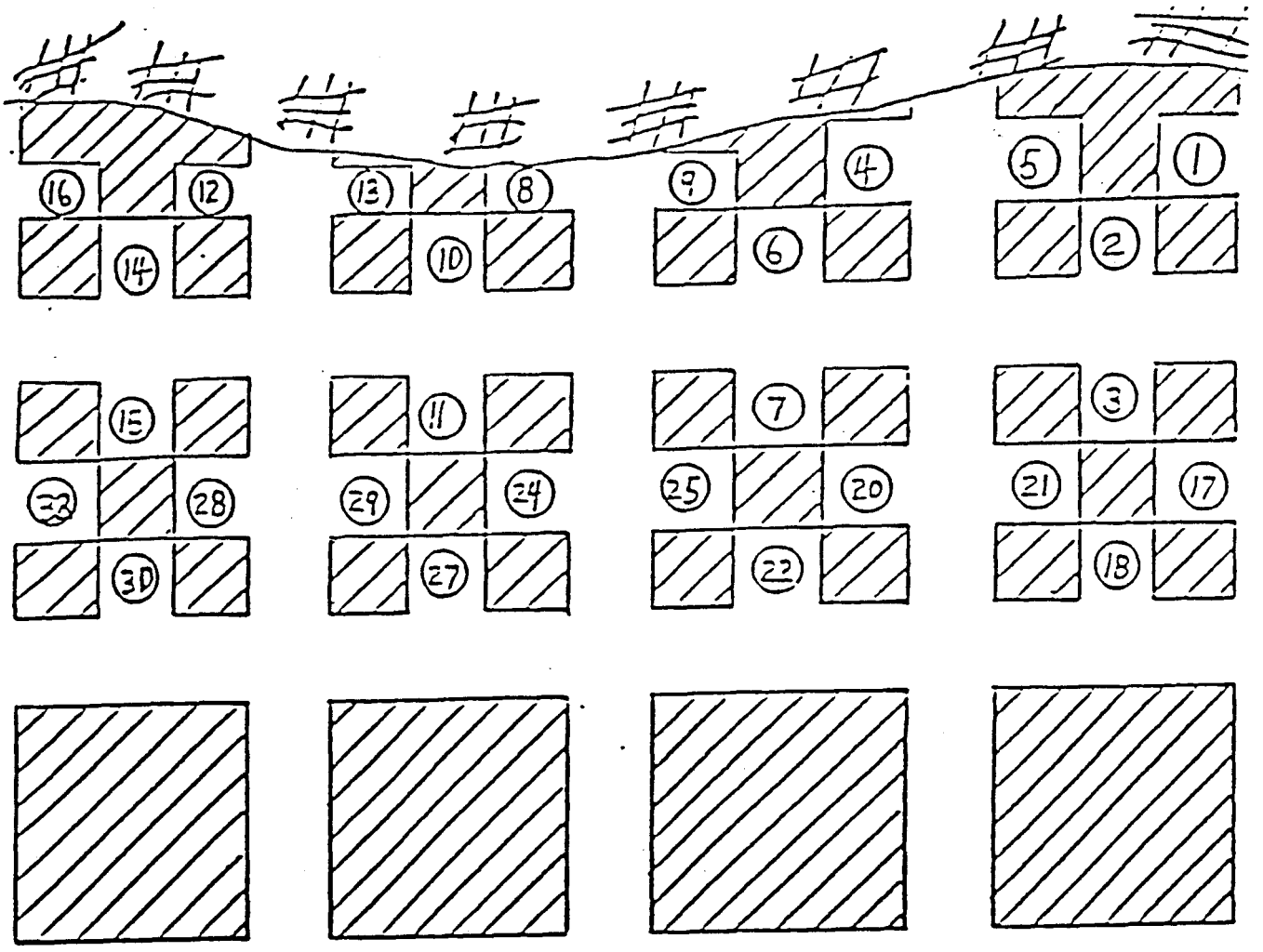


Figure 3-2c. Four-Way Pillar Split.



LEGEND

(3) Cutting Sequence

Solid Coal

No Scale

NOTE:
Normal pillar sequence represented. Unusual conditions may indicate a change in the sequence. A pillar row may be started from the intake side provided a complete row is pulled from the same direction.

Figure 3-2d. Pillar Sequence, Four-Way, Right to Left.

assessment of groundwater conditions within the No. 1 Mine will be made following collection of the groundwater monitoring data. Thus, no dewatering plans have been developed for either mine.

3.3.2 Barrier Pillars

Protective barrier pillars will be utilized where necessary, normally ranging from 100 feet to 300 feet in width, depending on the depth of cover and the purpose of the barrier. Barrier pillars will be left on either side of the main entries. Barrier pillars in the mains will be extracted on final retreat. Proposed locations of the barrier pillars are indicated on Plates 3-3 and 3-4.

3.3.2.1 Protection of Oil and Gas Wells

There are no oil or gas wells in this area.

3.3.2.2 Protection of Surface Structures and Streams

No surface structures exist within the zone of potential subsidence. However, eagle nests that occur in the northeast corner of the permit area (see Plates 3-3 and 3-4) will be protected from subsidence through the creation of a buffer zone from which second mining will not be practiced.

Stream buffer zones will be maintained beneath Beaver Creek and Gordon Creek in the areas noted on Plate 3-3. Second mining will not be practiced within these buffer zones.

3.3.2.3 Property Boundaries

A protective barrier pillar with a width of approximately 80 to 100 feet will be left at all property boundaries.

3.3.2.4 Outcrop Protection

A protective barrier pillar with a width of approximately 100 feet will be left when advancing toward or along an outcrop.

3.3.2.5 Other

At any time a slide occurs which may have an adverse effect on public property, health, safety, or the environment, the Division will be notified by the fastest available means. Blue Blaze Coal Company commits to complying with remedial measures required by the Division.

3.3.2.6 Underground Development Waste

As noted previously in Section 3.3, underground development waste will be disposed of in underground "gob" areas. Temporary surface storage of underground development waste may occur for a maximum of

90 days as discussed previously in Section 3.3. The duration of this surface storage will be minimized to the extent possible.

The Division and MSHA will be notified and plans submitted at least 30 days prior to use of gob areas where non-coal waste rock will be stored. Prior to disposal in the gob areas, the material to be stored will be analyzed (at a rate of one sample for every 5,000 yd^3 of waste) for acid and toxic-forming potential in accordance with "Guidelines for Management of Topsoil and Overburden" as published by the Division. The results of the tests will be sent to the Division along with the proposed disposal plan.

3.3.2.7 Return of Coal Processing Waste to Underground

No coal processing will be performed at the site. Therefore, no such waste will be returned underground.

Approximately 9718 yd^3 of waste coal exists at the site near Test Pit No. 8 from previous mining operations. Results of analyses of this material are presented in Section 8. This waste will be temporarily stockpiled adjacent to the coal stockpile (see Plate 3-1) and blended with coal shipped off site.

3.3.3 Conservation of Coal Resource

The maximum quantity of coal will be extracted that is consistent with safe operation of the mines and the mining methods to be employed. Engineering, production, and supervision of mining activities will be geared toward this end. If plans for resource recovery or abandonment (including portal sealing) change in the future, the U.S. Bureau of Land Management and the Division will be properly informed.

3.3.3.1 Projected Maximum Recovery

In-place total coal reserves were calculated by detailed plainimetering of old Consumers mine maps in conjunction with coal isopach maps. Coal reserves within the permit area are summarized below. Recoverable reserves were estimated using a recovery rate of 60 percent. Reserves on the Federal lease (SL-063011) total 4,338,600 tons between the two seams, of which 2,603,200 tons are estimated to be recoverable.

Area	Castlegate "A" Seam (tons)		Hiawatha Seam (tons)	
	Total	Recoverable	Total	Recoverable
Federal Lease (SL-063011)	761,000	456,600	3,577,600	2,146,600
Non-Federal Coal	1,039,000	623,400	1,272,400	763,400
Total	1,800,000	1,080,000	4,850,000	2,910,000

3.3.3.2 Justification for Non-recovery

All coal that can economically and safely be recovered will be recovered. Barrier pillars and buffer zones will be left only where required to protect surface resources, provide safe mining conditions, and as required by law or regulation.

3.3.3.3 Access for Future Reserves

Access to additional reserves will depend upon the results of exploration activities and obtaining of leases. However, it is currently anticipated that additional reserves may be access in the future to the west of the present mine plan area in the Hiawatha seam (in Sec. 18, T. 13 S., R. 8 E.) under that portion of the Castlegate "A" seam which was mined by Beaver Creek Coal Company. In addition, reserves in the Castlegate "A" and Hiawatha seams may be accessed to the north of the present mine plan area (in Sec. 7 and 8, T. 13 S., R. 8 E.

3.3.4 Equipment Selection

Major equipment to be used underground will include the following:

1 - Joy 12CM-11 Continuous Miner
1 - Lee Noris Roof Bolter RD1-43
2 - Joy Shuttle Cars
1 - Long Airdox Rosco II Feeder Breaker
1 - Wagner Scoop
1 - Joy Air Compressor
1 - MSA Rock Duster
1 - Calhune Rock Duster
2 - Long Airdox Conveyor Drives & Tail Pieces 42"
1 - John Deer Dust Wagon
1 - Power Center
3 - Transformers
2 - Pumps
1 - 992 Cat Loader
1 - Substation

Major equipment to be used on the surface will include the following:

1 - Material tractor
1 - Lincoln Welder
3 - Flatbed Material Trailers
1 - Storage Van
2 - Bathhouses

3.3.5 Mine Safety, Fire Protection, and Security

Mine Safety

The Blue Blaze No. 1 and No. 2 Mines will be operated in accordance with Mine Safety and Health Administration (MSHA) and applicable State of Utah regulations. Safety training will be taught and policies implemented for a safe operation.

Fire Protection

All surface and underground equipment will be provided with MSHA-required fire protection. In addition, belt drives will be equipped with deluge systems for fire protection. Water lines will also be equipped with outlets and fire hoses at regular intervals. Should a mine waste fire occur, it will be extinguished using water, extinguishers, rock dust, foam, or by sealing off the fire. Mine personnel will be trained in the use of fire-fighting techniques.

There will be no open burning on the surface. All garbage will be contained in dumpsters and hauled to the Carbon County Landfill. If flammable waste materials (oil, etc.) are generated, these will be disposed of in accordance with regulations promulgated by the Utah Division of Solid and Hazardous Waste. Disposal methods and locations will be determined based on the characteristics of the flammable waste.

Impoundment Hazards

Impoundment hazards will be reported promptly to the Division and the emergency procedures formulated for public protection and remedial action.

Security

Locked gates and signs will be installed and maintained at the road entrance to the permit area when the mine is idle. In addition, a guard will be employed and will inspect the mine site during off-hours and weekends to ensure security.

3.3.5.1 Signs

Specifications

All signs will be of a standard design that can be seen and read easily. They will be made of a durable material (treated/painted wood or metal) and supported by metal or wooden posts.

Identification Signs

Mine identification signs will be placed at the entrance to the mine yard at the location noted on Plate 3-1. Typical mine identification signs are presented in Figures 3-3 and 3-3a. Signs will show the mine name, company name, business address, telephone number, ID Number, and Permit Number. These signs will be maintained until bond release following reclamation.

Disturbed Area Perimeter and Buffer Zone Markers

Disturbed area perimeter markers will be placed a the locations noted on Plate 3-1. These will be steel fence posts with a silver portion on the top 6 inches. The posts also will carry signs at selected points, with the designation "Disturbed Area Perimeter Marker" (see Figure 3-4).

Buffer zone signs will be placed adjacent to Gordon Creek to prevent disturbance. A typical buffer zone markers is presented in Figure 3-4a.

Blasting Signs

No surface blasting will be employed at this site.

Topsoil Markers

Topsoil will be stored on the mine site at the locations noted on Plate 3-1. Topsoil storage piles will be marked with a signs as shown on Figure 3-4b.

Snow Storage Signs

Signs will be placed to designate Snow Storage Areas (see Figure 3-4c).

3.3.5.2 Fences and Gates

Stock fences will be employed at the canyon mouths to keep livestock off the property. Gates will be installed at the entrance to the mine yard area. These gates will be open during normal work hours and will be kept locked otherwise.

BLUE BLAZE NO. 1 MINE

I.D._____

BLUE BLAZE COAL COMPANY
P.O. BOX 784
PRICE, UTAH 84501
(801)472-3786

PERMIT NO._____

Figure 3-3. No. 1 Mine Identification Sign

BLUE BLAZE NO. 2 MINE

I.D._____

BLUE BLAZE COAL COMPANY
P.O. BOX 784
PRICE, UTAH 84501
(801)472-3786

PERMIT NO._____

Figure 3-3a. No. 2 Mine Identification Sign.

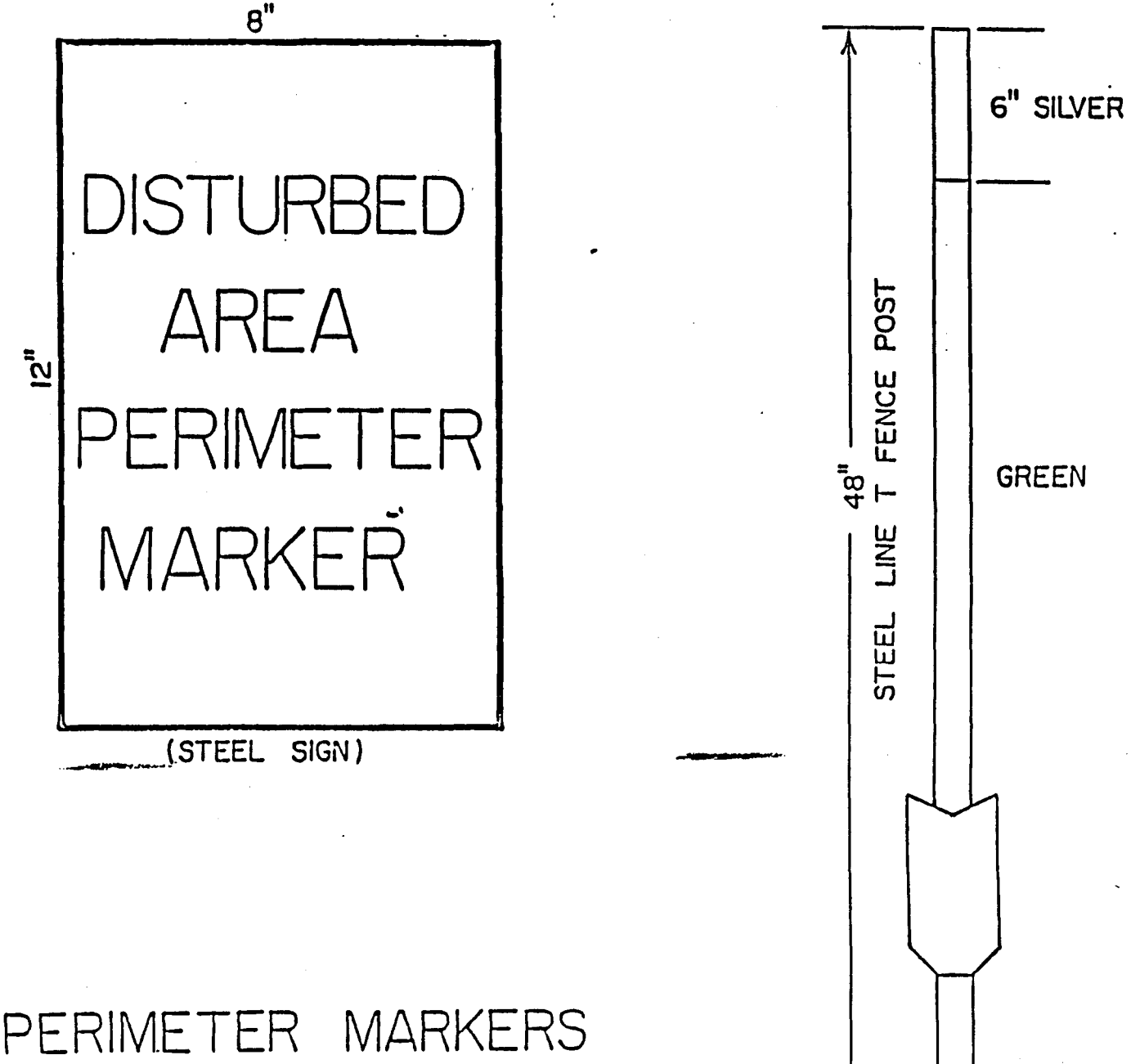


Figure 3-4. Perimeter Markers.

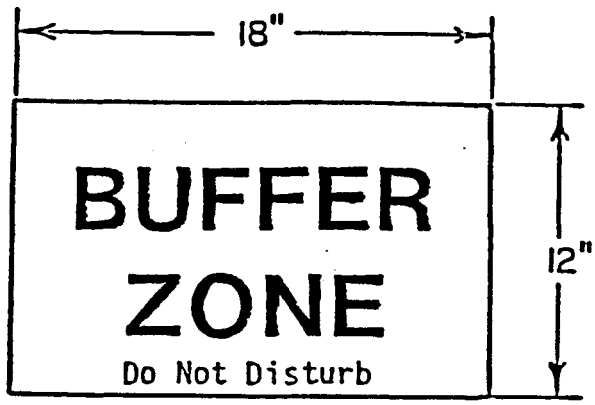


Figure 3-4a. Buffer Zone Marker.

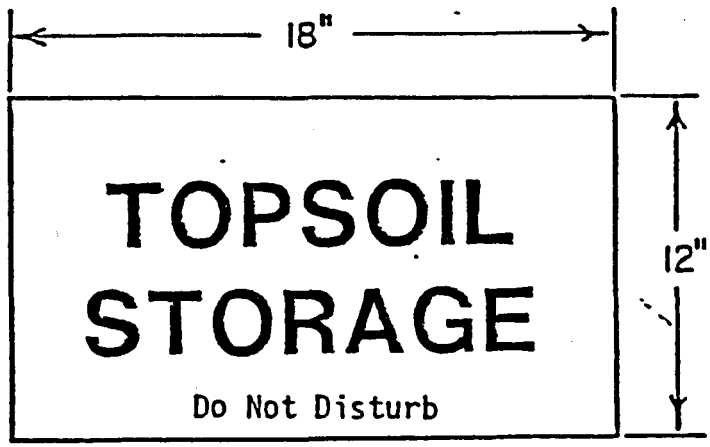


Figure 3-4b. Topsoil Storage Marker.

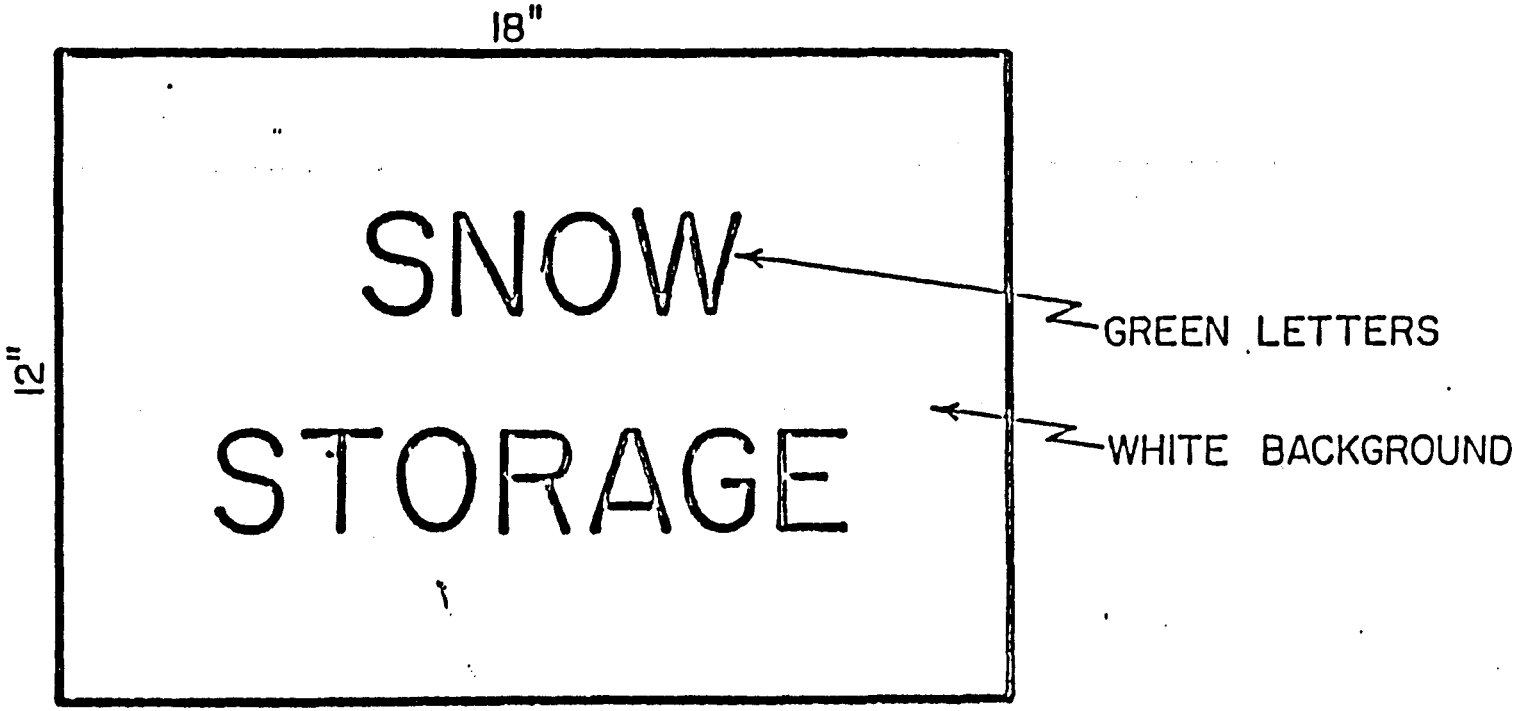


Figure 3-4c. Snow Storage Marker.

3.3.5.3 Fire Protection

Facilities

All facilities will be equipped with fire extinguishers. Water outlets and fire hoses will be available at specific locations.

Coal Stockpiles

The coal stockpile will be temporary and will be loaded out at frequent intervals, thus reducing the potential for spontaneous combustion. There will be no refuse piles or coal processing wastes at this location.

Coal Seam

No open burning will be allowed at the mine. All coal outcrops resulting from mining will be covered with incombustible material upon cessation of operations, as discussed in Section 3.5.

3.3.5.4 Explosives

Any explosives utilized in underground operations will be used in compliance with applicable State and Federal laws. Explosives will be handled and used only by persons trained, examined, and certified as required by 30 CFR 850 and the Utah State Industrial Commission.

3.3.6 Operations Schedule

3.3.6.1 Annual Production Per Year for Permit Term

The annual production for each mine is projected to be 220,000 to 360,000 raw tons, based on one miner section and two shifts per day. It is anticipated that this production level will be reached in 1993, with production during initial development (1992) being less.

3.3.6.2 Operations Schedule - Days - Shifts

Production will occur during two shift each day, five days per week (approximately 240 days per year). A small crew will perform maintenance work and other non-production jobs on the third shift of each work day.

3.3.6.3 Operation Employment

It is currently anticipated that the Blue Blaze Mines will employee approximately 7 salaried and 31 hourly people.

3.3.6.4 Temporary Cessation

If operations are to be temporarily ceased for more than 30 days, Blue Blaze Coal Company will submit to the Division a notice of

intention to cease or abandon the operations. In accordance with R645.529.210, each mine entry that has further projected useful service will be protected by barricades or other covering devices, fenced, and posted with signs to prevent access into the entry and to identify the hazardous nature of the opening. These devices will be periodically inspected and maintained by Blue Blaze Coal Company.

3.3.7 Mine Permit Area

3.3.7.1 Acreage and Delineation of Mine Permit Area

The total area contained within the mine permit area is 680 acres.

3.3.7.2 Projected Mining by Year

The projected mining by year is shown on Plates 3-3 and 3-4.

3.3.8 Mine Plan Area

The mine plan area is the same as the mine permit area. Plans for mining beyond the permit term will be developed as additional leases are acquired (e.g., to the north in Sections 7 and 8, and to the west in Section 18). No new areas will be mined until appropriate permits have been obtained from the Division and other regulatory authorities.

3.4 Environmental Protection

3.4.1 Preservation of Land Use

Upon completion of mining operations at the No. 1 and No. 2 Mines, final reclamation work will commence. Reclamation efforts will be directed to recreating the pre-mining land uses of wildlife habitat and limited grazing. This will be achieved by use of an acceptable seed mixture with shrubs and grasses.

3.4.1.1 Projected Impacts of Mining on Current and Future Land-Use

Blue Blaze personnel will control impacts in additional areas by maintaining surface disturbances within the present boundaries. Mining operations will not affect public facilities or roads (see Figure 3-1b). Future land uses will be protected through reclamation of surface disturbances following mining.

3.4.1.2 Control Measures to Mitigate Impacts

Wildlife may be impacted during mining operations. However, fences and gates will be installed to minimize the potential for wildlife to migrate into the mine yard. In addition, second mining will not occur beneath the stream channels and eagle nests indicated on Plates 3-3 and 3-4. Based on the boundaries of the present surface disturbance, no public parks or historic places will be impacted by

mining operations. A further discussion of Cultural Resources may be found in Section 5.

3.4.2 Protection of Human Values

3.4.2.1 Projected Impacts of Mining on Human Values

As discussed in Section 5, no historical sites listed on the National Register of Historical Places are known to exist within the proposed disturbed areas. In addition, no known archaeological sites exist within the proposed disturbed area.

As noted in Section 5, three dilapidated cabins and one isolated artifact were found some distance away from the proposed surface disturbance. These sites were analyzed by the State Preservation Officer to determine if they warranted listings in the National Register of Historic Places. It was determined that the sites were neither sufficiently old nor significant to be so listed.

3.4.3 Protection of Hydrologic Balance

Blue Blaze Coal Company will employ various control measures to protect the hydrologic balance of the permit area. As noted in Section 7.1.6, alternative sources will be developed and provided if water rights or uses are affected by mining operations. Also, sedimentation control will be provided for all disturbed areas.

Water rights on file with the Utah Division of Water Rights and located in the vicinity of the permit area are noted in Appendix 1. Blue Blaze Coal Company is presently in the process of obtaining rights to the use of 0.557 cfs (404 AF/yr) of water in the area for use in mining operations (File No. 330 currently owned by Sweets Coal Company). Information concerning these water rights is provided in Figures 3-5 and 3-5a. Should mining activities at the Blue Blaze No. 1 or No. 2 Mines cause an adverse impact on water supplies in the area, water from this right will be used to replace the impacted supplies.

Diversions will be established to direct flow from disturbed areas to the sedimentation pond. If water is encountered during mining operations, this water will be used for underground operations. An NPDES permit (UT-0023761) has been obtained for the No. 1 and No. 2

Form 116
25M 4-63

IN THE SEVENTH JUDICIAL DISTRICT COURT, IN AND FOR THE COUNTY OF CARBON STATE OF UTAH

IN THE MATTER OF THE GENERAL DETERMINATION OF RIGHTS TO THE USE OF WATER, BOTH SURFACE AND UNDERGROUND, WITHIN THE DRAINAGE AREA OF THE PRICE RIVER AND OF THE DRAINAGE AREA OF THE GREEN RIVER FROM THE CONFLUENCE OF THE PRICE AND GREEN RIVERS TO THE CONFLUENCE OF THE GREEN AND COLORADO RIVERS EXCLUDING THE DRAINAGE AREA OF THE SAN RAFAEL RIVER IN UTAH

STATEMENT OF WATER USER'S CLAIM
CODE NO. 91 SERIAL NO. 330
MAP NO. 39

NOTE This blank is sent to you in accordance with Utah Law. The information called for herein will be used in connection with the adjudication of water rights on the above mentioned drainage area. All questions applicable to your claim must be answered fully, and one copy of this form must be filed with the Clerk of the District Court at Price, Utah, within sixty (60) days from date of service of the attached Notice. A copy shall be filed with the State Engineer, State Capitol, Salt Lake City. Failure to file the attached Statement of the Water User's Claim with the Clerk of the District Court within the time stated will forever bar and estop you from asserting any right to the use of water from said drainage area.

1. Name of Claimant Sweets Coal Company
2. Address Continental Bank Building, Salt Lake City, Utah 84101 — Interest Claimed Full
3. Name of particular spring, spring area, stream, well, tunnel or drain from which water is diverted is Underground Water in Carbon County
4. Priority date claimed March 17, 1936 Date when water was first used
   Date when work on diverting system was first begun — Date when diverting system was completed
   Nature of work
5. Class of Right (Indicate by X):
   (a) Right to surface water initiated by beneficial use before 1903 Claim No
   (b) X Right to underground water initiated before 1935 Claim No 11830
   (c) Right decreed by court, cite title of case
   (d) Application filed, State Engineer's Office No. — Cert. of App. No.
   (e) Right acquired by adverse use prior to 1939
6. Nature (Indicate by X), Amount, and Annual Period of Use (by month & day):
   (a) Irrigation Sec. Ft. from to (both dates incl.)
   (b) Stockwatering Sec. Ft. from to (both dates incl.)
   (c) Domestic Sec. Ft. from to (both dates incl.)
   (d) Municipal Sec. Ft. from to (both dates incl.)
   (e) Mining Sec. Ft. 250 gpm from January 1 to December 31 (both dates incl.)
7. Direct Flow Appropriation (must be described with reference to U. S. Government Survey Corner)
   (a) Point of diversion from ~~XXXXXXXXXXXXXXXX~~ well ~~XXXXXXXX~~ S. 970 ft. and W. 1380 ft. from NE Cor., Sec. 18, T13S, R8E, SLB&M.
   (b) Description of spring area
   (c) Point of rediversion or point of return to natural channel
   (d) If flow is intermittently diverted, list by number or description, all rights involved
8. Where water is used for irrigation purposes:
   (a) Area irrigated in legal subdivisions of land by 40-acre tract. (All sources of water for same land or lands must be described in each instance by name or claim number)
   (b) Do you get water under a ditch owned by several users? If so, give names of all users and divisions of interest
9. Where water is used for Stockwatering:
   (a) Number of each kind of stock watered
   (b) All sources of water for same stock. (Describe by name or claim number)
10. Where water is used for Domestic:
   (a) Number of families or their equivalent — All sources of water for same use. (Describe by name or claim number)

Figure 3-5. Water Right Determination.

Florence H. Sweet
1750 Richard Drive
Salt Lake City, Utah 84106

Date September 24, 1990

Mr. George D. Fehr
10 Exchange Place #610
Salt Lake City, Utah 84111

Dear Mr. Fehr:

This is in answer to your request relative to information on the present status of certain water rights owned by V. W. Sweet & any & all portions of such rights which may have been inherited by me as his surviving spouse and sole heir at [illegible]:

I have leased the water rights to a surface spring with a flow of .015 cfs, which lease will run to November 1993 unless extended. At that time additionally, water flow in the amount of .557 cfs is filed as underground water claim #11850 with point of diversion S. 970 ft., W. 1580 ft. from NE. Corner, Sec. 18, T 13S, R 8 E, SLBM. This latter water source is, in whole or in part, available for immediate [illegible] which may be [illegible] based on the [illegible] price & evidenced by a [illegible] memorandum of agreement or like instrument.

Our family as neighbors of & former owner & operators of the Blue Blaze property, wishes you every success in its contemplated operation.

Very truly yours -
Florence H. Sweet by
Richard A. Sweet, atty-in-fact.

Figure 3-5a. Water Right Letter.

Mines. If the quantity of underground water encountered by mining exceeds the amount required for mining operations, discharges of water from underground workings will be monitored to ensure that effluent limitations are met.

3.4.3.1 Projected Impacts of Mining on Hydrologic Balance

The probable impacts of mining on surface or groundwater resources in the area are discussed in Section 7. Runoff-and sediment-control facilities within the disturbed area, together with coal buffer zones beneath Beaver Creek and Gordon Creek, will preclude significant impacts to surface water in the area. It is not anticipated that significant groundwater will be encountered in the No. 2 Mine. Groundwater investigation and monitoring activities associated with the Hiawatha seam and its adjacent strata will be conducted prior to opening the No. 1 Mine, thus allowing a determination of the potential groundwater impacts of Mining in the Hiawatha seam. A subsidence monitoring program (see Section 3.4.8) will provide a basis for determining possible impacts due to subsidence.

3.4.3.2 Control Measures to Mitigate Impacts and Monitoring Procedures

Blue Blaze Coal Company will maintain sedimentation control structures to prevent impacts to the surface waters in Gordon Creek. Groundwater that may be encountered during mining operations will be used for underground dust abatement. In the event that the quantity of groundwater encountered during mining is in excess of underground requirements, the water will be settled first in underground sumps and then discharged to the surface. Any such discharges will be monitored in accordance with the UPDES permit.

Surface and groundwater monitoring programs have been or will be implemented to assess the impacts of mining operations at the No. 1 and No. 2 Mines on hydrologic resources in the area. Details of these monitoring programs are presented in Section 7.

3.4.4 Preservation of Soil Resources and Projected Impacts of Mining on Soil Resources

Soil resource information for the mine area is presented in Section 8. Soil surveys were performed in the area in May 1980 and in January 1990. Naturally-occurring and presently-disturbed soils were delineated. The purposes of the surveys were to identify soils and their stripping depths for salvaging suitable natural soil prior to additional disturbance and to determine the amount of topsoil available for final reclamation.

Most of the existing disturbance at the No. 1 and 2 Mines occurred prior to enactment of P. L. 95-87 or the Utah Interim Program that set forth regulations for salvaging topsoil (i.e., pre-1950's

disturbance). However, some topsoil exists along the shoulders of cut areas where it was not disturbed during previous construction activities.

During construction of surface facilities at the No. 1 and No. 2 Mines, available topsoil resources will be segregated and stockpiled as indicated in Section 8. In addition, presently-disturbed soils will be carefully handled to salvage as much soil as possible for potential future use as substitute topsoil materials. This special handling will include segregation of large rock fragments and potentially toxic or acid-forming materials (based on previous analyses).

The large rock fragments will be used as rip-rap in channel restoration or buried with the fill. If the toxic or acid-forming material contains a significant quantity of coal, this material will be segregated, mixed with coal produced at the mine, and shipped off site with the coal. If the toxic or acid-forming material does not contain significant marketable coal, this material will be either stored underground as indicated in Section 3.3 or blended with outgoing coal.

Prior to placement of topsoil during reclamation, all areas to receive topsoil will be scarified to a depth of not less than 12 inches. The topsoil will then be applied. The seed mixture will be applied with a mulch to retain moisture prior to establishment of the vegetative cover.

3.4.4.1 Control Measures to Mitigate Impacts to Soil Resources

Surface disturbances will be limited to the boundaries noted on Plate 3-1. Topsoil that is stockpiled for future reclamation efforts will be vegetated with an interim cover to reduce erosion of the stockpile. All areas disturbed during mining activities will be reclaimed in accordance with the approved reclamation plan (see Section 3.5).

3.4.5 Protection of Vegetative Resources

3.4.5.1 Projected Impact of Mining on Vegetative Resources

Previous mining activities have resulted in alteration of natural vegetation at the site area. Approximately 10.3 acres will be disturbed in the new mining operation. Of this area, only about 0.3 acre will be newly disturbed (see Plate 9-2).

3.4.5.2 Mitigation Measures to be Employed to Reduce Impacts on Vegetative Resources

All mining activities will be conducted within the proposed disturbed area. Traffic will be confined to established roadways.

Upon completion of mining, all areas which are disturbed by Blue Blaze Coal Company will be reclaimed described in Section 3.5.3.

3.4.5.3 Monitoring Procedures - Reference Areas and Revegetation

No reference areas will be established. Sections 3.5.5, 3.5.6 and 9.8 discuss the monitoring procedures and revegetation to be undertaken during mining and reclamation operations at the No. 1 and 2 Mines.

3.4.6 Protection of Fish and Wildlife

3.4.6.1 Potential Impacts on Fish and Wildlife

Wildlife impacts typically can be categorized into three groups: loss or modification of habitat, disturbance and mortality. Since the majority of the disturbance associated with the No. 1 and No. 2 Mines will be in areas that have been previously disturbed, there will be no significant loss of habitat as a result of the mining activities described in this PAP.

Aquatic habitat loss along North Fork Gordon Creek apparently has not occurred, because (1) the stream has not been significantly disturbed and (2) the intermittent stream near the disturbed area does not offer good aquatic wildlife potential. However, substantial increases in sediment load or chemical pollutants could conceivably have adverse impacts on aquatic habitats downstream of the study area. Due to its remoteness from the proposed disturbed area, the aquatic habitat of Beaver Creek probably will not be affected by the mining operation.

Future impacts to wildlife may occur as a result of noise associated with the mines. Thus, most larger species of birds and mammals may avoid the mine site during working hours. Most of these species are likely to move freely around the mine site on weekends and to quickly re-inhabit the area after reclamation.

Three types of mortality potentially could result from the Blue Blaze Coal Co. Mines: raptor electrocutions on unsafe power poles, mammal road kills, and pollution of downstream areas via Gordon Creek tributaries. A raptor hazard survey conducted in 1980 suggests that pole configurations on the site will incorporate the latest in protective design features (see Section 10). Mitigation measures for road kills, stream pollution, and other potential impacts are discussed in Section 3.4.6.2.

3.4.6.2 Mitigation and Management Plans

The relatively small-scale habitat loss associated with the mining operation will be mitigated upon completion of the project by reclaiming the disturbed sites. The revegetation plant mix includes herbaceous and woody species that are adapted to on-site conditions

and are of known value to wildlife for cover, forage, or both. Details of the reclamation plan are provided in Section 3.5.

Habitat loss associated with disruption or pollution of North Fork Gordon Creek will be controlled by through the runoff- and sediment-control plan that will be implemented at the site. Details regarding this plan are presented in Section 7.

Impacts to wildlife will be further minimized by employee awareness programs which will inform mine personnel of especially sensitive periods (e.g., the nesting season for raptors, fawning season for deer) or habitats in the vicinity of the mine area. Road kills will be mitigated through the awareness program, speed limits, and game crossing signs. Selected personnel will record any road kills on a standard form. The kill report form will include information such as date, time of day, and location. If the road kill study indicates a significant increase in the number of kills, the Utah Division of Wildlife Resources will be consulted for recommendations to minimize the road kill rates.

Raptor electrocutions will be minimized by using power pole and line configurations known to avoid most types of conductor-conductor or conductor-ground contacts. The main distribution line will use a three-phase, single-arm "t" construction, both with and without cross-arm supports (i.e., diagonal supports from near the end of the cross bar to the pole). This pole design minimizes impacts because the center phase is elevated well above the cross-arm, and cross-arm supports are constructed of wood.

3.4.6.3 Fish and Wildlife Monitoring

A wildlife monitoring program will be conducted throughout the operational life of the No. 1 and No. 2 Mines. The monitoring program will utilize the services of an environmental specialist and, as necessary, professional consultants to evaluate the on going success of operational mitigation measures. The program will also ensure that sensitive or critical use areas remain undisturbed by future activities, deal with any unforseen difficulties which might arise, and permit monitoring of reclamation efforts upon completion of mining activities. Any threatened or endangered species observed during this monitoring will be reported to the Utah Division of Oil, Gas and Mining and the Utah Division of Wildlife Resources.

Three aspects of the monitoring program will immediately be initiated upon opening the Blue Blaze Coal Company: (a) inspections of specific stations along Gordon Creek to monitor sediment load, (b) routine reporting by selected personnel of any road kills along the access corridor and (c) surveys of the site to locate - and thus avoid - active raptor nests.

3.4.7 Protection of Air Quality

3.4.7.1 Projected Impacts of Mining Operation on Air Quality

Impacts from Gordon Creek Canyon mining operations on air quality will be expected to be minimal due to the rapid fallout of particles with distance from the source. Particulate matter is the only air pollutant that has the potential to degrade air quality. The particulate matter is predominantly fugitive dust. Increases in concentrations of other pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, and photochemical oxidants are considered to be insignificant from the mining operation. Air quality information for the area is presented in Section 11 of this PAP.

3.4.7.2 Mitigating Measures to be Employed to Control Air Pollutants

Due to the moisture content of the coal (4.4%) and the water carryover from dust suppression sprays underground, the potential for fugitive dust emissions from coal is minimal. Water sprays are used on the continuous miners to eliminate coal dust at the working face underground. As coal is loaded onto the mine conveyor, it is again sprayed with water for additional dust suppression.

Whether the coal drops from a chute or from a conveyor to the stockpile area, fugitive emissions will be minimized due to the water carryover from the in-mine dust-suppression activities. Limited drop distances from coal loading by front-end loaders to haul trucks will further reduce fugitive emissions during conveying operations.

Coal haulage over unpaved road surfaces have the greatest potential for fugitive dust emissions. However, mitigating measures such as non-overloading of haul trucks, abiding by speed limits, watering the road surface on an as-needed basis, and application of a chemical dust suppressant and roadbed stabilizer have the potential to reduce fugitive emissions by 80% to 85%. Frequency of water and chemical dust suppressant application on the unpaved road surfaces will be determined by visual observation of the degree of road dustiness. Furthermore, surface dust-suppression activities will be extended to the loading pad and around the stockpile area if necessary. The air quality permit for the mine is provided in Figure 3-6.

3.4.7.3 Air Quality Monitoring Plans

Neither the Utah Division of Air Quality and nor the U.S. Environmental Protection Agency have established air quality monitoring network requirements for the area. Therefore, no air quality monitoring is planned for the permit area.

Scott M. Matheson
Governor

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS
Community Health Services
Environmental Health
Family Health Services
Health Care Financing and Standards

OFFICES
Administrative Services
Health Planning and Policy Development
Medical Examiner
State Health Laboratory

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110

533-6108
March 3, 1981

Alvin E. Rickets, Director
Room 426 801-533-6121

Scott R. Williams
Sanders Exploration, Ltd.
P.O. Box 377
Kaysville, UT 84037

Re: Air Quality Approval Order for C & W No. 1 Coal Mine Surface Support and Storage Activities

Dear Mr. Williams:

On January 29, 1981 the Executive Secretary published a notice of intent to approve C & W Coal Producers, Inc. and Blazon Company's proposed C & W No. 1 Coal Mine surface support and storage activities. The 30-day public comment period expired March 1, 1981 and no comments were received.

This air quality approval order authorizes the construction/installation and operation of the surface support and storage activities at C & W Mine No. 1 in Carbon County as proposed in the notice of intent dated June 20, 1980 with the following conditions:

1. All emission control equipment shall be maintained in good operating order as per manufacturer's recommendations.

2. No visible emissions shall exceed 20% opacity.

3. All conveyors shall be covered and the crusher station emissions shall be controlled with water sprays.

4. Conveyor discharge points shall be controlled with water sprays with a chemical additive.

5. The haul road shall be chemically treated as dry conditions warrant or as determined necessary by the Executive Secretary to minimize fugitive emissions. A record/log of the dates, amounts, and locations of treatments shall be kept and be made available to the Executive Secretary upon request.

Figure 3-6. Air Quality Approval Order.

6. Annual production of coal from the C & W No. 1 Mine shall not exceed 220,000 tons without prior approval from the Executive Secretary as per Section 3.1, Utah Air Conservation Regulations.

7. The Executive Secretary shall be notified when the mine operation has started as an initial compliance inspection is required.

Sincerely,

Brent C. Bradford
Executive Secretary
Utah Air Conservation Committee

MRK:js

cc: EPA/Region VIII (N. Huey)
Southeastern District Health Dept.
Division of Oil, Gas and Mining (J. Smith)

Figure 3-6. (Continued).

3.4.8 Subsidence Control and Monitoring Plan

3.4.8.1 Structures

No currently used, man-made structures occur within the permit area. An archaeological survey of the permit area indicated four historical archaeological sites and one prehistoric artifact. A subsequent search of the site files at the Utah Division of State History turned up no recorded sites in, or near, the project area. Since the identified sites are abandoned homestead cabins or mining camp dwellings and are not recorded as warranting preservation efforts, no special mining techniques are deemed necessary for their protection. Only one site, 42cv209, overlies the existing or projected mine workings and, with the extensive overburden at that point (800'), no surface effects are likely to become evident. The archaeologic survey is described in detail under Section 5 of this plan.

3.4.8.2 Renewable Resources

Hydrologic and vegetative renewable resources exist within the permit area. One perennial stream, Beaver Creek, and two springs are known to exist above the area to be mined. Flow data have been collected by Beaver Creek Coal Company from these sources for several years. During these periods of previous mining activities in the region, no indications of any significant mining-related flow depletions have been evident. Based on their past experience and monitoring results from this area, it is not expected that mining will affect any hydrologic resource through subsidence.

Significant inflows of groundwater to underground workings area not currently anticipated. However, should a substantial inflow of groundwater occur, mitigation measures may include: attempts to seal off the inflow through grouting, increased monitoring efforts, lining of the stream bed through the affected area, and replacement of lost water if indicated by monitoring.

The vegetation resource above the mining area consists of rangeland for stock and wildlife grazing and a limited timber resource. Previous mining in the area has indicated no surface effects upon this resource. If subsidence should occur, the effects would be minimal, possibly resulting in some fractures or slight depressions. Thus, the effect upon vegetation resource would also be minimal. Should impacts to vegetation occur, mitigation measures may include: filling of fractures, regrading of broken areas, replanting degraded areas, and intensified monitoring.

3.4.8.3 Geologic Hazards

Geologic hazards in the mine area exist in the form of steep slopes and numerous inactive normal faults. The geologic hazards from the

faults are normally confined to the underground entries crossing or approaching the fault. Roof conditions will typically worsen in these areas due to fracturing and slickensides; however, no surface movement or new effects have been noted to date from mining through fault zones in this area.

The steep slopes in the Gordon Creek area present a hazard if movement should occur from mining. This could result in rock falls from exposed outcrops; however, no evidence of such falls or movement has been noted in this area from past mining. There are no potential landslide or slump areas known to exist that were caused by previous mining activities in the area.

3.4.8.4 Subsidence

Subsidence can normally be expected to occur over areas where second mining (pillaring) has taken place. Maximum potential subsidence for the average panel in the No. 2 Mine (the Castlegate "A" seam) has been estimated from Figure 3-7, using the following criteria:

Panel Width = 400 ft
Average Depth = 600 ft
Width/Depth Ratio = 0.67
Seam Thickness = 7.0 ft

Based on these criteria and the graph, subsidence could reach a maximum of 3.85 feet directly over a pillared panel. However, since past pillaring has been performed in this area as much as 40 years ago, and there are no obvious surface expressions of resulting subsidence, it is anticipated that actual subsidence in the area will be substantially less.

Maximum potential subsidence from pillar extraction in the No. 1 Mine (the Hiawatha seam) has been estimated from Figure 3-7 using the following criteria:

Panel Width = 400 ft
Average Depth = 800 ft
Width/Depth Ratio = 0.50
Seam Thickness = 7.0 ft

Using these data, subsidence due to pillar extraction in the Hiawatha seam could reach 2.33 feet directly over a pillared panel. The cumulative potential subsidence for areas where both seams are pillared is 6.18 feet (3.85 + 2.33). Again, past experience in this area suggests that subsidence would be of a lesser magnitude. No pillaring will occur beneath Beaver Creek or Gordon Creek in either the Castlegate "A" or Hiawatha Seams (see Plates 3-3 and 3-

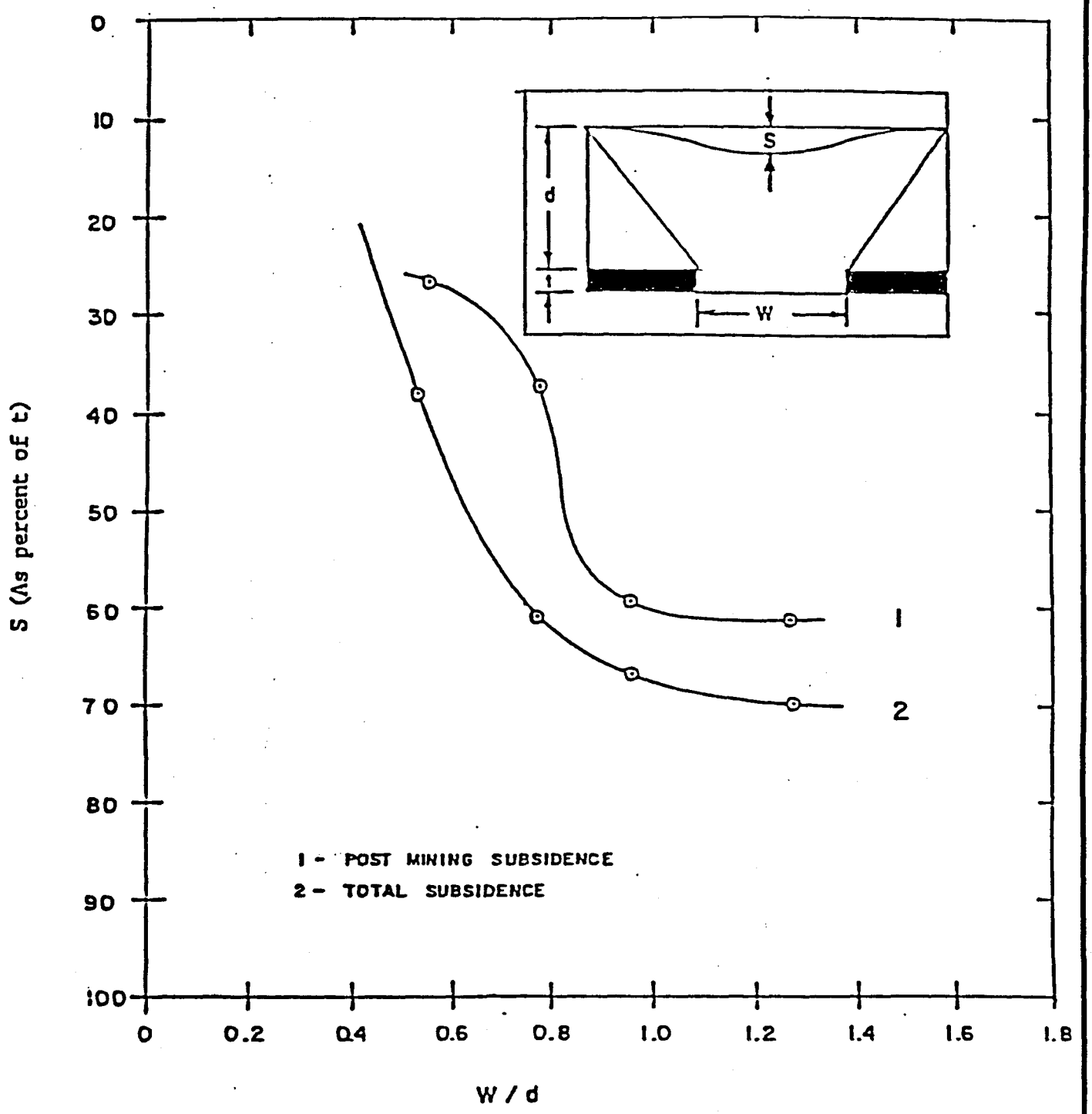


Figure 3-7. Subsidence/Seam Thickness Ratios (from Dunrud, 1980).

4). In addition, an area identified as containing eagle nests on Plates 3-3 and 3-4 will also be protected with barrier pillars to preclude subsidence.

The following observations and conclusions regarding subsidence have been made from past mining activities in the vicinity of the proposed Blue Blaze No. 1 and No. 2 Mines:

(1) Pillaring in the upper (Castlegate "A") seam has previously occurred place beneath Beaver Creek. Specifically, the northernmost west panel was pillared beneath Beaver Creek by Swisher Coal Company in January 1978 in an areas where the overburden thickness was about 650 feet. In addition, in September 1981, Beaver Creek Coal Company pillared the "A" Panel area beneath Beaver Creek in an area with an overburden thickness of approximately 425 feet. Neither of these areas show any measurable effect on Beaver Creek.

(2) The Gordon Creek No. 2 Mine overlies areas pillared up to 40 years ago in the lower seam (Sweet's Mine) with no noticeable subsidence effects. The Consumers No. 3 Mine also pillared areas in the permit area which show no noticeable subsidence effects.

(3) The overburden in the permit area above the Castlegate "A" seam (with a thickness of 600 to 800 feet) contains massive sandstone units which are unlikely to allow caving effects to reach the surface. In addition, the seams are separated by over 150 feet of similar interburden with no noticeable effects from past pillaring.

(4) Subsidence, should it occur, is not likely to affect the Beaver Creek flow due to the numerous beds of swelling shales within the overburden and interburden. Fractures within these sedimentary deposits have a strong tendency to heal due to the swelling of the shales and sandy shales contained therein.

A plan to mitigate adverse subsidence effects to Beaver Creek (should they occur) has been provided in Section 3.4.8.2. If adverse impacts to Beaver Creek are noted as a result of subsidence, Blue Blaze Coal Company will notify the Division in writing, concerning the kind and extent of the damage, and begin implementation of the approved mitigation plan as directed by the Division.

3.4.8.5 Subsidence Control and Monitoring Plan

The subsidence monitoring network will consist of permanent survey monuments located outside of the anticipated area of subsidence and a series of monitoring stations within the potential subsidence zone. The monitoring stations will be steel re-bar with aluminum

caps set so that weather, frost heave, or livestock will not disturb them.

The monitoring stations will be established mainly in drainages located above the proposed mining area with stations spaced at regular intervals of not more than 1000 feet. Stations will be installed above the active mining area and between the surface limits of expected subsidence.

If any measurable subsidence effects are detected on the stations along the Beaver Creek drainage above the panels to be mined first, complete pillaring will not be performed under the remaining unmined area beneath Beaver Creek for a distance of 250' on each side of the stream. A measurable subsidence effect is defined for the purpose of this plan as: (1) elevation change greater than 0.25 feet between monitoring cycles, (2) development of obvious (0.25 feet or greater) tension cracks in the pillared area, or (3) a marked decrease in flow in Beaver Creek (i.e., greater than 30% of baseline for similar periods of the year).

All northing, easting, and elevation coordinates will be established by the use of a one-second theodolite and six-mile electronic distance meter. Multiple readings will be taken where necessary to ensure accuracy. These coordinates will be redetermined at nominal six-month intervals, depending upon accessibility, while mining is occurring within 500 feet of a station and will continue for a period of at least one year thereafter. Monitoring of a subsidence station will occur over a longer period if substantial subsidence continues to occur.

This plan will be confined to the area of mining in the Blue Blaze No. 1 and No. 2 Mines, and will continue for a period of one year following cessation of mining in this area. Reports of monitoring will be sent to the regulatory authority on a yearly basis.

3.5 Reclamation Plan

3.5.1 Contemporaneous Reclamation

As soon as a disturbed area is no longer needed, it will be backfilled, graded, re-topsoiled, and revegetated. Seeding, fertilizing, and mulching will be performed as soon as practical following redistribution of topsoil. The techniques described in subsection portions of this section will be used during contemporaneous reclamation.

3.5.2 Soil Removal and Storage

Soil surveys conducted at the mine site (Section 8) have distinguished disturbed lands from undisturbed soil mapping units (see Plate 8-1). Areas mapped as disturbed land are areas where the soils, vegetation, or both were affected by previous mining

operations. Disturbance of the roads and pads occurred prior to regulatory requirements to salvaged topsoil from those areas.

All topsoil will be stockpiled in the areas noted on Plate 3-1. The stockpiles will be contoured, fertilized, vegetated with a temporary seed mix, and mulched as outlined in Section 8.7. Markers will be placed indicating that the piles contain topsoil. Berms will be placed around each stockpile to minimize off-pile transport of sediment.

3.5.3 Final Abandonment

Upon permanent cessation of operations, permanent reclamation will be performed. All surface equipment, structures and facilities (other than sedimentation control) associated with the operation will be removed during reclamation of the affected area.

3.5.3.1 Sealing of Mine Openings

The first phase of the reclamation activity following final abandonment of the operations will be permanent sealing of the mine openings. Mine openings will be sealed by placing a block seal 20 to 50 feet in from the portal. The area between the seal and the surface will then be backfilled during reclamation to minimize roof caving. The portal structures will be removed and the exposed coal seam, including portal area, will be covered during the reclamation of the upper pad and highwall areas. Details of the seals are shown on Figures 3-8 and 3-9.

The majority of the workings are downdip from the portals. Hence, water will not impound behind the seals, negating the need for hydrologic seals.

3.5.3.2 Removal of Surface Structures

Following sealing of the portals, all surface structures and facilities associated with the mining operation will be removed. The schedule and cost of removal is detailed in Section 3.5.6 and 3.5.7, respectively.

3.5.3.3 Disposition of Dams, Ponds, and Diversions

Diversions that are not planned for permanent use following reclamation will be removed during the backfilling and regrading operations. The area will be recontoured to drain to the final reclamation channel.

The sedimentation pond will be removed at the end of backfilling and grading operations. Sediment control following removal of the sedimentation pond will be provided as outlined in Section 3.5.4.3.

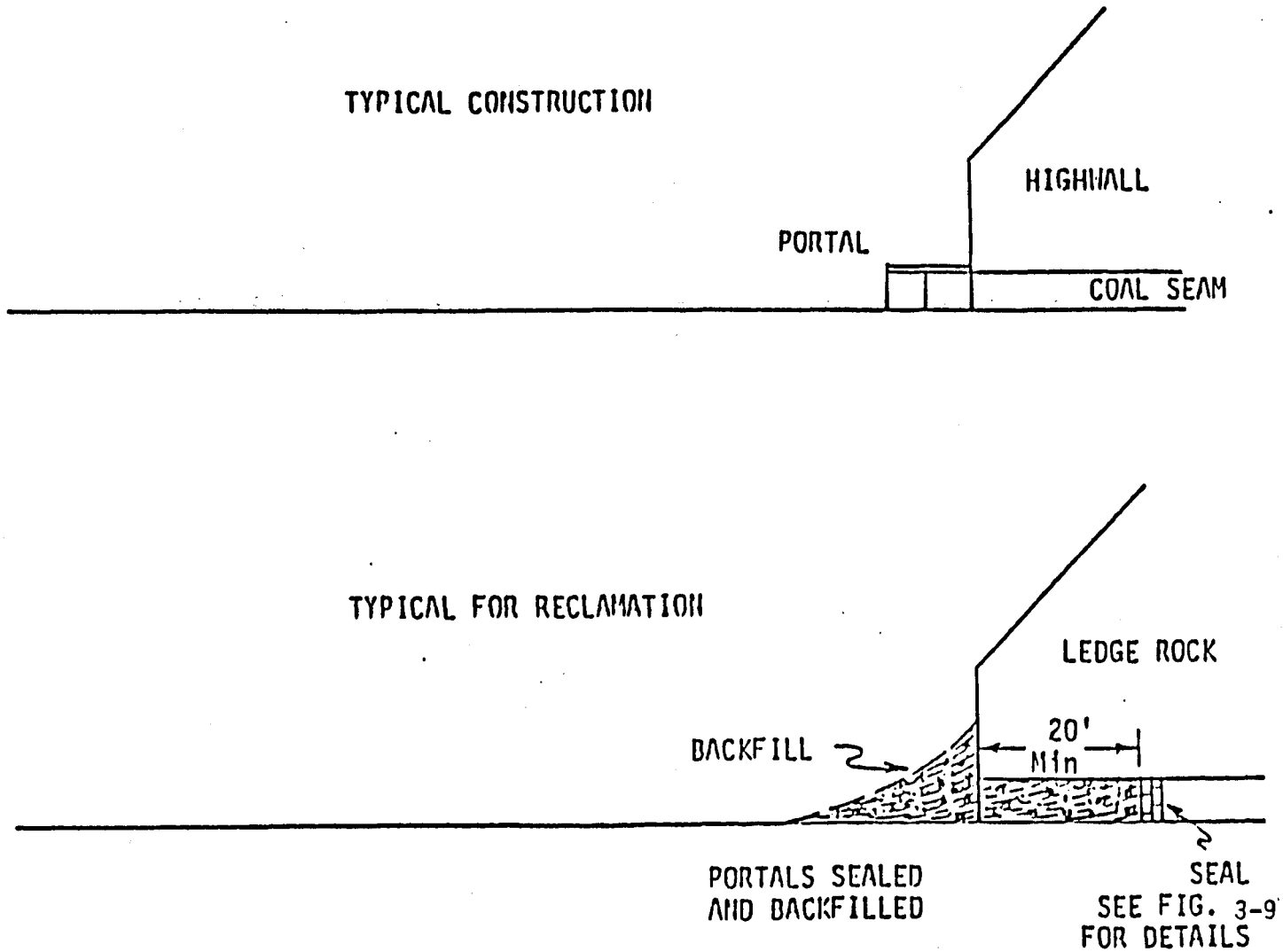


Figure 3-8. Typical Portal Sealing.

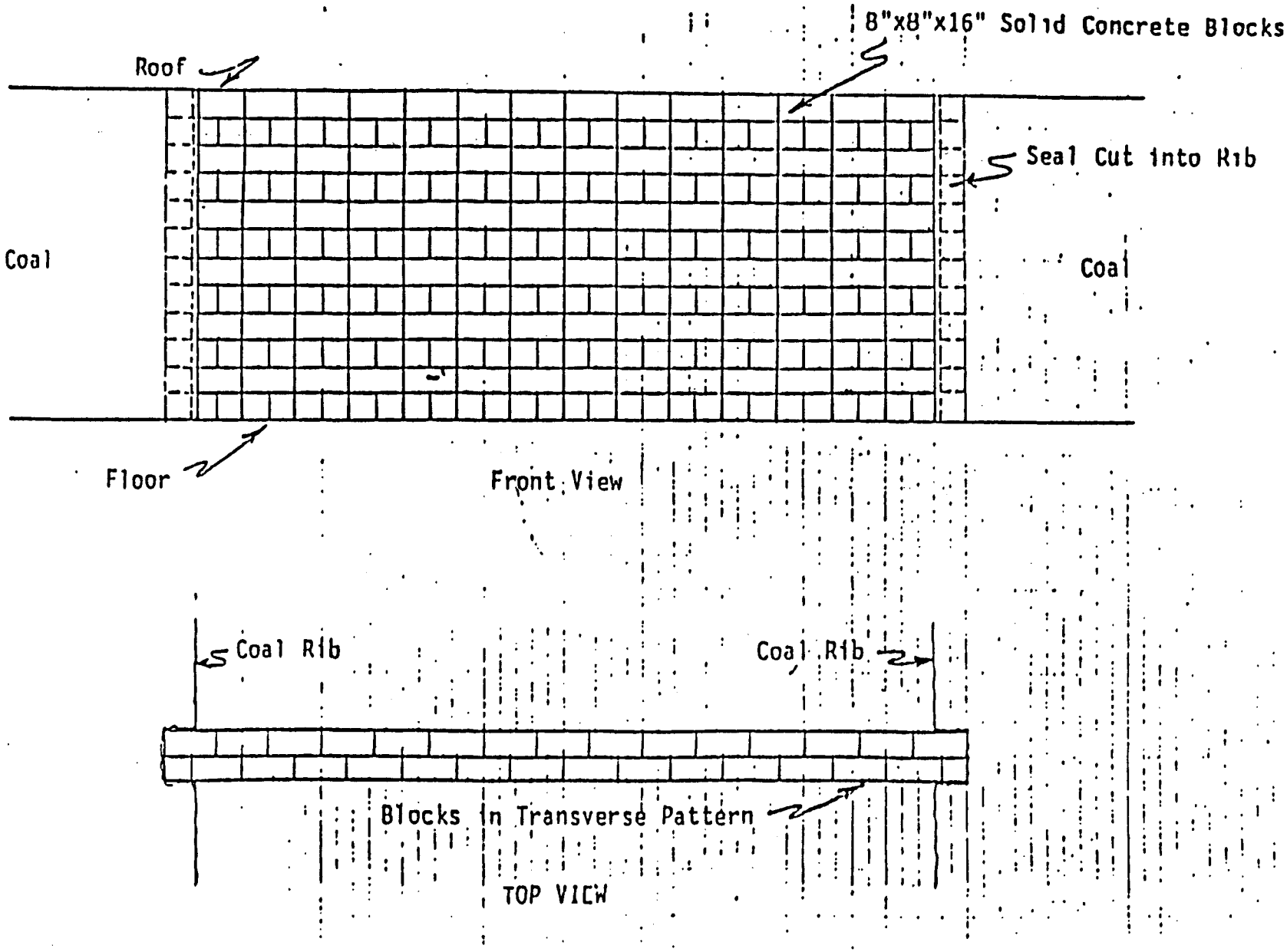


Figure 3-9. Typical Portal Block Seal.

3.5.4 Backfilling and Grading Plans

The surface of this area was originally disturbed between 1928 and the 1950's by previous owners. The surface is all privately owned. Since no major effort was made at that time to save or store any topsoil or other material, restoration to a contour that approximately pre-mining conditions is neither practical nor required by the regulations. However, it is the intent of Blue Blaze Coal Company to restore the area to a topography that is compatible with the post-mining land use, using such materials that are available at the site. Cut and fill calculations are provided in Table 3-1, for the premining to operational (i.e., construction) phase and Table 3-1a for the operational to post-mining (i.e., reclamation) phase.

In general, the backfilling and regrading will proceed as follows:

(a) After sealing of the portals and removal of all structures, a backhoe (Cat 235 or larger) will be brought to the upper portal terrace.

(b) The backhoe will begin by reaching down over the fill bank and retrieving as much material as can be reached. This material will be placed on the terrace.

(c) A dozer (Cat D-7 or larger) will work with the backhoe, taking the retrieved material and spreading and compacting it from the highwall outward to reach the configuration as shown on Plate 3-7.

(d) The mine yard will then be recontoured using backhoes and dozers to drain to the center. The slopes noted on Plate 3-7 will be achieved during this backfilling and grading operation. A reclamation channel (described in Section 7) will be constructed to convey runoff through the reclaimed area.

(e) The procedure, as noted above, will continue down the haul road with the backhoe and cat operating in conjunction to reclaim this area down to the permit boundary.

(f) Upon completion of backfilling and regrading operations, the surface will be scarified to prevent slippage of topsoil and promote root penetration.

(g) A loader will be used to load haul trucks at the topsoil stockpiles. The haul trucks will be used to deliver the topsoil from the topsoil stockpile to the area where the dozer and backhoe will be working. The dozer will be used to evenly distribute the topsoil to a depth of one foot over the area.

TABLE 3-1

CUT AND FILL CALCULATIONS
(Construction Phase)

	CUT					FILL				
STATION	PLAN. READ.	AREA sq ft	AVE. E.A.	DIST. ft	VOL. cu yd	PLAN. READ.	AREA sq ft	AVE. E.A.	DIST. ft	VOL. cu yd
A - A'	0.42	174.7				0.1	41.6			
			336.96	200	2496			120.64	200	893.63
B - B'	1.2	499.2				0.48	199.7			
			343.2	200	2542			102	200	755
C - C'	0.45	187.2				.01	4.2			
			320.3	200	2372.6			19	200	139
D - D'	1.09	453.4				0.08	33.3			
			775.8	150	4310			18.8	150	104.4
E - E'	2.64	1098.2				0.01	4.2			
			1250	100	4629.8			257.95	100	955.4
F - F'	3.37	1401.9				1.23	511.7			
			1485	100	5500.4			318	100	1179
G - G'	3.77	1568.3				0.3	124.8			
			1127.4	100	4175.3			249.6	100	924.4
H - H'	1.65	686.4				0.9	374.4			
			547.06	100	2026			503.4	100	1864.4
I - I'	0.98	407.7				1.52	632.3			
			405.6	125	1877			544.95	120	2422
J - J'	0.97	403.5				1.10	457.6			
			243.4	100	901.3			280.8	100	1040.
K - K'	0.2	83.2				.25	104			
			56.16	200	416			613.6	200	4545.2
L - L'	0.07	29.12				2.7	1123.2			
			305.76	200	2264.8			1046.3	200	7750.4
M - M'	1.4	582.4				2.33	969.3			
			299.5	200	2218.5			1212.7	200	8983
N - N'	0.04	16.64				3.5	1456			
			651	200	4822.2			1123.2	200	8320
O - O'	3.09	1285.4				1.9	790.4			
TOTAL					40,552					39,876
B1 - B1'	0.24	99.84				0.20	83.2			
			166.4	75	462.1			153.9	75	427.5
B2 - B2'	0.56	232.9				0.54	224.6			

TABLE 3-1A

CUT AND FILL CALCULATIONS
(Reclamation Phase)

	CUT					FILL				
STATION	PLAN. READ.	AREA sq ft	AVE. E.A.	DIST. ft	VOL. cu yd	PLAN. READ.	AREA sq ft	AVE. E.A.	DIST. ft	VOL. cu yd
A - A'	.06	24.96				.23	95.68			
			43.68	200	323.6			413.92	200	3066
B - B'	.15	62.4				1.76	732.16			
			31.2	200	231			641	200	4745
C - C'	-o-	-o-				1.32	549			
			47.84	200	354.4			314	200	2326
D - D'	.23	95.68				.19	79.04			
			87.36	150	485.3			143.52	150	797.3
E - E'	.19	79.04				.5	208			
			297.44	100	1101.6			255.8	100	947.5
F - F'	1.24	515.84				.73	303.65			
			576.16	100	2132.9			193.42	100	716.3
G - G'	1.53	636.48				.2	83.2			
			332.8	100	1232.6			366	100	1355.8
H - H'	.07	29.12				1.56	648.96			
			232.96	100	862.8			336.96	100	1248
I - I'	1.05	436.8				.06	24.96			
			339.04	125	1569.6			12.48	125	57.8
J - J'	.58	241.28				-0-	-0-			
			120.64	200	893.6			187.2	200	1386.6
K - K'	-0-	-0-				.9	374			
			332.8	200	2465			208	200	1540.7
L - L'	1.6	665.6				.1	41.6			
			900.64	200	6671.4			530.4	200	3928.9
M - M'	2.73	1135.68				2.45	1019.2			
			1046.2	200	7749.9			611.52	200	4529.7
N - N'	2.3	956.8				.49	203.84			
			752.96	200	5577.5			422	200	3129
O - O'	1.32	549.12				1.54	641			
TOTAL					31,651.20					29,775
B1 - B1'	.42	174.72				.32	113.12			
			228.8	75	635.5			247.92	75	688.6
B2 - B2'	.68	282.88				.92	382.72			

(h) Following redistribution of topsoil, the site will be reseeded, fertilized, and mulched in accordance with Section 3.5.5.

Plates 3-1 and 3-7 show the planned surface facility and the proposed final configuration, respectively. Plate 3-8 presents the related cross sections. Figure 3-10 shows the typical road reclamation. The schedule for backfilling and grading is detailed in Section 3.5.6.1.

All exposed coal outcrops resulting from this operation as well as toxic and acid-forming materials will be covered with a minimum of 4 feet of non-combustible, non-acid, non-toxic material during backfilling and grading. Similarly, any underground development waste that remains in temporary storage on the surface at the time of reclamation will be placed against an adjacent highwall or cut slope and covered with at least 4 feet of suitable backfill. For the purpose of estimating reclamation cost, it is assumed that 5,000 yd^3 of underground development waste will be on the surface at the time of reclamation. The backfill material will consist of existing coal-free soil and rock from the mine site.

3.5.4.1 Removal or Reduction of Highwalls

The highwalls will be backfilled along the pad and road areas. This will be accomplished by backfilling recovered downslope material with a backhoe and dozer. Erosion controls (silt fences, etc.) will be placed below these backfill areas to minimize washing of the fill materials prior to revegetation. All fills will be compacted with repeated passes of the earth-moving equipment to promote stabilization of the backfills.

3.5.4.2 Recontouring

All final grading, preparation of overburden, and placement of topsoil will be done along the contour to minimize subsequent erosion and instability. Should rills or gullies develop with depths deeper than 9 inches in regraded areas, these will be filled, graded, or otherwise stabilized and then reseeded. This will be accomplished by hand, using adjacent or eroded material whenever possible. If larger gullies develop, a backhoe may be used in addition to handwork.

3.5.4.3 Fencing and Erosion Control

During redistribution of the topsoil, silt fences will be established and anchored at the bottom of fill slopes and along the top bank of the reclamation channel to control possible erosion from newly graded and seeded areas. The sedimentation pond will be retained until removal is required to complete backfilling and

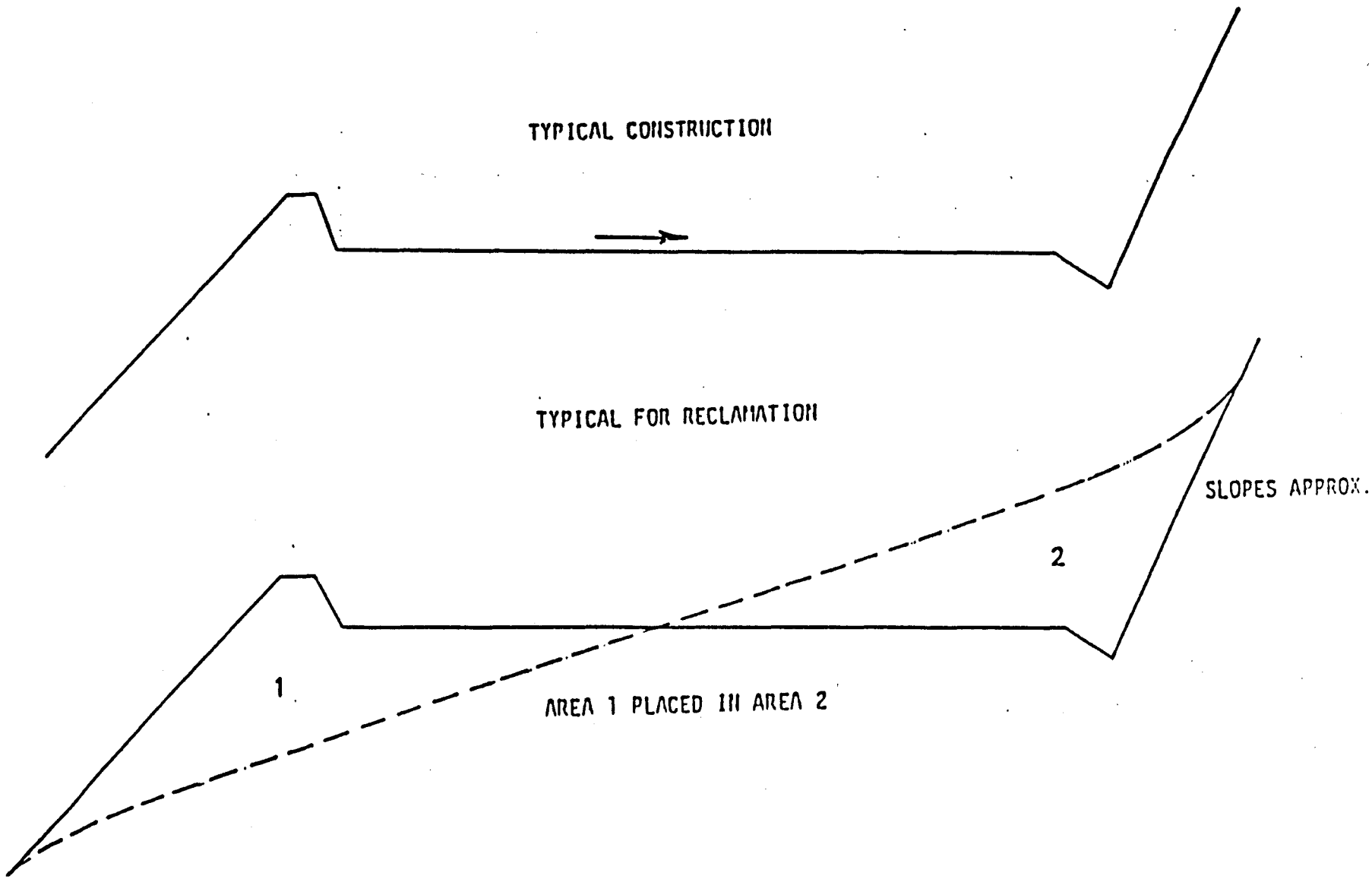


Figure 3-10. Typical Road Reclamation.

grading operations. All areas will be mulched during seeding and slopes 2 1/2:1 or greater will be matted to minimize erosion. Fencing will be placed as required to protect revegetation efforts from livestock overgrazing.

3.5.4.4 Soil Redistribution and Stabilization

When final reclamation begins, the disturbed areas to be reclaimed will be loosened by ripping to allow easier backfilling and grading operations. The materials will then be redistributed as outlined above. During redistribution, care will be taken to prevent excessive compaction.
After fill material has been put into place, compacted zones will be eliminated by deep chiseling. Prior to placement of topsoil, the area to be topsoiled will be scarified. Topsoil will then be placed as outlined above.

3.5.5 Revegetation Plan

The revegetation plan has been designed to assure that all disturbed lands will be returned to productive self-perpetuating plant communities once the mining operation has been completed. The plan calls for temporary revegetation of disturbed areas where possible during the mining operation as well as permanent reclamation of all areas once mining has ceased. The goal of the plan is to create diverse plant communities which are at least as productive and have comparable amounts of plant cover which occurred on the site prior to mining.

3.5.5.1 Soil Preparation

After backfilling, grading, recontouring, scarifying, and the redistribution of topsoil, the topsoil will be ripped to a depth of approximately 18 inches (depth of the ripper). The seedbed will then be prepared using a disc, harrow, or clod buster (slope chain). Prior to seeding, composite soil samples will be collected at a rate of five samples per acre, with each composite being comprised of four sub-samples. These samples will be analyzed in accordance with guidelines promulgated by the Division to determine fertilizer requirements and revegetation suitability. The tests to be performed will be pH, electrical conductivity, sodium absorption ratio, texture, nitrogen, organic content, phosphorus, potassium, available water capacity, and percent rock fragments. Based on the results of these analyses, fertilizer will be applied at the time of seeding. Mulch (straw or hay) will be applied to the area to be reseeded at the rate of 4000 pounds per acre. Matting will be used on all slopes 2 1/2:1 or steeper to control erosion.

3.5.5.2 Seeding

Areas which have been disturbed during the mining will be reseeded with either a temporary seed mix (Table 3-2 - used if the site is

TABLE 3-2

TEMPORARY RECLAMATION SEED MIX

Species	Pounds of PLS per acre*
PERENNIAL GRASSES	
Streamband Wheatgrass (Agropyron riparium)	4.0
Bluebunch Wheatgrass (Agropyron spicatum)	2.0
Slender Wheatgrass (Agropyron trachycaulum)	4.0
Pubescent Wheatgrass (Agropyron trichophorum)	3.0
Indian Ricegrass (Oryzopsis hymenoides)	2.0
FORBES	
Cicer Milkvetch (Astragalus cicer)	2.0
Yellow Sweetclover (elilotus Officinalis)	2.0
TOTAL	19.0

* Seeding rates assume drill seeding. Rates for broadcast seeding and hydroseeding will be twice the values listed.

likely to be re-disturbed prior to reclamation) or with a permanent seed mix (Table 3-3 - used if the site will not be disturbed again). These mixes are composed primarily of native species which either occur on the site or would be expected to grow on the site, especially on reclaimed areas. The mix has been designed to include species which will provide sufficient cover to prevent serious soil erosion, and should contain sufficient species diversity to produce a stable self-perpetuating plant community. All seeds to be purchased will comply with all applicable state and federal seed laws.

Temporary Seed Mix

On those sites where revegetation is needed during the operating years, a temporary seed mix will be used. This mix (Table 3-2) is composed primarily of native species and is designed for quick establishment and erosion control. Only one introduced grass species (pubescent wheatgrass - Agropyron trichophorum), is included in the mix. It has been included since it is known to do well on dry sites, and will assist in controlling soil erosion. Cicer milkvetch (Astragalus ciscer) and yellow sweetclover (Melilotus officinalis) have been included because of their ability to fix nitrogen. No shrubs or forbs are included in the temporary mix, since these areas will be re-disturbed prior to final reclamation. At the actual time of planting, the mix may be altered depending on availability of the listed species and under the approval of the Division prior to substitution.

Permanent Seed Mix

The permanent revegetation mix is composed of a mixture of native grasses, forbs, and shrubs (Table 3-3). The grasses, forbs, and some of the shrubs will be planted as seeds, and some of the shrubs will be planted as containerized stock. A variety of species is included in the mix in order to obtain a higher level of diversity on the revegetated surfaces. This will increase habitat diversity as variations in the microenvironments of the reclaimed surface will enhance or inhibit the germination and development of the various species.

The permanent seed mix reflects the composition of the original communities which occurred on the site. Cicer milkvetch is the only introduced species in the mix. It is included because of its ability to fix nitrogen. Approval will be obtained from the Division prior to using any substitution seed mixtures. The containerized stock will be planted at a rate of 2360 individuals of large shrub species and 200 individuals of low shrub species per acre over 20 percent of the reclaimed area. This planting rate is approximately equivalent to one shrub per 36 square feet (3.4 square meters). Because of the steepness of the slopes on the reclaimed areas, the containerized stock will be planted by hand.

TABLE 3-3

PERMANENT RECLAMATION SEEDING MIX

SPECIES	POUNDS OF PLS PER ACRE*	COST/ACRE
SHRUBS		
Serviceberry Amelanchier utahensis	2.0	$64.00
Big Sagebrush (Vasey) Artemisia tridentata	0.2	$ 6.80
Mtn. Mahogany Cercocarpus ledifolius	2.0	$76.00
Rubber Rabbitbrush Chrysothamnus nauseosus	0.5	$16.50
FORBS		
Yarrow Achillea millifolium	0.1	$ 1.60
Pacific Aster Aster chilensia	0.2	$18.00
Northern Sweetvetch Hedysarum boreale	1.5	$60.00
Lewis Flax Linum lewsii	1.0	$10.00
Yellow Sweetclover Melilotus officinalis	1.0	$ .45
Palmer's Penstemon Penstemon palmeri	0.5	$ 7.13
GRASSES		
Gt. Basin Wildrye Elymus cinereus	3.0	$12.15
Thickspike Wheatgrass Elymus lanceolatus	2.0	$ 4.20

TABLE 3-3 (Continued)

PERMANENT RECLAMATION SEEDING MIX

SPECIES	POUNDS OF PLS PER ACRE*	COST/ACRE
Western Wheatgrass Elymus smithii	3.0	$ 9.60
Bluebunch Wheatgrass Elymus spicatus	3.0	$ 5.55
Indian Ricegrass Stipa hymenoides	2.0	$18.80
TOTAL	22.0	$310.78
CONTAINERIZED STOCK		
Oak Brush Quercus gambelii	400	$316.00
Aspen Populus tremuloides	300	$237.00
White Fir Abies concolor	200	$200.00
Big-tooth Maple Acer grandidentatum	400	$316.00
Serviceberry Amelanchier alnifolia	300	$237.00
Mountain Mahogany Cercocarpus montanus	400	$316.00
Oregon Grape Mahonia repens	500	$395.00
TOTAL	2,500	$2,017.00

* Seeding rates assume drill seeding. Rates for broadcast seeding and hydroseeding will be twice the values listed.

TABLE 3-3 (Continued)

PERMANENT RECLAMATION SEEDING MIX

Locations where containerized stock will be planted:

Oakbrush----------South & East Slopes

Aspen----------North Slopes & Canyon Bottoms

White Fir----------North Slopes

Big-tooth Maple------North Slopes & Canyon Bottoms

Serviceberry---------South Slopes

Mountain Mahogany----Ridge tops & South Facing Slopes

Oregon Grape---------North, East, West Slopes & Canyon Bottom

Seeding Methods

Reclaimed areas on moderate slopes will be drill seeded using the seed mixes and rates given in Table 3-2 for temporary revegetation and Table 3-3 for permanent reclamation. On moderate slopes, drill seeding is almost always superior to broadcast seeding. Seeds will be planted no deeper than one-half inch.

Reclaimed areas on steep slopes will be hand broadcasting. Seeds which are broadcasted will be raked to ensure proper seed/soil contact. For hand broadcasting, the seeding rates will be twice those given in Tables 3-2 and 3-3. If the first seeding does not establish, then a second and third attempt will be made. Reclaimed areas will be seeded in the fall. Since the majority of the species in the mix are cool season grasses, fall is a better time to plant. The containerized stock will be planted in late fall or early spring, attempting to avoid undesirable conditions such as overly wet, overly dry, or frozen soils. In the event of a drought condition, the containerized stock will be watered at the time of planting and as necessary throughout the year by hauling water from the Price River Water Improvement District and hand watering the stock.

3.5.5.3 Mulching

Mulch will be applied to all newly reseeded areas in order to provide a more equitable environment for seed germination and initial growth. On slopes, a straw mulch will be applied at a rate of 4000 pounds per acre. Once applied, it will be crimped in with either a crimper or a straight set disk. Erosion control matting will be placed on all slopes 2 1/2:1 or steeper.

3.5.5.4 Reclamation Management

The reclaimed and revegetated areas will be closely monitored to determine if any maintenance is necessary (refer to Section 3.5.5.5 for a description of the monitoring program). Problems which may require management include severe erosion, excessive weeds, bare patches of failed planting, and damage by rodents. Soil erosion will be controlled by regrading (if necessary), application of mulch, and matting. Large gullies and rills will be filled and stabilized. If weeds occur, a weed control plan will be proposed to the Division and implemented upon approval. No weed control will be attempted during the first growing season following planting. It is likely that weed species will form a conspicuous part of the vegetation on the reclaimed areas during the first year.

3.5.5.5 Revegetation Monitoring

Revegetated areas will be monitored using qualitative observations as well as quantitative sampling. The areas will be evaluated qualitatively by looking for sites of failed seeding, extensive

Seeding Methods

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3.5.5.5 Revegetation Monitoring

Revegetated areas will be monitored, see Section 9.8 for details.

3.5.5.6 Establishment of Wildlife Habitat

Reclamation is particularly important as a means of controlling erosion and restoring disturbed areas to productive wildlife habitat and grazing (the post-mining land use - see Figure 3-11). To assist in meeting these desirable ends, the following aspects have been incorporated into the reclamation plan: (1) planting a diverse mixture of native grasses, forbs, and (where appropriate) woody species, (2) using seedling stock rather than relying solely on seeds for trees or shrubs, and (3) planting vegetation to create an edge effect by clumping selected shrub or tree species.

Section 10.5 provides a detailed discussion of the reclamation, mitigation and management plans for terrestrial habitats and wildlife.

Enhancement of the area for wildlife will be accomplished by the installation of rock piles for smaller mammals, the improved revegetation of the area, and planting of 1000 Salix cuttings per acre along the creek banks.

3.5.6 Reclamation Monitoring

The standards for success in the previously disturbed areas of the site are outlined in section R645-301-356.250 of the regulations. The applicant intents to return the previously disturbed areas to stable plant communities capable of withstanding the intended post-mining land use and controlling erosion (See Section 9.8 for details).

3.5.7 Schedule of Reclamation for Blue Blaze No. 1 & 2 Mines

3.5.7.1 Timetable for Completion of Major Reclamation Processes

The approximate schedule of reclamation activities is outlined in Figure 3-12. The graphical schedule has been extended by approximately 10 percent beyond the numerical estimates presented below to account for unanticipated delays. Reclamation is proposed to be initiated within 90 days (weather permitting) of final abandonment of the mining operation. The time and work required (as presented below) were estimated is estimated using the (Means Site Work Cost Data 1992, 11th Annual Edition). Each listing is for an 8-hour work day.

Seed Bed Materials ordering -- 6 months prior to seeding

Containerized stock ordering --1 year prior to planting

ALEXANDER H. WALKER, JR.
ATTORNEY AND COUNSELOR
245 NORTH JIMMY DOOLITTLE ROAD
SALT LAKE CITY, UTAH 84116-3730
(801) 521-3292
FAX (801) 521-3301

March 4, 1991

State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Re: Utah Coal and Chemicals Corporation

Gentlemen:

In regard to the application for a permit to mine coal, you have requested the landowner to indicate the use of the land after mining operations have been completed.

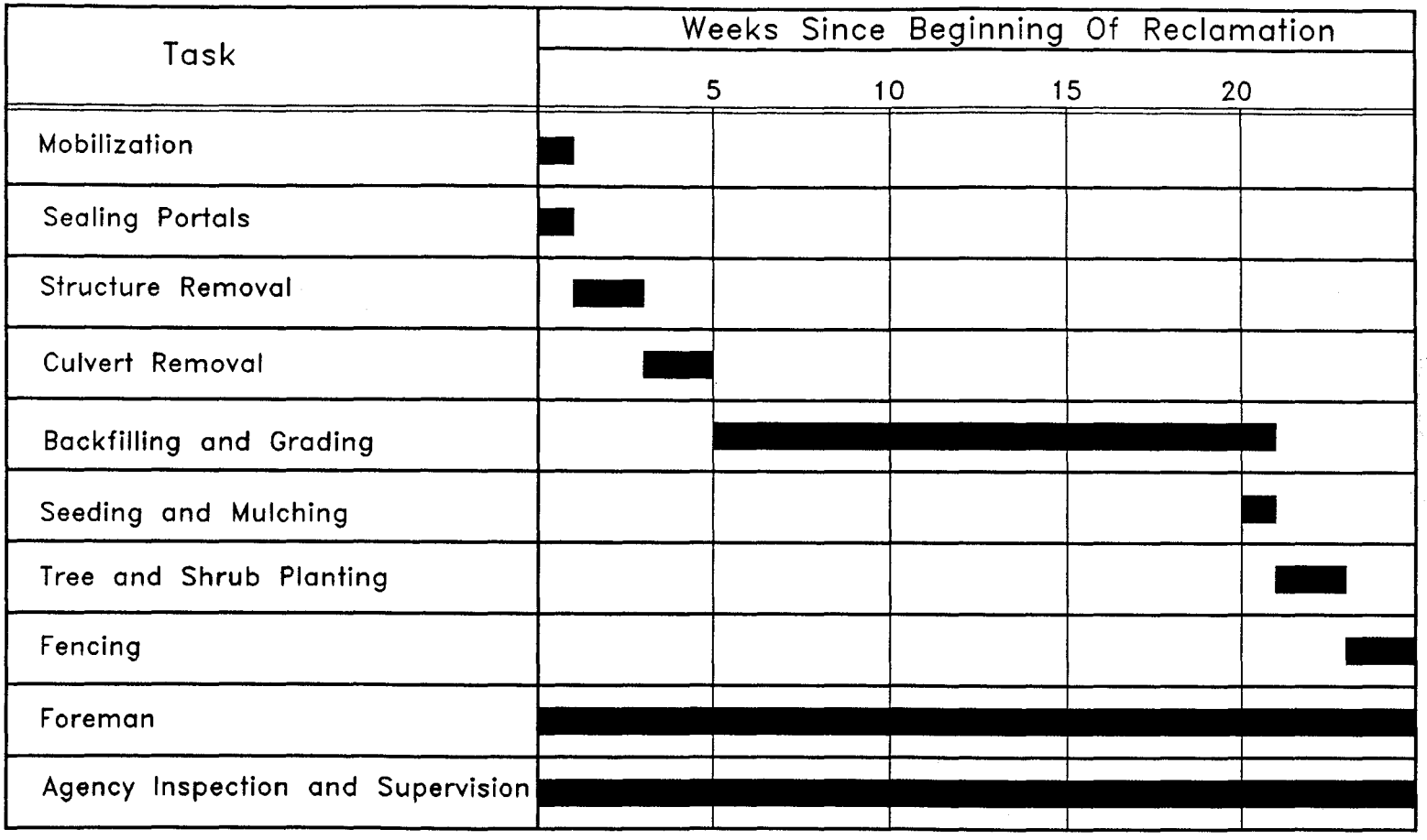
I have been authorized by Utah Coal and Chemicals Corporation, the owner of the property, to advise you that it will be used as previously indicated, which was for grazing and for wildlife.

Very truly yours,

Alexander H. Walker

A.H.Walker:cje

Figure 3-11. Letter Regarding Post-Mining Land Use.



Note: Containerized stock to be ordered 12 months prior to planting. Seed to be ordered 6 months prior to planting. Monitoring to continue following reclamation.

FIGURE 3-12. RECLAMATION SCHEDULE.

	Req. Time
1. Sealing Portal	
Pg. 139 - Format 042 200 (232-4200) Daily Output 375 Square Feet Cost $1.20 per block 8" x 16" x 8" thick 7 Portals Sealed 15' wide x 7' high Total sq. ft. required 1,470	4 Days
2. Remove Structures	
Pg. 30 - Format 021 200 (204-0200) Daily Output (Move 1 Unit per Day) Units on site: 1 Bathhouse trailer 1 Office trailer 1 Parts Trailer 1 Oil Storage Trailer	4 Days
Portal Structure Pg. 26 - Format 020 700 (714-2000) Daily Output 500 linear feet per day 16 beams per portal x 7 portals Total 112 beams	2 Days
Belt Structure Removal Pg. 26 - Format 020 700 (714-2000) Daily Output 500 linear feet per day Total Structure consists of: 160 beams 60 Belt Frames = 120 structural beams 3 Ramp Structures = 40 structural beams	2 Days
Drive and Tailpiece Removal Estimated Actual work performed at mining operations Daily Output 1 Drive + 1 Tailpiece per day 2 Drives to be removed 2 Tail pieces to be removed	2 Days
3. Culvert removal	
Pg. 40 - Format 022 200 (254-120) 1 cu. yd. hydraulic backhoe Daily Output 400 cu. yds. per day 12" culverts removal - 1012 cu. yds. 18" culverts removal - 255 cu. yds. 36" culverts removal - 1706 cu. yds. Total = 2943 cu. yds.	8 Days
4. Soil Placement (backfilling)	
Hauling total soil by dump truck 1/2 mile.	

Pg. 41 - Format 022 200 (266-0320)
Daily Output 3.2 loads/hr. 12 cu.yd. ea. 41 Days
Daily Output 308 cu.yds.
Daily Output for 3 trucks 924 cu. yds.
No. 2 Portal area (Table 3-1a) = 635 cu. yds.
Permit area (Table 3-1a) = 31,651 cu. yds.
Undisposed of waste rock (assumed) = 5,000 cu. yds.
Total = 37,286 cu. yds.

Grading (Dozer)
Pg. 38 - Format 022 200 (242-5020)
Daily Output 1,650 cu. yds. 23 Days
Cu. Yds. = 37,286

Scarifying (Road Grader)
Pg. 101 - Format 029 200 (204-2620)
Daily Output 12,222 sq. yds. 5 Days
Permit Area = 10.3 acres
Permit area = 49,852 sq. yds.

5. Mulching and Seeding

Pg. 104 - Format 029 500 (516-0550)
Daily Output 700 thousand sq. ft. 1 Day
Permit area = 10.3 acres
Total sq. ft. = 448,668

6. Tree and Shrub Planting

Pg. 105 - Format 029 500 (521-0561)
Daily average 364 plants per person 8 Days
10 people planting
Plants per acre 2,500
Permit area = 10.3 acres
Total Plants 25,750

7. Protective Fencing

Pg. 23 - Format 020 550 (554-0650)
Daily Output 280 Linear Feet 8 Days
Fencing Required 2210 ft.

Total Days Required = 108 Days

Total Weeks = 22 (assuming 5 days per week)

The above reclamation tasks are therefore proposed to be completed within 22 weeks following the start of reclamation activities.

3.5.8 Cost Estimate for Final Reclamation

3.5.8.1 Equipment Requirements

Rental rates are located in the Rental Rate Blue Book for Construction Equipment, Volume 1, dated April 1991 (except as noted). Rental rates were assumed for as 8-hour work day. Pages for each equipment are listed by the equipment listed. Operating costs for equipment include fuels, maintenance, and lubricants.

Operator costs were obtained from the U.S. Department of Labor, General Wage Decision No. UT91-3. Pages for each operator's wages are listed by the operator.

		Total 8 hr. Shifts
1. Loader - 950 B (3 cu. yd. bucket)		
Equipment Rental (Pg. 9-17)		
Daily	$ 300.00	$ 404.00
Operating costs/hr.	$ 13.00	
Operator (pg. 414) Group 4		
Hourly	$ 18.60	$ 213.04
Fringe Benefits	$ 8.03	
Subtotal		$ 617.04
2. Truck (10-12 yd.)		
Equipment Rental (Pg. 20-1)		
Daily	$150.00	$ 252.00
Operating costs/hr.	$ 12.75	
Operator (pg. 412)		
Hourly	$ 16.54	$ 184.48
Fringe Benefits	$ 6.52	
Subtotal		$ 436.48
3 Trucks required		x 3
Subtotal using 3 trucks		$1,309.44
3. Cat - D-7G		
Equipment Rental (Pg. 9-29)		
Daily	$ 555.00	$ 715.80
Operating costs/hr.	$ 20.10	

Operator (pg. 414) Group 4		
Hourly	$ 18.60	$ 213.04
Fringe Benefits	$ 8.03	
Subtotal		$ 928.84

4. Cat - D-7G (implements)

Cat Ripper 359		
Equipment Rental (Pg. 9-35)		
Daily	$175.00	$ 204.60
Operating costs/hr.	$ 3.70	
Subtotal		$ 204.60

5. Road Grader (implements)

Scarifiers-Disk 5 shank		
Equipment Rental (Pg. 9-3)		
Daily	$ 9.00	$ 11.40
Operating costs hr.	$ .30	
Subtotal		$ 11.40

6. Road Grader (Cat 120G)

Equipment Rental (Pg. 9-1)		
Daily	$225.00	$ 313.00
Operating costs/hr.	$ 11.00	
Operator (pg. 414) Group 4		
Hourly	$ 18.60	$ 213.04
Fringe Benefits	$ 8.03	
Subtotal		$ 526.04

7. Backhoe (Cat 225D)

Equipment Rental (Pg. 10-4 dated 6/91)		
Daily	$ 545.00	$ 864.60
Operating costs/hr.	$ 17.45	
Operator (pg. 416) Group 4		
Hourly	$ 18.60	$ 213.04
Fringe Benefits	$ 8.03	
Subtotal		$ 897.64

8. Labor (Pg. 410)

Hourly	$ 12.82	$ 127.28
Fringe Benefits	$ 3.09	
Subtotal		$ 127.28

9. Foreman (Means Site Work Cost Data, 1992, inside of back cover)

Hourly	$ 39.60	$ 316.80
Subtotal		$ 316.80

3.5.8.2 Summary of Reclamation Cost Estimate

The inflation factor was based on the preceding three years of the Means Historical Cost Index (1992 edition). Inflation during this period averaged 2.1 percent annually. As a conservative approximation, the 2.5 percent Compound Amount Factor was used to determine the effects of inflation on reclamation costs.

a.	Mobilization (estimated)	-	$ 3,000.00
b.	Sealing Portals	-	4,530.10
c.	Structure Removal	-	7,889.92
d.	Culvert Removal	-	6,835.52
e.	Backfilling & Grading	-	103,036.20
f.	Seeding and Mulching	-	3,328.31
g.	Tree & Shrub Planting	-	10,182.40
h.	Fencing	-	3,985.92
i.	Foreman for 121 Days	-	34,214.40
j.	Maintenance & Monitoring	-	20,131.20
k.	Agency Inspection and Supervision		10,842.37
	Sub-Total	-	$207,976.34
	10% Contingency*	-	20,797.63
	Total (1992)	-	$228,773.97

Inflation at (2.5% annually)

Total (1997)		$258,834.87
Rounded inflated cost	-	$259,000.00

* Reference: Handbook for Calculation of Reclamation Bond Amounts, OSM, 1987, Table 4, p.15.

3.5.8.3 Cost Estimate Detail for Final Reclamation

(a) Mobilization

$3000 Lump (estimated)	$ 3,000.00
Total	$ 3,000.00

(b) Sealing Portals

Laborers 5 @ $127.28/day	$ 636.40
Days Required	x 4
Subtotal	$ 2,545.60
Materials Sealing 7 Portals	$ 1,984.50
Grand Total	$ 4,530.10

(c) Structure Removal

Building Removal

1 Truck + Operator per day	$ 436.48
Days Required	x 4
Subtotal	$ 1,745.92

Portal Structure Removal

1 Truck + Operator per day	$ 436.48
3 Laborers per day	+ 381.84
Subtotal per day	$ 818.32
Days Required	x 2
Subtotal	$ 1,636.64

Belt Structure Removal

1 Truck + Operator per day	$ 436.48
3 Laborers per day	+ 381.84
Subtotal per day	$ 818.32
Days Required	x 2
Subtotal	$ 1,636.64

Drive and Tailpiece Removal

1 Loader + Operator per day	$ 617.04

1 Truck + Operator per day	$ 436.48
3 Laborers per day	$ 381.84
Subtotal	$ 1,435.36
Days Required	x 2
Subtotal	$ 2,870.72
Grand Total	$ 7,889.92

(d) Culvert Removal

Backhoe + Operator per day	$ 854.44
Days Required	x 8
Total	$ 6,835.52

(e) Soil Placement (Backfilling & Grading)

3 Dump Trucks + Operators per day	$ 1,309.44
Days Required	x 41
Subtotal	$ 53,687.04
1 Loader + Operator per day	$ 617.04
Days Required	x 41
Subtotal	$ 25,298.64
1 Cat + Operator per day	$ 928.84
Days Required	x 23
Subtotal	$ 21,363.32
Scarifying	
1 Grader + Operator + Scarifiers/day	$ 537.44
Days Required	x 5
Subtotal	$ 2,687.20
Grand Total	$ 103,036.20

(f) Mulching + Seeding

Mulcher + Operator per day	$ 332.68
1 Laborer per day	+ $ 127.28

Subtotal	$ 459.96
Days Required	x 1
Subtotal	$ 459.96
Seeds @ $310.78/acre x 10.3 acres (see Tables 3-2 and 3-3)	$ 3,201.03
Grand Total	$ 3,660.99

(g) Tree & Shrub Planting

10 Laborers @ $127.28 per day	$ 1,272.80
Days Required	x 8
Total	$ 10,182.40

(h) Fencing

3 Laborers @ $127.28 per day	$ 381.84
Days Required	x 8
Subtotal	$ 3,054.72
Material Costs for 2210 linear ft. (Costs from Intermountain Farmers)	
Fencing	$ 399.50
Posts	455.70
Stays	76.00
Subtotal of material	$ 931.20
Grand Total	$ 3,985.92

(i) Foreman (Means Site Work Cost Data, 1992, 11th Annual Edition (Inside of back cover)

$316.80 per day	$ 316.80
Total project days	x 108
Total	$ 34,214.40

(j) Maintenance & Monitoring

1 Engineer @ $47.00/hr., 1 day per quarter, 4 quarters per year for 10 years	$ 15,040.00
1 Laborer helper @ 127.28/day, 1 day per quarter, 4 quarters per year for 10 years	5,091.20

Total	$ 20,131.20
(k) Agency Inspection and Supervision 5.5% of the above amounts (reference Handbook for Calculation of Reclamation Bond Amounts, OSM, 1987, Graph 3, p. 19)	$ 197,133.97 x 0.055
Total	$ 10,842.37

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Section 4

LAND STATUS, LAND-USE AND POSTMINING LAND-USE

4.1 Scope

This section details surface and mineral ownership as well as lease holders or easement holders, or other pending options or interests in lands which are contiguous to or within the area to be covered by the permit pursuant to requirements of UMC 782.13.

The existing regional and site specific land use as well as the possible impacts which may occur during and after mining to the land-use and socioeconomy are considered.

4.2 Methodology

All information documenting land status has been acquired from information on file with various governmental agencies, and also through independent land checks completed by Utah Coal and Chemical Corp.

4.3 Land Status

4.3.1 Surface Land Status

Tables 4-1 and 4-2 (numerically cross referenced) identify the current ownership, right-of-way, easements, leases, special use permits, water rights, and surface managing authorities for all property in and contiguous to the permit area. Figure 4-1 shows the location of the subject tracts. Letters notifing surface land owners in the permit area that mining will be taking place. See Figure 4-o, page 4-14a.

4.3.2 Mineral Status

Tables 4-1 and 4-2 also identify coal, oil and gas, and other mineral leases and ownership for the mine area. Figure 4-2 shows the locations of the subject tracts.

4.3.3 Pending Interests

Blue Blaze Coal Company does not own any lands or interests in lands contiguous to the area to be covered by the permit. Blue Blaze Coal Company does not hold any options or pending bids on lands or interests in lands contiguous to the area to be covered by the permit.

4.3.4 Legal Right to Enter

Figure 4-3 shows the boundaries of land within the proposed permit area upon which the applicant has the legal right to enter and conduct coal mining activities.

The documents which give the applicant the legal right to enter and begin mining activities in the permit are as follows:

The Federal Lease SL 063011 dated November 28, 1941 was issued to Wasatch Coal Co. and transfered to Utah Coal and Chemicals Corp. December 30, 1986, and lease dated October 13, 1988 to William Roger Skaggs and Margaret A. Skaggs and also, Federal Mining Lease Act of 1920 gives the legal right to enter and mine (coal). No surface mining will be done.

Mining Lease entered into on October 13, 1988 between Utah Coal and Chemical Corporation, a Nevada corporation (Owners), and William Roger Skaggs and Margaret A. Skaggs of Blue Blaze Coal Company, a Utah Corporation and the Federal Mining Lease Act of 1920 cover the following described lands:

Leased Property

Section 8: SE1/4SW1/4
Section 17: NW1/4NE1/4, W1/2SE1/4, SE1/4SE1/4, S1/2NW1/4
N1/2SW1/4, SE1/4SW1/4

Containing 400.00 acres, more or less.
All located in Township 13 South, Range 8 East, SLM.

Subleased Property

Federal Coal Lease SL 063011
Township 13 South, Range 8 East, SLM

Section 7: S1/2SE1/4
Section 8: SW1/4SE1/4
Section 17: N1/2NW1/4, SW1/4NE1/4
Section 18: NE1/4NE1/4

Containing 280 acres, more or less.
Lessee has the right "to use and occupy so much of the surface as may be required for all purposes reasonable incident to the mining, removal, and disposal of said minerals..."

4.3.4.1 Agreements Road Usage

Agreement dated February 6 1989 between Carbon County and Blue Blaze Coal Company grants the right to use the County Road formerly designated as State Highway 139 in its coal mining operation. (See Figure 3-1)

4.3.5 Associated Surface Mining

The surface operations associated with underground coal mining activities do not involve the surface mining of coal. The private mineral lease to be mined (coal) has not been severed from the private surface lands.

Table 4-1

Surface and Mineral Land Status

urface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
	All	Coal	Coal	
Movell A. Jewkes (5) Margaret P. Grant (6)	U. S. A. (7) Leased to Utah Coal and Chemicals Corporation (1) SL 063011	Leased by: Blue Blaze Coal Company (2)	Utah Coal and Chemicals Corporation (1) U. S. A. (8)	
	Federal Mine Lease Act of 1920 allows mining under surface lands.			

Sec. 7 T 13S R 8E
Descr. 7: S½SE¼

Within permit area

Blue Blaze Coal #1 & #2

Table 4-1

Surface and Mineral Land Status

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
	ALL	ALL	Coal	
Utah Coal and Chemicals Corporation (1)	Utah Coal and Chemicals Corporation (1)	Blue Blaze Coal Company (2)	Utah Coal and Chemicals Corporation (1)	

Sec. 8 T 13S R 8E

Descr. #: SE¼SW¼

Within permit area

Table 4-1

Surface and Mineral Land Status

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
U. S. A. (7)	All U. S. A. (7) Leased to Utah Coal and Chemicals Corporation (1) SL 063011 Federal Mine Lease Act of 1920 allows mining under surface lands..	Coal Leased by: Blue Blaze Coal Company (2)	Coal Utah Coal and Chemicals Corporation (1) U. S. A. (8)	Within permit area

Sec. 8 T 13S R 8E
Descr. 8: SW¼SE¼

Table 4-1

Surface and Mineral Land Status

Blue Blaze Coal #1 & #2

urface Owner (s)	.Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
	Coal	Coal	Coal	
J. Mark & (3) James C. Jacobs	Utah Coal and (1) Chemicals Corporation	Blue Blaze Coal Company(2)	Utah Coal and (1) Chemicals Corporation	
	Non-coal Minerals Carl Nyman or (10) Successors.			
	Federal Mine Lease Act of 1920 allows mining under surface lands.			

Sec. 16 T 13S R 8E
Descr. 16; W½SE¼

Not Within permit area

Table 4-1 Surface and Mineral Land Status

Sec. 17 T 13S R 8E

Descr. 17: W720ft. of W½SE¼, E½SW¼, N½SW¼, SE¼NW¼

Within permit area

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
	ALL	ALL	Coal	
Utah Coal and Chemicals Corporation (1)	Utah Coal and Chemicals Corporation (1)	Blue Blaze Coal Company(2)	Utah Coal and Chemicals Corporation (1)	

Table 4-1

Surface and Mineral Land Status

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
	Coal	Coal	Coal	
J. Mark & (3) James C. Jacobs	Utah Coal and (1) Chemicals Corporation	Blue Blaze Coal Company(2)	Utah Coal and (1) Chemicals Corporation	
	Non-coal Minerals Carl Nyman or (10) successors.			
	Federal Mine Lease Act of 1920 allows mining under surface lands.			

Sec. 17 T 13S R 8E

Descr. 17: E600ft. of W½ SE¼SE¼, N½NE¼ SW¼NW¼

Within permit area

Table 4-1 Surface and Mineral Land Status

urface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
ldred E. Peirce, Jr.(4)	All U. S. A.(7) Leased to Utah Coal(1) and Chemicals Corporation SL 063011	Coal Leased by: Blue Blaze Coal Company (2)	Coal Utah Coal and (1) Chemicals Corporation U. S. A. (8)	
	Federal Mine Lease Act of 1920 allows mining under surface lands.			

Sec. 17 T 13S R 8E
Descr. 17: NW¼NW¼

Within permit area

Table 4-1 Surface and Mineral Land Status

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
U. S. A. (7)	All U. S. A. (7) Leased to Utah Coal (1) and Chemicals Corporation SL 063011 Federal Mine Lease Act of 1920 allows mining under surface lands.	Coal Leased by: Blue Blaze Coal Company (2)	Coal Utah Coal and Chemicals Corporation (1) U. S. A. (8)	Descr. 17: NE¼NW¼, SW¼NE¼ Within permit area

Table 4-1

Surface and Mineral Land Status

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
J. Mark & (3) James C. Jacobs	All U. S. A. (7) Leased to Utah Coal (1) and Chemicals Corporation SL 063011	Coal Leased by: Blue Blaze Coal Company(2)	Coal Utah Coal and (1) Chemicals Corporation U. S. A. (8)	
	Federal Mine Lease Act of 1920 allows mining under surface lands.			

Sec. 18 T 13S R 6E

Descr. 18: NE¼NE¼

Within permit area

Table 4-1 Surface and Mineral Land Status

Surface Owner (s)	Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
	ALL	ALL	Coal	
Utah Coal and (1) Chemicals Corporation	Utah Coal and (1) Chemicals Corporation	Blue Blaze Coal Company(2)	Utah Coal and (1) Chemicals Corporation	

Sec. 20 T 13S R 8E
Descr. 20: NW¼NE¼, NE¼NW¼

Within permit area

Blue Blaze Coal #1 & #2

Table 4-1

Surface and Mineral Land Status

urface Owner (s)	.Mineral Owner (s)	Leasehold Interest	Royalty Interests	ROW-Easement & Miscellaneous
J. Mark & (3) James C. Jacobs	Coal Utah Coal and (1) Chamicals Corporation Non-coal Minerals Carl Nyman or (10) successors.	Coal Blue Blaze Coal Company(2)	Coal Utah Coal and (1) Chemicals Corporation	
	Federal Mine Lease Act of 1920 allows mining under surface lands.			Not Within permit area

Sec. 21 T 13S R 8E
Descr. 21: NW¼NE¼

Table 4-2

Names and Addresses
Record Holders of Legal Interests

1. Utah Coal and Chemicals Corporation
   Suite 980, Valley Bank Plaza
   50 West Liberty
   Reno. Nevada 89501

2. Blue Blaze Coal Company
   P.O. Box 784
   Price, Utah 84501

3. Mark & James Jacobs
   734 S. Cherry Drive
   Orem, Utah 84057

4. Eldred E. Peirce, Jr.
   3432 South 500 East
   Price, Utah 84501

5. Movell A. Jewkes
   730 N. 4th East
   Price, Utah 84501

6. Margaret P. Grant
   c/o Catherine Jewkes
   730 N. 4th East
   Price, Utah 84501

7. United States of America
   Bureau of Land Management
   324 South State Suite 301
   Salt Lake City, Utah 84111-2303

8. United States of America
   U.S. Geological Survey
   2040 Administration Building
   1745 West 1700 South
   Salt Lake City, Utah 84104

9. Carl Nyman
   4260 Olympus View Drive
   Salt Lake City, Utah 84111

Figure 4-1o

William R. Skaggs

P.O. Box 784
Price, Utah 84501
Telephone (801) 472-3786

ATTENTION: Surface owners
Township 13 S. Range 8 E. SLM.
Section 17, 18, 7, 8, & 21

It is the intention of William Roger Skaggs, P.O. Box 784, Price, Utah, 84501, to mine the coal belonging to Utah Coal and Chemicals in Section 7, 8, 17, 18, & 20 in the Consumers area.

It is also, the intention of Mr. Skaggs to have this mine in production by the end of 1990.

For comment and further information please contact Mr. Skaggs at (801) 472-3786 or at the above address.

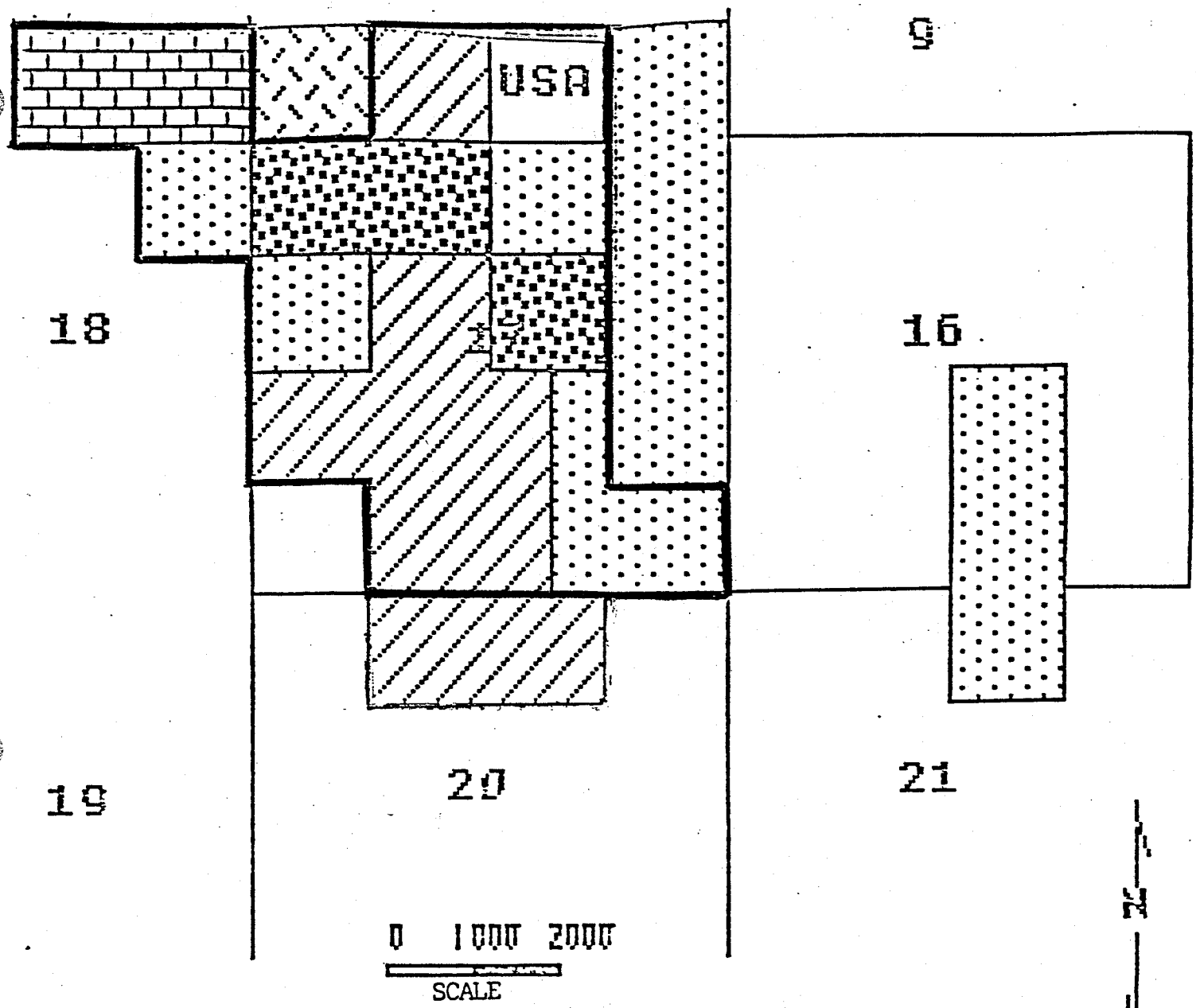
Sincerely,

Margaret Skaggs

Margaret Skaggs

cc: J. Mark & James C. Jacobs
Edward E. Pierce, Jr.
Margaret Pierce Grant

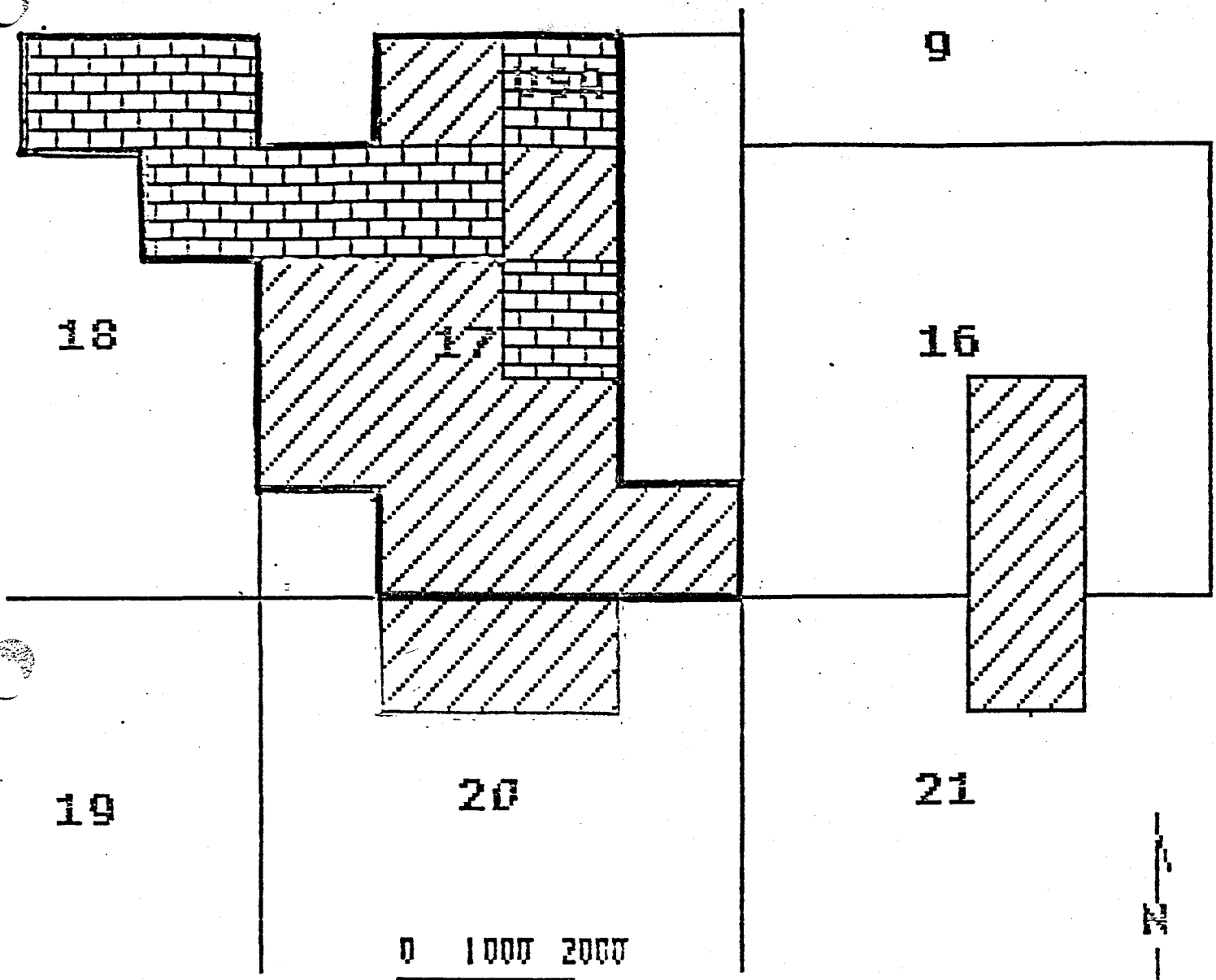
Figure 4-1



Surface Ownership Map

- Utah Coal & Chemical
- J. Mark & James C. Jacobs
- State of Utah
- Edward E. Pierce Jr.
- Margaret Pierce Grant
- Permit Area

Figure 4-2



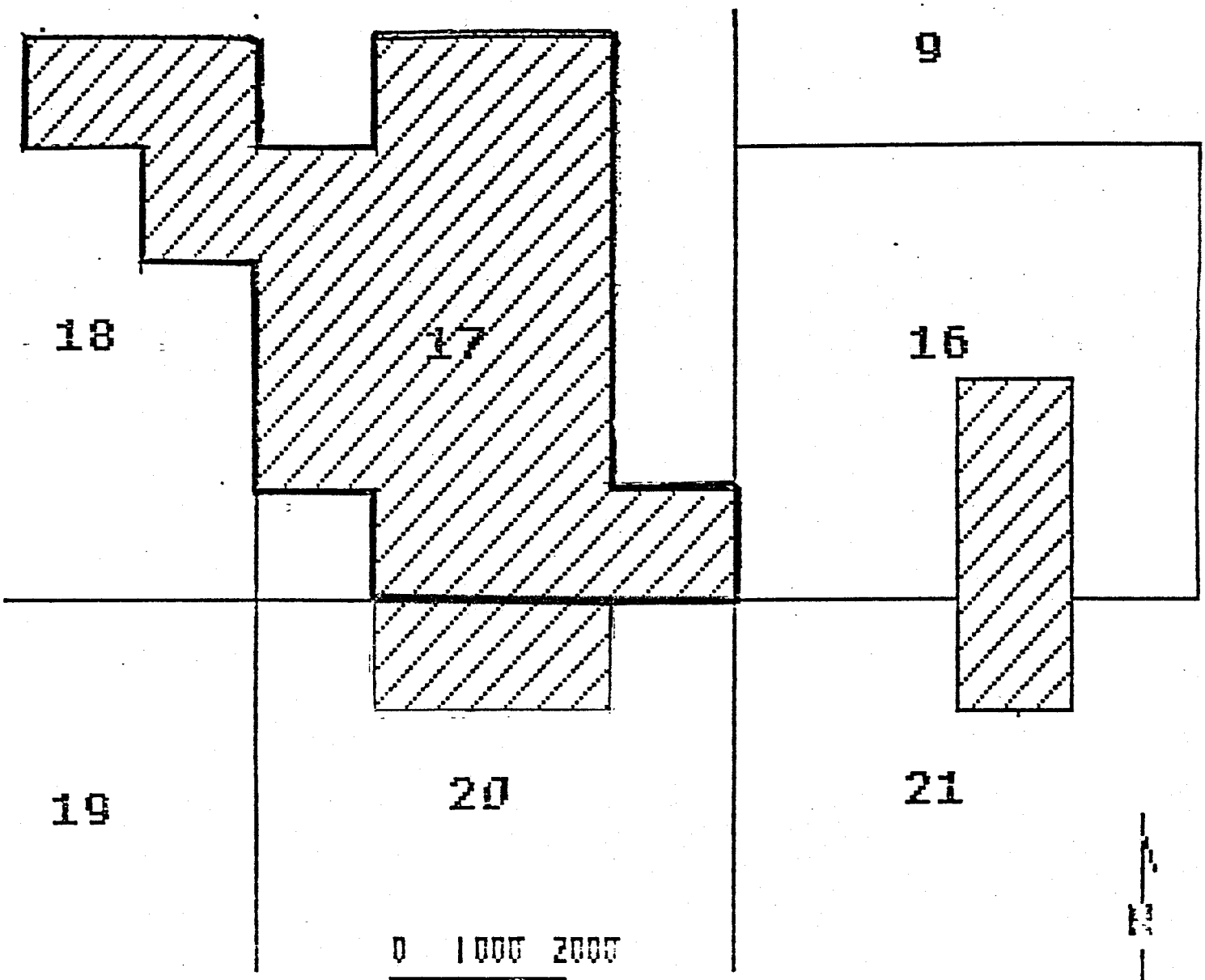
Sub-Surface Ownership

Utah Coal & Chemical

Federal Coal Lease SL 063011

Permit Area

Figure 4-3



Legal Rights to Enter

Utah Coal & Chemical
and Federal Coal Lease SL 063011

Permit Area

4.4 Existing Land Use

4.4.1. Regional Land Use

Agricultural

Irrigated lands are common throughout the region. More recently, part of the irrigation water is being consumed by growing communities. This has not affected tillage rotation operations appreciably.

Historically, the livestock industry has played an important part of the regions economy. Early settlers depended on range land for grazing sheep, cattle and horses. Presently, the trend is towards more cattle grazing and fewer sheep. Typically, ranchers conduct their operations adjacent to the grazing area. BLM and USFS lands are used extensively for grazing.

Forestry

Timber operations were once closely tied to ranch operations. Early settlers needed the timber for fences, corrals, mine timber, railroad ties, etc. In more recent years, the majority of the sawmills have closed due to less demand for wood products.

Current uses of forest products have changed somewhat since earlier times. The demand is now for fence posts, poles, Christmas trees and saw timber. Present levels of forest products used in an upswing with population growth.

Recreation

A large variety of wildlife zones are present ranging from cold desert to high mountain forest. Large amounts of data are present for game species due to their economic value.

Mule deer are the most abundant big game in the region. Deer populations are low and range lands are improving.

Winter range for deer is the most limiting factor for expansion at the present time. Hunting is expected to rise in popularity as population in Carbon and Emery Counties increases. Mule deer and elk are popular big game species that are hunted.

Lakes, streams, and rivers of this region provide habitat for 40 varieties of fishes. Rainbow, cutthroat, brown and brook trout are some of the better known game fish pursued by fishermen.

In addition to hunting and fishing, USFS and BLM provide lands for a variety of recreational activities in this region. They include camping, hiking, pioneering, snowmobiling, snow skiing, etc.

4.4.2 Mine Plan Area Land Use
Past and Present Land Use

The land on which the No. 1 and No. 2 Mines are located has long been used for coal mining. Other than coal mining, this area has been used for deer hunting, sightseeing and hiking. There are no developed campgrounds or public roads within the area and none planned for the future.

Private landowners presently administer the lands in this area for limited livestock forage, (sheep are trailed through the proposed mine site area in early spring and back through in the fall. No sheep should be grazing on the property.), wildlife habitat, watershed, dispersed recreation and coal mining are also land uses. There are no range improvements in the area. Access to the lease tract is limited to jeep trails into the higher elevations leading to Beaver Creek which is above the proposed mine sites. There are no plans to alter this access situation. See Figure 4-4

The above described uses of this land are primarily the same for stream valleys, steep slopes or flats, hilltop areas, with the exception of coal mining, which is located on the slope and beneath the hilltop areas.

4.4.3 Affect of Operations on Land Use and Mitigation Measures

The surface disturbance created by the mining operations at the No. 1 & 2 Mines will be limited to what is proposed for disturbance. Therefore, the potential to affect the land use is discussed below.

The surface disturbance at the No. 1 & 2 Mines will consist for the most part of access and haul roads that will service the mining operations; some wildlife (mainly deer) will be displaced due to coal hauling. There will be little impact on range land as the mine plan area is below areas used for summer grazing by private landowners.

The cultural resources survey showed that there are four delapidated cabins within the Beaver Creek area. These cabins are considered sites used by various early inhabitants. There are no public roads or public parks in or near the proposed mining operations that would suffer any impacts from mining operations.

The sedimentation ponds will be constructed below the disturbed area to prevent sediment from entering the

Gordon Creek. A berm along the haul road, adjacent to Gordon Creek, prevents runoff from entering the stream.

It is not projected that the mining operation will affect the land use within and adjacent to the permit boundary. Efforts will be made to minimize the area of disturbance so the environmental impacts will remain minimal.

4.5 Post-Mining Land Use

The post-mining uses of the land will be the same as the pre-mining and present uses described above. Once mining has ceased, the disturbed areas will be reclaimed to a degree acceptable to the Division of Oil, Gas and Mining and the land will once again support its principle pre-mining uses: i.e., deer forage, hunting, sightseeing, watershed and hiking. Also private landowners will continue to graze sheep and cattle on areas near Beaver Creek, which is above the mine site.

The restoration of the area will be achieved by regrading the yards, reclaiming the roads and portal areas to a practical degree, planting all disturbed areas and monitoring the revegetation effort to the satisfaction of the Division of Oil, Gas and Mining.

4.6 Socioeconomic Consideration

The coal mining industry within Emery County has shown several errattic periods of renewed growth and sudden decline. During the 1950-1960 census period, the population of Emery County declined 8.79 percent. From 1960-1970, Emery County's Population declined .74 percent per year. From 1970- to 1975, the population increased from 5,137 to an estimated 6,700 persons, a 23 percent increase.

Carbon and Emery Counties are economically dependent upon conditions in the coal market. This is evident by the slump in population of these counties that occurred between 1950-1970. The recent increase in coal mining has centered on Emery County where mining employment has increased over 210 percent from 1969 to 1980. The increase has been more modest in Carbon (40 to 50 percent).

Most of the mine personnel reside at Helper, Huntington or Price. Of these three communities, Price is recognized as providing a variety of services and has made larger investments in facilities than the other two communities. However, recent economic growth in the area has decreased the potential for many communities to provide services to still more people unless additional investment in expansion and improvement of facilities is undertaken. It appears that these communities are currently improving and expanding the communities facilities. Obviously, as the economic base of Carbon and Emery Counties rises, private business will encourage the development of more and better community services.

Figure 4-4

CARBON COUNTY
PRICE, UTAH 84501

May 23, 1989

To Whom It May Concern:

Carbon County Zoning on the property located at Township 13S R8E Section 17 is M & G 1.

See attached a copy of M & G 1 zoning as per Carbon County development code as of 1981.

Sincerely,

Harold R. Marston

Harold R. Marston
Carbon County Planner

4-2-15 M&G-1 Mining and Grazing Zone

A. Legislative Intent

The M&G-1 Mining and Grazing Zone generally covers the low rangeland areas of Castle Valley. Because of the limitations imposed by climate, topography, soil capability, inadequate water supply and the presence of economically significant mineral deposits, this area has historically been utilized as a place for the grazing of livestock on the open range and as the location of numerous mining and mineral exploration sites. The peculiar characteristics and conditions present in this area make the land more appropriately suited for a continuation of these uses. However, because of the relatively fragile balance of nature in the area, all permitted activities must be carried out in a manner consistent with the limitations of the environment.

It is hereby declared that the specific purposes and intent of the Legislative Body in establishing the M&G-1 Mining and Grazing Zone are:

1. To take advantage of and to more fully implement the basic purposes for planning and zoning as set forth in Section 17-27-5 and 17-27-13 of the Utah State Code and Section 1-2 of this Code.
2. To promote the conservation of water, land, mineral and other resources.
3. To prevent the degradation of the natural and social environment.
4. To foster agriculture, mining and industry within the state.

In order to accomplish the above-stated purposes, those uses which are reasonably necessary to the use of the land for agricultural, mining and certain types of industrial operations shall be encouraged, provided that adequate guarantees for the protection of the area have been incorporated. Conversely, residential, commercial and similar urban type uses which are inconsistent with the militate against the continued use of the area for the above-stated purposes are not permitted in this zone.

The specific regulations necessary for the accomplishment of the purposes as outlined above are hereinafter set forth.

B. Permitted Non-Conditional Uses

The following buildings, structures and uses of land shall be permitted upon compliance with the standards and requirements as set forth in this Code:

1. Grazing of livestock on open range land.
2. Production of fruit and crops in the field.
3. Buildings, silos and other structures for the storage and keeping of agricultural products and machinery.
4. Care and keeping of domestic livestock and fowl.

5. Barns, stables, corrals, pens, coops and other buildings for the care and keeping of domestic livestock, provided that no such barn, stable, corral, pen, coop or other building shall be located closer than one hundred (100) feet to an existing dwelling.
6. Raising of mink, beaver, nutria and similar furbearing animals, and the pens and other structures necessary in the raising of such animals.
7. Minor utility transmission projects.
8. Manmade lakes, reservoirs, ponds and dams when under ten (10) acre-feet in capacity.
9. Minor mines and pits, subject to the prior approval of a site plan as provided under Section 3-3-26.
10. Caretaker dwellings subject to the provisions of Section 3-3-21.
11. Production Wells.

C. Permitted Conditional Uses

The following buildings, structures and uses of land shall be permitted upon compliance with the requirements set forth in this Code and after approval has been given by the designated reviewing agencies: (Approval of other agencies or levels of government may be required.)

1. Major underground and surface mine developments, when approved by the County Commission and in accordance with the applicable provisions of Chapter 5-4.
2. Major utility transmission and railroad projects, when approved by the County Commission in accordance with the applicable provisions of Chapter 5-5.
3. Automobile and motorcycle race tracks and race courses, subject to approval of a site plan by the County Commission.
4. Fairgrounds, rodeo arenas, race tracks and race courses, schools, training and correctional facilities when operated by a public agency and subject to the prior approval of Site Plan by the County Commission.
5. The following industrial uses and activities when approved as a large scale industrial project in accordance with the provisions of Chapter 5-3.

   a. The storage, processing and loading of earth products and facilities relating thereto.
   b. Electric generating plants.

6. Manmade lakes, reservoirs, ponds and dams over ten (10) acre-feet in capacity when approved by the County Commission.
7. Airports, flying fields, helicopter pads, including terminal and aircraft storage facilities, subject to approval of a site plan by the County Commission.
8. Shooting ranges subject to the approval of the County Commission, after recommendation of the Planning Commissioin.
9. Water treatment plants, culinary water storage tanks and sewage treatment plants when approved by the County Commission.

D. Area Requirements

There shall be no minimum area requirements except as may be required under other provisions of this Code.

E. Width Requirements

There shall be no minimum width requirements except as may be required under other provisions of this Code.,

F. Location Requirements

All buildings shall be set back at least sixty (60) feet from the center line of a County road or thirty (30) feet from the front line, whichever is greater.

G. Size and Height Requirements

There shall be no size and height requirements.

H. Utility Requirements

1. Culinary Water

All dwellings and other buildings used for human occupancy shall:

a. Be served by an approved central water system, or
b. Be served by an individual cistern water system subject to the following conditions:

(1) That connection to an approved central water system is not possible.
(2) The cistern shall comply with County standards for design and construction of water cisterns as approved by the local health authority.

c. Regardless of the type of system utilized, the requirements of Section 3-3-23 regarding conveyance of water rights and the availability of a reliable water supply are fully complied with.

2. Sewage Disposal Facilities

No building used for human habitation shall be constructed, nor shall any permit be issued therefor, until sewage disposal facilities have been approved in accordance with minimum health standards as established by the State and/or local health authority.

I. Special Requirements

1. Trash Requirements

The yards around buildings shall be kept free of debris, refuse, weeds and other flammable material which may constitute a fire hazard.

Section 5

CULTURAL AND PALEONTOLOGICAL RESOURCES

5.1 Scope

During July and August of 1980, Utah Archaeological Research Corporation conducted a two phase archaeological investigation on a parcel of land leased by Blue Blaze Coal Company in Carbon County, Eastern Utah. The property is 920 acres in size and has the Beaver Creek Coal Company and the proposed Blue Blaze Coal No. 1 & 2 Mines on it. This parcel of land is located on the eastern edge of the Wasatch Plateau. The area is drained by the Gordon Creek a ephemeral stream.

The area lies approximately 15 miles northwest of Price, Utah. The properties are located in Township 13 South, Range 8 East. The site of the Blue Blaze No. 1 & 2 Mines will be located in Township 13 South, Range 8 East, Section 17, SLM for the portal area. The mining will progress underground into Sections 7,8, and 18, all in Township 13 South Range 8 East, SLM.

5.2 Methodology

The first phase of the project was to conduct a literature search in order to compile all previously known and recorded cultural information for the project area. Included in this phase of the project was an evaluation of all geological, physiographical, floral, and faunal information which might be pertinent to the understanding of the various cultures in the area.

Phase II of the Project was an intensive archaeological field survey of the entire project area. Evenly spaced parallel transects were used by the consultants where possible. On extremely steep terrain of the project area, different survey methods were used. Because of the nature of the historical sites found during this phase of the project, it was possible to conduct interviews with persons familiar with the history of the immediate area in order to gather specific information pertaining to these sites. This was accomplished after the field work had been done. This report includes the results of both phases of the project, plus appendices containing archaeological site information and locations.

5.3 Archaeological Resources

5.3.1 Archaeological Literature review and Summary

Human activity in the Castle Valley area extends over a period beginning as much as 12,000 years ago and lasting until the present. Human exploitation patterns are governed by different levels of technological development and the ways these technologies are applied in extracting resources from a changing ecological system.

These economic and Technological changes through time are the key to understanding cultural dynamics in the Castle Valley area.

Prehistoric human activity in the Castle Valley area can be divided into four phases: Paleo Indian, Archaic, Fremont and Numic.

Paleo Indian

The Paleo Indian phase is represented by a lifestyle geared toward the hunting of the now extinct Pleistocene mammals such as mammoth and giant bison (Bison antiquus). It dates from approximately 12000 B.P. until 7000 B.P. and can be divided into three subphases: Llano, Folsom and Plano (Jennings, 1977).

The Llano culture dates from approximately 12,000 - 10,000 years ago and is characterized by the hunting of mammoths. Evidence for this culture is generally found in sites where these animals were killed and butchered, and bones along with hunting and butchering tools were left behind. Evidences for this subphase of the Paleo Indian culture in the Castle Valley area are scanty. One site, the Tripp site, yielded one Clovis point (Tripp,1966). Other Clovis points have been reported from other parts of Utah (Lindsay, 1976, BLM files).

During the Folsom period (11,000 B.P to 9000 B.P.), emphasis turned from the hunting of the rapidly adiminishing mammoth to the Bisonantiquus. A smaller and thinner point, known as the Folsom Point, came into use at this time. As in the case of the Llano culture, evidence for the Folsom culture comes from kill and butchering sites. These sites are found predominately on the high plains east of the Rocky Mountains, although many sites are found outside that area.

In the Castle Valley area, only one site has been found which might date to this period. Site 42Em8, also known as the Silverhorn Site, was excavated by Gunnerson in the 1950's (Gunnerson, 1956). One point which is very similar to the Folsom point was found by a local collector in an arroyo cut. Other materials from the site are very similar to materials taken from other Folsom sites.

Evidence for the Plano subphase (9000B.P. to 7000 B.P.) is minimal in Utah. During this time, a great diversity of projectile points were manufactured and activity became restricted pretty much to an area east of the Rocky Mountains.

In summary, although there is very little evidence for Paleo Indian activity in the Castle Valley area, what evidence there is does show that this area was used by these early big game hunting people.

Archaic

Beginning about 8000 - 9000 years ago, the lifestyle of the aboriginal populations shifted from the hunting of big game animals to a dependence on smaller game animals and gathering of wild plant foods. This period is known as the Archaic Phase and in the Castle Valley area can be devided into four subphases based on changes in both projectile point types and population densities (Schroedl, 1976).

The Black Knoll subphase lasted from approximately 8300 B.P. to 6200 B.P. and is characterized by two types of dart points, the Pinto and the Northern Side Notch (Schroedl, 1976). During this period, hunting was done with the atlatl (spear thrower) and the primary species utilized were deer and mountain sheep with some dependence on antelope and bison. A variety of wild plants and insects were also utilized. Caves and rockshelters were the main areas of occupation. Near the end of this phase, projectile points of the Elko series were introduced. Around 7200 B.P., there was an increase in population.

The Castle Valley subphase lasted from 6200 B.P. to 4500 B.P. Subsistence strategies and the use of caves and rockshelters were essentially the same as in the Black Knoll subphase. The main difference between the two subphases is a change in projectile point types. During the Castle Valley subphase, points such as the Rocker Base, Sudden Side Notch and Hawken Side Notch appeared. Toward the end of the Castle Valley subphase, the Humboldt point became the dominant point style.

The Green River subphase began about 4500 B.P. and lasted until about 3300 B.P. Subsistence strategies appear to have continued basically unchanged from the previous subphase. The Humboldt point continued in use through this period but other points, such as the Gypsum and San Rafael Side Notch, became popular. During this time, the northeastern part of the Colorado Plateau received influence from the Plains.

The last subphase of the Archaic, the Dirty Devil, lasted from approximately 3300 B.P. to 1500 B.P. Subsistence activities during the early part of this period were essentially unchanged from the previous periods but, between 1600 B.P. and 2000 B.P., evidences of corn horticulture began to appear (Winter, 1973; Hurst, 1948;

Jennings, in press). The Gypsum point continued to be the dominant projectile point in use during this period but, toward the end of the Dirty Devil (1600 B.P. to 1500 B.P.), the bow and arrow came into use. The end of the Dirty Devil subphase marked the transition from an Archaic hunting and gathering lifeway to the beginnings of sedentary village life.

Archaeological evidence for the presence of Archaic peoples in the Castle Valley area is relatively abundant. For example, in Emery County, a total of 16 Archaic sites are known; one on the Wasatch Plateau, four from the San Rafael Area and the remaining eleven are from Castle Valley (Sargent, 1977). A total of four Archaic rockshelters have been excavated in and near the Castle Valley area (Wylie, 1971; Lindsay and Lund, 1976; DeBloois, in preparation; Jenning, Schroedl and Homer, in preparation). From the information gathered at these sites, it appears there was a preference for upland hunting - lowland gathering during Archaic times, possibly reflecting a seasonal round (Jennings, 1975; Schroedl, 1976; Lindsay and Lund, 1976). Toward the end of this period, there was a gradual shift from seasonal hunting and gathering to the beginnings of corn horticulture and a more sedentary way of life.

Fremont

The Fremont culture dates from approximately 1800 B.P. to 650 B.P. and, in general, is characterized by the use of permanent habitations, ceramics and some dependence upon corn horticulture. The Freemont culture inhabited most of Utah north of the Colorado River and part of eastern Colorado. Traditionally, the Fremont have been divided into five regional variants; Parowan, Sevier, Great Salt Lake, Uintah and San Rafael. Recently Madison and Lindsay (1977) have re-evaluated the information and proposed a three-fold division; The Sevier culture, located west of the Wasatch Plateau and dependent primarily upon marsh land environments for subsistence; the Fremont culture, located east of the Wasatch Plateau and north of the Colorado River, dependent upon corn horiculture and living in small permanent villages adjacent to permanent stream; and the unnamed plains-derived culture located in northeastern Utah, dependent upon bison hunting and collecting of wild plants for subsistence and living in shallow pit-like structures.

The Castle Valley area lies entirely within the Fremont culture area. Fremont sites in the area are characterized by the presence of Emery Gray pottery, with some Uintah Gray in the north and Sevier Gray and Ivie

Creek Black-on-white in the west. Snake Valley Gray and Anasazi trade wares are also present in the area.

Diagostic projectile points include Rose Spring, Desert Side Notch and jBull Creek types with a continuation of the use of Elko series and Gypsum type dart points.

Villages tended to be small. Semi-subterranean and surface dwellings are built and both stones and abode are utilized in their construction. These small villages were usually located on ridges or knolls near permanent streams where both water and rich soils were present. Caves and rockshelters were often utilized for storage and habitation.

Although no Fremont sites have been excavated in the immediate vicinity of the No. 1 and 2 Mines, there has been considerable work done on Fremont sites in other parts of the Castle Valley area. The main body of work has been done by the University of Utah with excavation at 42Em47 (Gunnerson, 1956), Windy Ridge Village, Crescent Ridge and Power Pole Knoll (Madsen, 1975), Innocents Ridge (Schroedl and Hogan, 1975), levels of Clyde's Cavern (Wylie, 1971) and Pint-Size Shelter (Lindsay and Lund, 1976). The U.S. Forest Service also found Fremont remains in Joe's Valley Alcove (DeBloois, in preparation).

Numic

The Numic speaking peoples, commonly known as the Ute, Paiute, Southern Paiute, Shoshoni and Bannock, were the last aboriginal peoples to inhabit Utah prior to European contact. Although there is considerable debate as to their origins (Lamb, 1958; Taylor, 1959; Ginnerson, 1962; Madsen, 1975), the Numic speakers were definitely in the southwestern Great Basin by 650 B.P. (Madsen, 1975). They rapidly spread throughout the Great Basin and Colorado Plateau and, by the arrival of the Europeans in the 1700 - 1800's, they appear to have been occupying virtually all of Utah and Nevada and portions of surrounding states (Warner, 1976; Powell, 1975).

Archaeologically, we know very little about the Numic. All that remains of their occupation of the area are bits of pottery, arrowheads and, in unusual circumstances, fragments of basketry, clothing and other perishable materials. Their pottery is easily distinguished from other types in that it is crudely made using a paddle-and-anvil technique, is typically thick walled, has large temper particles, is poorly smoothed, is fired in an oxidizing atmosphere and occasionally has fingernail incised decoration (Euler, 1964). The

distinctive projectile point is the Desert Side Notch point.

The Numic practiced as Archaic-type subsistence, depending upon the hunting and gathering of wild plants, animals and insects for survival. Groups tended to be loosely formed and usually consisted of no more than an extended family.

Large areas were needed for subsistance activities but these were too ill defined and different bands utilized portions of the same areas.

With the arrival of the Europeans, the Numic lifeway rapidly began to change. Traditional hunting and gathering grounds were cut off by white expansion. The various Numic bands were severely restricted in their movements and were eventually forced to change their lifeway. Today, the Numic speaking people are restricted to several reservations scattered throughout Utah, Nevada, Colorado, Idaho and Arizona.

Unfortunately, not much evidence of Numic occupation of the Castle Valley area has been found. Sargent (1977) lists only two Numic sites which post-dated 650 B.P. (Adovasio, 1971). Historical accounts say very little about Indians being present in the area at the time of white arrival (MCElprang, 1949).

5.4 Historical Resources

5.4.1 Historical Literature Review and Summary

The first documented exploration of the Castle Valley area began with the Dominguez-Escalante expedition of 1776. The purpose of the expedition was to explore a possible route from the Spanish settlements in New Mexico to Monterey on the California coast (Miller, 1968). The expedition actually passed to the north of the Castle Valley area, but it served to open up the area to further Spanish exploration.

Subsequent Spanish expeditions into the area, and American fur trapping activities both served to eventually open up a main route between New Mexico and California. This route, known as the Old Spanish Trail, came through the San Juan Country, crossed the Colorado River at Moab, continued to the Green River crossing at the present town of Green River, extended through the San Rafael Desert into the Castle Valley, then crossed the Wasatch Plateau through Salina Canyon and continued on through Southern Utah, Nevada and into California. The main traffic on this route included numerous trading, trapping, Indian slave and horse trading expeditions

(Miller 1968). The trail was in use almost yearly until after the Mexican War. After that, the trail received use from travelers, immigrants, mail carriers and army troops (Stokes and Cohenour 1956).

In 1853, Captain J. W. Gunnison of the Corps of Topographical Engineers traversed the length of Castle Valley. On October 11, Lieutenant E. C. Beckwith reported that coal had been found and brought to camp. At that time, the party was camped some three miles east of the present town of Emery. Several days after leaving Castle Valley, Captain Gunnison and several members of his party were killed by Indians (Stokes nd Cohenour 1956).

In 1869 and again in 1871, Major John W. Powell led exploring expeditions down the Green and Colorado Rivers and in so doing opened up an area which until then had been virtually unknown to whites.

In 1873, Lieutenant R. L. Hoxie of the Corps of Engineers and his party mapped the topography and geology of Eastern Utah including the Castle Valley area.

The first attempts to establish permanent settlements in the area were undertaken by the Mormon Church. In 1854, a party led by William Huntington traveled through Castle Valley on their way to the San Juan River and Navajo country. On the basis of this report, the Elk Mountain Mission was sent out by Brigham Young in 1855 to establish a mission near the present town of Moab. Indian hostilities plus hardships forced the mission to be abandoned that same year (MCElprang, 1959). During this period, there was some sheep and cattle grazing in the more favorable ridges and valleys of the Wasatch Plateau (Dilly. 1900).

The first attempt at a permanent settlement in the area was by James McHadden and Leander Lemmon in 1875. The diverted water from Huntington Creek onto some land near the mouth of Huntington Canyon (Stoke and Cohenour, 1956). By 1877, word had reached the Mormon Settlements to the west of good water and arable land along some of the creeks in Castle Valley. In September of that year, a priesthood meeting was held in Mount Pleasant in which 75 men from the Sanpete Stake were called to settle in Castle Valley. However, only a few men responded to the call. Another call was given in the fall of 1878 with a more favorable response. Orange Seeley was called to superintend the founding of the settlements. By the fall of 1878, the crops were sufficient for the families of the settlers to come into the valley. During this time, Ferron, Castle Dale, Huntington, Wilsonville, Lawrence, Molen and Orangeville were settled.

In 1880, the Utah Legislative Assembly created Emery County which included the present counties of Carbon, Grand and Emery. Price wasn't officially established until 1882 when a group of Mormon settlers on the Price River were organized into a ward. In 1883, the Rio Grande Railroad was built through Price and from that time on the settlement became the hub of the area. In 1894, the northern party of Emery County was made into Carbon County and Price was named the county seat (McElprang, 1949).

Even though coal had been reported by Gunnison in 1853, the coal industry in the area really didn't get going until 1875. In that year, the Fairview Coal Mining and Coke Company opened its operations at Connelsville in the upper part of Huntington Canyon. The coke was made there and shipped by wagon to Springville. However, the operation soon became unprofitable and, after three years, it was abandoned (Powell 1976).

With the large Mormon settlements to the west growing, the need for coal naturally increased. In 1875, the Pleasant Valley Coal Company built a wagon road from Springville up Spanish Fork Canyon to the coal fields in the Pleasant Valley area. By 1877, a mine had been operated in Winter Quarters Canyon and the area began a rich coal productinon which continues today. To alleviate problems of transporting the coal over the sometimes impassable wagon road, the Pleasant Valley Railroad Company built a narrow gauge railroad through Spanish Fork Canyon in 1879.

This new coal prosperity lured the Denver and Rio Grande Railroad into routing its new line through Price and Spanish Fork Canyon rather than following the originally proposed line through Castle Valley and Salina Canyon to the south (McElprang 1949).

In 1882, the D&RGW purchased the Pleasant Valley Railroad Company and the Pleasant Valley Coal Company. Threatened by the possibility of losing its hold of the Utah coal industry, the Union Pacific Railroad Company moved into the Pleasant Valley in 1882 and formed the Utah Central Coal Company. Later, it opened the Union Pacific Mine near Scofield in 1884. During this period, the railroad companies almost totally dominated the Utah coal in 1908, but actual production did not begin until the early 1920's. Companies active in the area were Consumers Mutual Coal Company, National Coal Company, and Sweet Coal Company. Camps were built at all three locations, and Coal City (Dempseyville) was laid out in 1921 to serve as a business and residential neighborhood for the mines located 2 miles away at National and Consumers (Carr 1972). Coal City lasted for only a few years, and

National and Consumers died out by the 1940's and 1950's. Coal mining operations continue in the area today.

Most of the coal mines were productive through the first 3 decades of the 20th Century, but with the coming of the depression and the increasing use of other fuels, coal production gradually decreased and many of the camps had to close down.

The downward trend of coal production continued through the 1940's and 1950's with a brief up-swing during WWII. During the 1950's many operations had to shut down. With the increased demand for energy in the 1970's there has been a stepped up pace in coal mining operations, a trend which appears to be promising for 1980's.

History of Archaeological Work

The first account of an archaeological site being reported in the Castle Valley area comes from the 1869 journal of Major John Wesley Powell. On his journey down the Green River, Powell noted the presence of some ruins, possibly in the vicinity of Chandler Creek (Dellenbaugh, 1926).

The first expedition into the area for the purpose of doing archaeological work was in 1929-1930 by the Claflin-Emerson expedition and mention was made of several sites (Morss, 1931; Gunnerson, 1969).

In 1935, A.B. Reagan did a survey in the area and noted a pictograph label (Reagan, 1935).

Range Creek to the north of Castle Valley was investigated by Leh in 1936 and several granaries were noted (Leh, 1936).

Work continued to be sporadic through the 1930's and 1940's. Durung the 1950's however, interest was turned again to eastern Utah. In 1945, Morss made mention of the site from which the Piling Cave figurines came (Morss, 1954). In the 1950's, the University of Utah passed through the Castle Valley area as a part of the statewide archaeological survey. They surveyed on Range, Last Chance, Ivie, Quichupah, Muddy and Ferron Greeks and recorded 49 sites (Gunnerson, 1957). Since that time, the University of Utah has been extensively involved in the archaeological survey of the area.

Their work included several surveys (see bibliography) and a number of excavations which constitute the main body of archaeological knowledge for the Archaic and Fremont of Eastern Utah. The excavation includee: the Silverhorn site, a possible Paleo-Indian site (Gunnerson,

1956); 42Em5, a Fremont structure (Gunnerson, 1957); Clyde's Cavern, a rockshelter in Emery Country with nine strata ranging from Archaic through Numic (Wylie, 1971); three small Fremont villages - Windy Ridge, Crescent Ridge, and Power Pole Knoll (Madsen, 1975); Innocents Ridge, a Fremont village with five structures (Schroedl and Hogan, 1975); the Poplar Knob site (Taylor, 1957); Snake Rock Village (Gunnerson, 1957); (Aikens, 1967); the Old Woman site (Taylor, 1957); the Round Spring site (Gunnerson, 1957; the Fallen Woman, Old Road and Ivie Ridge sites (Wilson and Smith, 1976); and Sudden Shelter, an Archaic rockshelter (Jennings, Schroedl and Holmer, in preparation). The University of Utah also conducted excavation north of the project area in Nine Mile Canyon in 1936 (Gillin, 1955).

Other excavations in the area include Pint Size Shelter, and Archaic-Fremont site dug by the Utah State Division of History (Lindsay and Lund, 1976) and Joe's Valley Alcove, another Archaic-Fremont site dug by the U.S. Forest Service in 1974 (DeBools, unpublished manuscript).

The decade of the 70's has brought about a market increase in surveys as a result of cultural resource management. Institutions involved in the bulk of the work have been Brigham Young University (see bibliography), the Museum of Northern Arizona (Keller, 1975 a,b,c,d; 1976) and agencies such as the Bureau of Land Management, the U.S. Forest Service and the antiquities Section of the Division of State History. Most of the work done is the last few years, since the expansion of cultural resource management, has been survey, with very little excavation taking place.

5.4.2 Historical Field Survey

A field survey of the permit area was conducted from July through August 1980. The project area is located on the eastern edge of the Wasatch Plateau, one of the dominant topographical features of Eastern Utah. The area is drained by the Coal Canyon Creek. Topography in the area is extremely rugged. Much of the area is dominated by slopes usually in excess of 60%, and many places are regularly broken up by 100% slopes.

The area received in the neighborhood of 16 inches of rain per year. Vegetation includes Subalpine and Montane communities. The major game species in the area are mule deer and elk, with smaller species abundant.

Because of the extremely rugged terrain, it was not possible to systematically examine the area using evenly spaced parallel transects. As a result, different methods were used depending upon the terrain being

examined. Those parts of the permit area which were free of impassable undergrowth, were systematically examined by walking transects spaced 15 meters apart throughout those areas. The relatively flat ridge tops in the area were also examined by walking parallelled transects over the entire area.

Steep slopes on some areas presented a special problem. Evenly spaced transects or transects following the natural contours were entirely out of the question. Since roads had been cut into the slopes in several locations it was possible to utilize them in examining the slope areas for archaeological sites. Passes were made along these roads and with binoculars the areas above and below each road were examined for cultural remains. Slope areas where there were no roads were examined by hiking up and down prominent ridges and looking off to both sides with binoculars. In this way, work hazards were kept to a minimum and the entire area received an adequate sampling.

Survey Results

The Archaeological survey of the Gordon Creek properties recorded no historic archaeological sites. A search of the site files at the Utah Division of State History turned up no previously recorded sites in, or near, the project area.

The Beaver Creek area was probably first exploited in the 1870's by some of the first settlers to come to Castle Valley. Among them were James Price, Caleb Rhodes, and Abraham Powell settlers who supplemented their incomes by trapping beaver. They were naturally drawn to the large beaver colonies along Beaver Creek (Movell Jewkes, personal communication, 1980). Remains of early trapper cabins can still be found along Beaver Creek several miles north of the project area.

In the 1880's coal mining operations began to develop in Pleasant Valley to the west of the project area, and Scofield grew into the largest town in the area. In the 1890's Carbon County was created when Emery County divided, and a rivalry grew between Scofield and Price over the location of the county seat. Beacuse Price was located on the main line of the Denver and Rio Grande Western Railroad, it was chosen as the County seat. The people of Scofield subsequently built a wagon road over the mountain in order to gain access to Price. This road followed along Beaver Creek and then wound down the ridges and slopes of the plateau in Section 8 and 17 of Township 13 Sourth, Range 8 East, SLM, the canyon bottom of Gordon Creek, where it continued on to Price. Much of the current road through the area follow the course of

this old wagon road. The spring in the SW 1/4 of the SW 1/4 of the SW 1/4 of Section 7, Township 13 South, Range 8 East, SLM, was the location of one of the major camp spots along this road. Nothing remains to indicate the camp site.

In 1920, George Frandsen acquired Sections 5, 6, and part of 4 of Township 13 South, Range 8 East SLM, from the U.S. Government for homesteading. He used the area for raising sheep and cattle, and occasionally took lumber out of the area for sale to local mills. Sometime between 1925 and 1928; Frandsen's children homesteaded sections of land close to the ones he had taken, and the family worked a ranching operation which was prosperous until the early 1950's. The Frandsen's built 3 cabins on their land 2 of them in Section 8 and one in Section 13, Township 13 South, Range 7 East.

About the time the Frandsen's were getting their ranch going up on the plateau, coal was being developed down on Gordon Creek. Prospecting had begun in the area as early as 1908, but no mines were opened until the 1920's. Among the larger mines to be opened in the area were; Sweet in 1925, Consumers in 1928, and National in 1928. Mining camps sprang up at the Mines and for a short time Coal City (Dempseyville), located 2 miles east of the mines served as the business and residential center of the mining district. Remains of the main mining camps and coal mining operations can still be seen. National Coal Company had some operations up Gordon Creek from the mining camps (Movell Jewkes, ibid.), and remains of cabins and work areas can still be seen.

Three sites occur on the Blue Blaze No. 1 and 2 Mines Permit area, therefore, they are discussed under the permit application. Coal mining operations have continued intermittently in the area until the present.

5.5 Paleontological Resources

During the 1980 field season geologic investigations were performed. At that time, the Blackhawk Formation (coal bearing unit) was examined and no animal fossil remains were found on the surface of the permit area. However, dinosaur footprints are known to occur in the Blackhawk Formation so it is possible they are present in the coal at the Blue Blaze No. 1 and 2 Mines. Plant fossil remains were found to be present in the exposed formations of the permit area. Among the plant fossil remains that were found or expected to occur are broadleaf Angiosperms genera with a scattering of palms, conifers, and ferns. The dominant conifer is the pine-like Araucaria. In the more landward areas, delta and coastal plain settings, it is the dominant conifer.

5.6 Future Cultural Resource Discoveries and Mitigation Efforts

If any previously unidentified cultural resources should be discovered during mining operations, Blue Blaze Coal Company will ensure that the site is not disturbed and will immediately notify the Division of Oil, Gas and Mining.

The current mine plan does not call for any actions resulting in impacts to the historic sites identified above. Also, subsidence resulting from the operation is not expected to impact the sites (See Section 3.4.8 for a discussion of subsidence). However, if the Blue Blaze Coal operation presents any additional significant impacts to those sites, Blue Blaze Coal will consider regtistering them on the National Register of Historic Places. (See Appendices 2)

5.7 Public Parks

A check of the National Register showed no public parks or facilities within or adjacent to the Blue Blaze No. 1 and 2 Mines. Therefore, none will be impacted by mining operations. (See Figure 5-1)

Figure 5-1

State of Utah

Division of State History
(Utah State Historical Society)
Department of Community and Economic Development
300 Rio Grande
Salt Lake City, Utah 84101-1182
801-533-5755
FAX: 801-364-6436

Norman H. Bangerter
Governor
Max J. Evans
Director

July 3, 1991

Pamela Grubaugh-Littig
Permit Supervisor
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: Permit Application Package, Blue Blaze Coal Company, Blue Blaze Mine, PRO/007/020, Folder #2, Carbon County, Utah

In Reply Please Refer to Case No. 90-0858

Dear Ms. Grubaugh-Littig:

The Utah State Historic Preservation Office has received the above referenced project. The one historic site has been reviewed and a determination was made that the one site would not be affected by the project. Our office has no additional comments on this project.

The above is provided on request as outlined by 36 CFR 800 or Utah Code, Title 63-18-37. The Utah SHPO makes no regulatory requirement in this matter. If you have questions or need additional assistance, please contact me at (801) 533-7039.

Sincerely,

James L. Dykman
Regulation Assistance Coordinator

JLD:90-0858 OR/NE

Board of State History: Thomas G. Alexander • Douglas D. Alder • Leonard J. Arrington • Marilyn Barker
Boyd A. Blackner • J. Eldon Dorman • Hugh C. Garner • Peter L. Goss • Dean L. May • Amy Allen Price • Jerry Wylie

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SECTION 6

GEOLOGY

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Section 6

GEOLOGY

6.0 Scope

This section includes the geologic information for the Blue Blaze No. 1 and No. 2 Mine areas in accordance with the requirements set forth in R645-301-600.

6.1 Methodology

Previously assembled geologic data obtained from Beaver Creek Coal Co. has been used as a basis for this section. The data from Beaver Creek Coal Co. included drill logs generated during their mining efforts. This section also includes information from more recent drilling and mining operations in the Blue Blaze No. 1 and No. 2 Mine areas. Information from recent geologic publications and in-house reports is also included to supplement the information obtained from Beaver Creek Coal Co.

6.2 Regional Geologic Framework

The Blue Blaze No. 1 and No. 2 Mines are located in the northern portion of the Wasatch Plateau (Figure 6-1). The Wasatch Plateau is the northwestern outlier of the eroded San Rafael Swell. The plateau dips westward producing a great monoclinal fold that is interrupted by faults in the borderlands of the Great Basin. Superimposed over the region are numerous structural features including anticlines, synclines, faults and igneous intrusions.

The Wasatch Plateau is comprised primarily of Cretaceous to Tertiary age sedimentary rocks. These rocks are principally siliciclastic of both continental and marine origin. Coal seams of economic significance occur in the Cretaceous sediment (Table 6-1).

The Upper Cretaceous Rocks of the Wasatch Plateau were deposited along the western margin of the Western Interior Basin. The dynamic depositional sequence of the Mesaverde Group is the result of deltaic sedimentation. During the Upper Cretaceous, the area now occupied by the Wasatch Plateau was a trough, gradually subsiding, attracting drainage and receiving terrigenous clastics from the tectonically active Sevier highlands. Wave-dominated delta complexes prograded easterly into this epicontinental sea. The Sevier orogenic belt was tectonically active during the entire Cretaceous Period. Near the end of the Cretaceous Period, rocks that were deposited in the marginal marine environments were deformed as the result of the Laramide Orogeny.

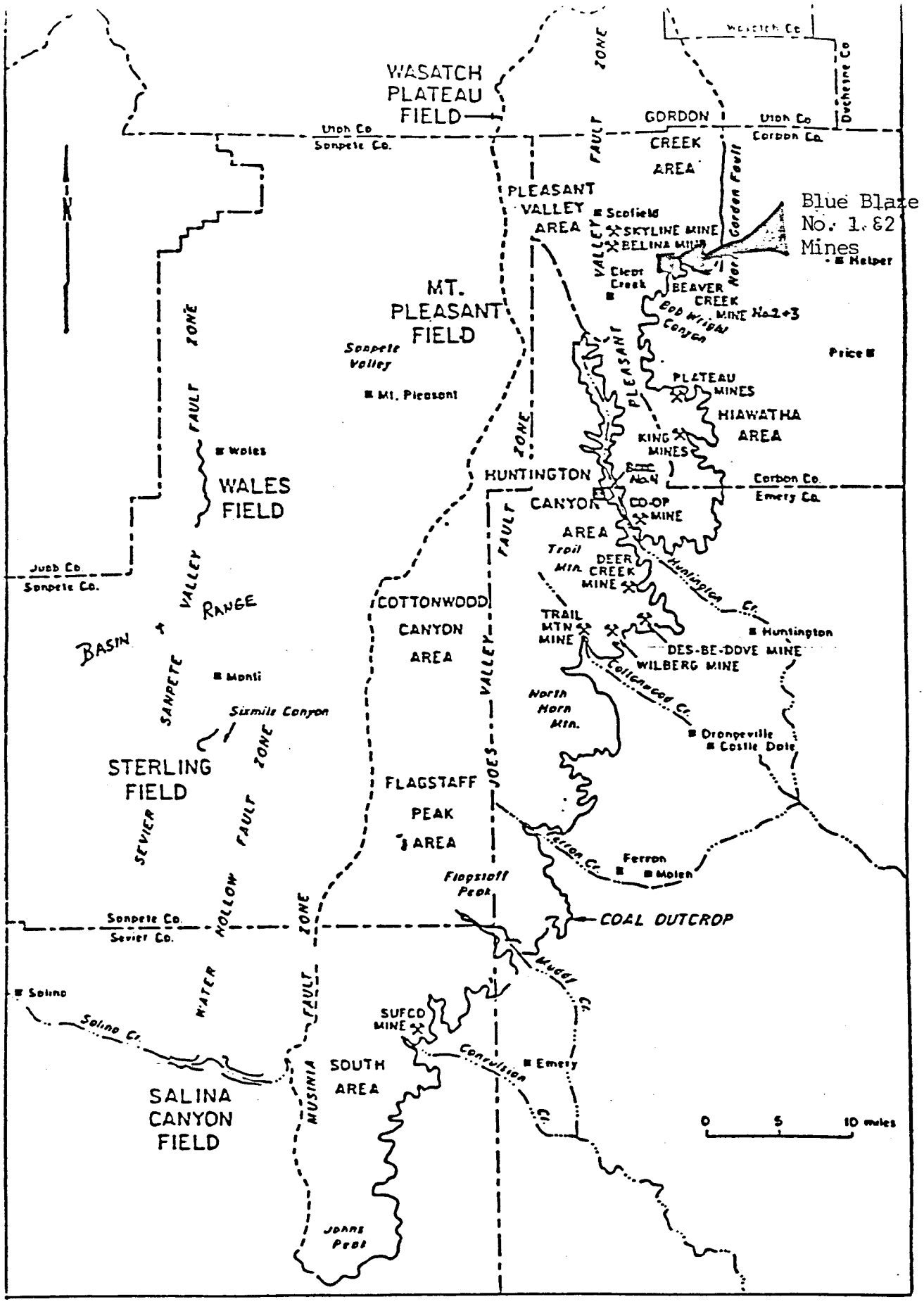

Figure 6-1. Location Map.

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Table 6-1
Centralized Stratigraphic Section
Northern Wasatch Plateau

SYSTEM	STRATIGRAPHIC UNIT		THICKNESS (feet)	DESCRIPTION
TERTIARY	WASATCH GROUP	North Horn Formation	500-2,500	Variegated shales with subordinate sandstone, conglomerate and freshwater limestone, slope former; sandstone and limestone units may supply limited quantities of groundwater.
CRETACEOUS	MESA VERDE GROUP	Price River Formation	600-1,000	Gray to white gritty sandstone interbedded with subordinate shale and conglomerate, ledge and slope former, little potential for groundwater
		Castlegate Sandstone	150-500	White to gray, coarse-grained often conglomeratic sandstone, cliff former, weathers to shades of brown, good aquifer material, groundwater not present if outcrops occur nearby.
		Blackhawk Formation (Major Coal Seams)	700-1,000	Yellow to gray, fine to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick coal seams; perched groundwater may occur in sandstone units.
		Star Point Sandstone	90-1,000	Yellow-gray massive cliff-forming sandstone, often in several tongues separated by Masuk Shale.
	MANCOS SHALE	Masuk Shale	300-1,300	Yellow to blue-gray sandy shale, slope former.
		Emery Sandstone (Coal)	50-800	Yellow-gray friable sandstone tongue cliff former. Coal present in subsurface; major regional aquifer.
		Blue Gate Member	1,500-2,400	Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into rolling hills and badlands.
		Ferron Sandstone Member (Major Coal Seams)	50-950	Alternating yellow-gray sandstone, sandy shale and gray shale with important coal beds of Emery coal field, resistant cliff former; major regional aquifer.
		Tununk Shale Member	400-650	Blue-gray to black sandy marine shale slope forming mudstone.

(Modified from Doelling, 1972)

6.3 Geology of Project Vicinity

6.3.1 Stratigraphy

The coal beds of interest lie within the Upper Cretaceous Mesaverde Group. This group is divided into four stratigraphic units and include in ascending order: The Star Point Sandstone, the Blackhawk Formation, the Castlegate Sandstone, and the Price River Formation. The minable seams are found in the lower 350 feet of the Blackhawk Formation. Plates 6-2 and 6-3 are geologic cross sections that illustrate the stratigraphic relationships of the Blackhawk and Star Point Formations and the mappable coal beds present in the Blue Blaze No. 1 and No. 2 Mine areas.

Star Point Sandstone

The Star Point Sandstone is the oldest stratigraphic unit exposed in the Blue Blaze No. 1 and 2 Mine lease areas. It is the basal unit of the Mesaverde Group and is approximately 440 feet thick. The formation contains the Panther, Storrs, and Spring Canyon Sandstone Members which consist of coarsening upward littoral sequences of white to light gray, fine to medium grained, tight, quartzose sandstone (Blanchard 1981). The Star Point Formation overlies and intertongues with the marine Mancos Shale. The Star Point is the lowest cliff-forming unit over most of the east side of the Wasatch Plateau.

Blackhawk Formation

The Blackhawk Formation measures approximately 900 feet thick in the Gordon Creek area and consists of interbedded fluvial and marine sandstone, siltstone, and shale. The Blackhawk Formation conformably overlies the Star Point Sandstone and the boundary between the two formations is sharp; the massive Spring Canyon Sandstone member of the Star Point Sandstone is overlain by an easily erodible, shaly sandstone.

A total of eight coal seams can be identified in the Gordon Creek region. Four of the eight seams are present in the mine area and outcrop on the walls of the North Fork of Gordon Creek Canyon, Coal Canyon, and Bryner Canyon. Weathering, burning and vegetation obscures the majority of coal outcrops of the Hiawatha, Gordon, Castlegate "A", and Bob Wright seams. Only the Hiawatha and Castlegate "A" seams have been economically mined in the Blue Blaze No. 1 and No. 2 Mine areas. The Hiawatha seam marks the base of the Blackhawk Formation. The Castlegate "A" seam overlies the Aberdeen Sandstone. The Aberdeen is a marine sandstone sequence that coarsens upward, and is similar in character to the Star Point Sandstone. The Aberdeen measures over 120 feet at Price Canyon (Sec. 12, T13S, R9E) and thins to the west. In the vicinity of the Blue Blaze No.1 and No.2 Mines and the National Mine (Sec. 17, T13S, R8E), the Aberdeen Sandstone is apparently discontinuous and not

easily recognizable on outcrop. The westward pinch-out of the Aberdeen Sandstone is illustrated on the west-east stratigraphic section between drill hole LMC-4 and the Arco measured section near the National Mine as illustrated on Plate 6-3.

In the Blue Blaze No. 1 & 2 lease area, the Blackhawk Formation is the principal surficial bedrock unit. The Blackhawk is disconformably overlain by the massive, coarse grained, fluvial Castlegate Sandstone.

Castlegate Sandstone

The Castlegate Sandstone is exposed in the central and northeastern portion of the lease block (Plate 6-1) The formations consists of a white to gray, coarse grained to conglomeratic fluvial sandstone. Exposures of the Castlegate Sandstone typically form cliffs to steep slopes. The Castlegate Sandstone is approximately 300 feet thick in the Gordon Creek area.

Price River Formation

The Price River Formation occurs in the northeastern portion of the lease block (Plate 6-1). The Price River is also a fluvial deposit and contains gray to white silty sandstones with interbedded subordinate shale and conglomerate. The formation typically forms ledges and slopes. The Price River formation ranges from 600 to 1,000 feet in thickness.

Unconsolidated Deposits

Unconsolidated deposits composed of silt and fine grained sand, alluvial sediments and talus debris occur along valley floors and at the base of steep slopes. The thickness of these sediments is variable. In the Blue Blaze No. 1 & 2 Mine areas, the thickest alluvial deposits occur along Beaver Creek. Based on field observations, the alluvial sediments appear to exceed 10 feet in thickness.

Igneous Dikes

Several igneous dikes have been reported in area mines including the Beaver Creek Coal Mines #2 and #3. The dikes are reported to be Miocene age and are a mica peridotite (Tingey, 1986). The dikes are typically associated with faults that bisect the area and trend east-west to northwest-southeast.

6.3.2 Structure

The area of the Blue Blaze No. 1 and 2 Mines is heavily faulted (Plate 6-1). Two major fault zones affect the lease block: the North Gordon and Fish Creek fault zones (Figure 6-2). The North Gordon fault zone measures three miles wide and five miles in length

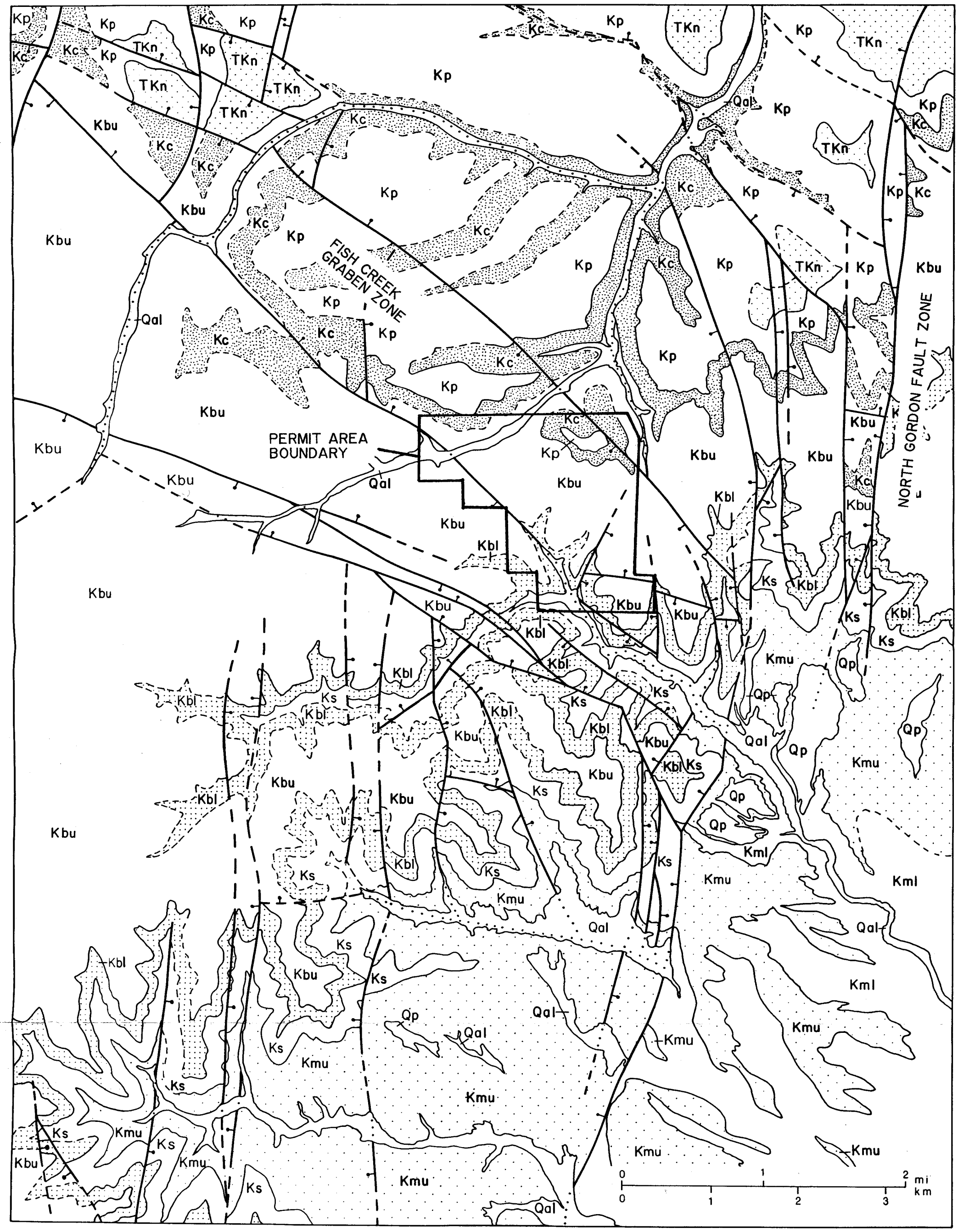

FIGURE 6-2. REGIONAL GEOLOGY MAP OF THE BLUE BLAZE NO. 1 & 2 MINE PERMIT AREA (HANSEN, 1988).

and is located east of the lease. The Fish Creek fault zone averages two miles wide and enters the lease from the northwest.

The Blue Blaze No. 1 & 2 Mine areas contain essentially two major fault trends. They are the N60 degree west trending faults (Range N50-75W) associated with the Fish Creek fault zone, and the N-S trending faults associated with the North Gordon fault zone. Sympathetic faulting also occurs within the mine area. Displacements of the faults in the mine area are variable ranging from a few feet to as much as 200 feet.

The faulting in the mine area appears to have influenced the development of stream courses. For example, the North Fork of Gordon Creek drainage appears to have formed subsequent or contemporaneously with the movement along the Gordon Creek Fault Zone (Plate 6-1).

Faulting may also effect the locations of springs and seeps in the mine area. The faulting and fracturing of the bedrock in the mine area may provide open conduits for surface water to enter into the subsurface or allow groundwater movement between aquifers. A series of springs at the head of the North Fork of Gordon Creek in the northwest corner of section 18 T13S R8E may be related to the faults bisecting the area. Immediately east of the Blue Blaze Mine area, groundwater associated with faulting was encountered in the Beaver Creek #3 mine. The effects of faulting on the groundwater system in mine area is discussed further in Section 7.1.2.

Another major structural feature which influences the lease is the Beaver Creek Syncline (Figure 6-3). The synclinal axis trends NE-SW and actually crosses the southern portion of the lease. The strata dip toward this axis at approximately 3.5 degrees.

The igneous dikes of the area generally trend parallel to the Fish Creek fault trend. The dikes range from 0.1 to 14.0 feet in thickness.

6.4 Geology of Coal Beds and Adjacent Strata

6.4.1 Exploration and Drilling

Numerous surface exploration and surface development holes have been drilled by various energy companies and government agencies in the area surrounding the Blue Blaze No. 1 and 2 Mine lease areas. Many of these drill holes were drilled under the direction of the Beaver Creek Coal Company during exploration and evaluation projects for their Gordon Creek mines. Four holes, LMC 1 - 4, were drilled within the lease boundaries under the direction of LMC Resources. The LMC drill hole geophysical logs were interpreted and lithologic logs were constructed by the Bureau of Land Management (BLM). The

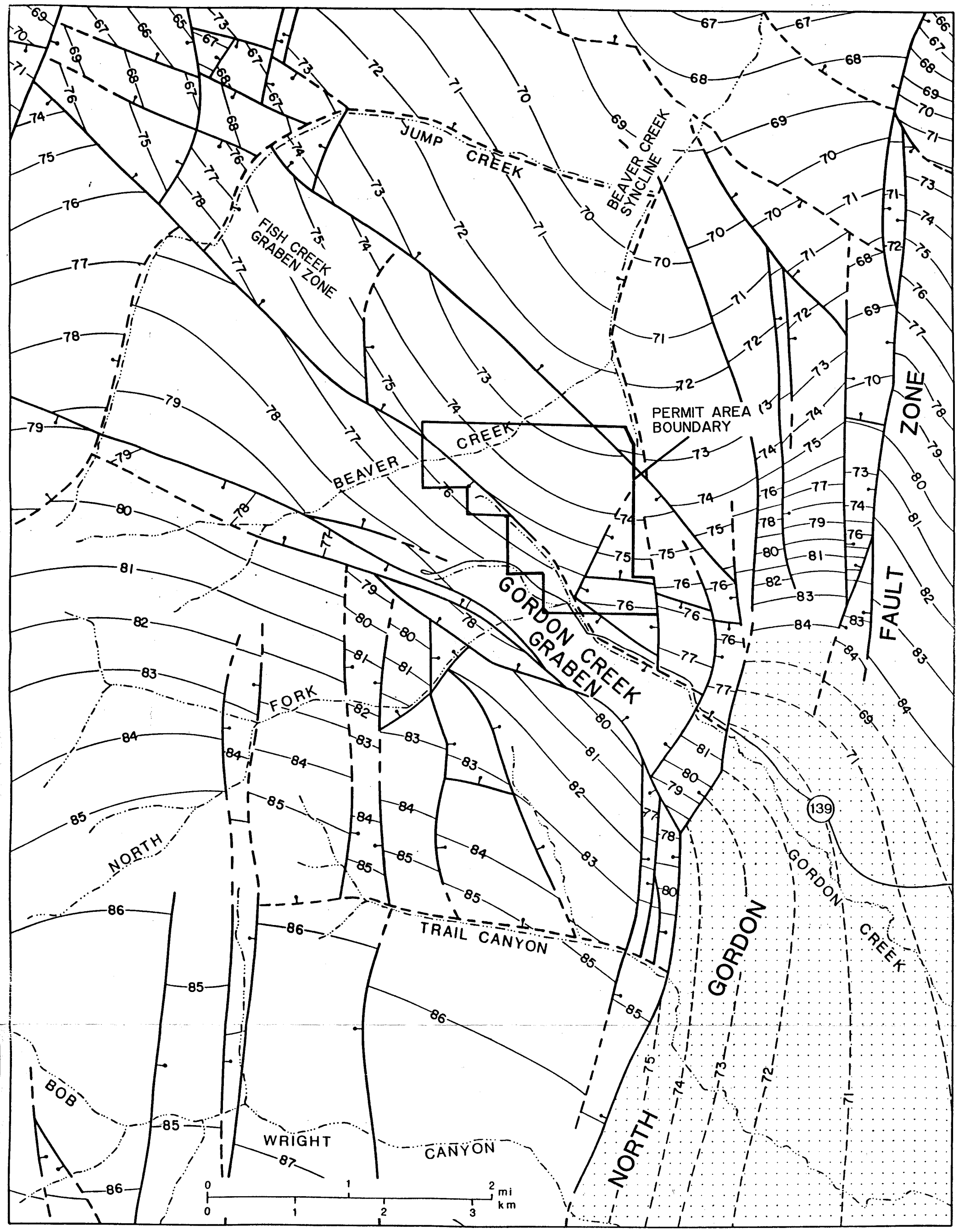

FIGURE 6-3. REGIONAL STRUCTURAL CONTOUR MAP.

DATUM IS TOP OF SPRING CANYON MEMBER OF STARPOINT FORMATION EXCEPT IN SHADED AREAS. IN SHADED AREAS, DATUM IS TOP OF EMERY SANDSTONE MEMBER OF MANCOS SHALE. (HANSEN, 1988).

location of LMC holes are shown on Plate 6-1. Table 6-2 provides the date and depth drilled, the measured depth (February 1992), depth to the top of the Castlegate and Hiawatha seams for the LMC drill holes. Copies of the LMC drill hole logs are included in Appendix 3.

A re-interpretation of the geophysical and lithologic log of LMC-2 was made by after discovering that the previous interpretation of the LMC-2 logs did not correlate with the lithologic interpretation of other drill holes in the area. Initially, the Castlegate "A" seam was identified at approximately 370 feet below ground surface (elevation 7880) and the Hiawatha seam at 518 feet below ground surface (elevation 7732). In drill hole LMC-3, which is located less than 2000 feet west of LMC-2, the same seams were identified at approximately 630 feet (elevation 7590) and 791 feet (elevation 7429) respectively. No faults have been mapped in the area that would offset the formations encountered in the two drill holes. Assuming the current interpretation by the BLM is not correct, a better stratigraphic and structural fit is achieved if the coal seam initially identified as the Hiawatha is re-interpreted as the Castlegate "A" seam and the overlying coal seams initially identified as the Castlegate "A" are reclassified as local coal beds. Personnel at the Salt Lake Office of the BLM were contacted and questioned about the accuracy of their interpretation of the LMC boreholes. The BLM personnel feel that many of the interpretations of the logs are suspect and they are in the process of re-interpreting the logs.

A north to south geologic cross-section and an east to west geologic cross-section were generated from the logs of several of the drill holes advanced under the direction of Beaver Creek Coal Company, LMC, and the U.S.G.S. The cross sections are shown on Plates 6-2 and 6-3 respectively. The locations of the drill holes from which the logs were used to construct the cross sections are shown on an index map included on the plates. The cross sections provide a graphic illustration of the stratigraphic and structural relationships of the coal seams in the lease area.

6.4.1.1 Casing and Sealing

Drill holes LMC 1 and 2 will be plugged and abandoned following State approved methods. New holes will be drilled adjacent to the current LMC 1 and 2 locations and completed as monitoring wells within the uppermost saturated zone beneath the Hiawatha seam to better predict the potential of inflow into the mine. Drill Holes LMC 3 and 4 will be improved at the surface and used as monitoring wells. An additional monitoring well will be installed within the

TABLE 6-2

DRILL HOLE EVALUATION

Hole ID	Date Drilled	Depth Drilled	Measured Depth (February 1992)	Depth to Top of Castlegate	Depth to Top of Hiawatha
LMC-1	Sep 1976	900 ft	599 ft	793 ft	Unknown*
LMC-2	Oct 1976	568 ft	None	518 ft	Unknown*
LMC-3	Nov 1976	836 ft	664 ft	630 ft	791 ft
LMC-4	Jan 1980	430 ft	217 ft	105.2 ft	215.3 ft

* Drilling completed before reaching the Hiawatha seam.

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Blue Blaze No. 2 mine (Castlegate "A" seam). This well will also be completed at least 30 feet into the uppermost saturated zone beneath the Hiawatha seam.

When no longer needed for monitoring or other use approved by the UDOGM and upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well, each well or boring will be capped, sealed, backfilled, or otherwise properly managed, as required by UDOGM. Permanent closure measures will be designed to prevent access to the borings or monitoring wells by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering the groundwater system.

6.4.2 Stratigraphy - Coal Seams

The commercial coal beds on the tract occur in the Blackhawk Formation. Only the Castlegate "A" and Hiawatha Seams are minable.

6.4.2.1 Hiawatha Seam

The Hiawatha Seam is the lowest stratigraphic coal in the Blue Blaze Coal Mine lease. It directly overlies the Star Point Sandstone and is the most laterally persistent seam in the area. It can be correlated with the Kinney or Upper O'Connor seams mined in the Pleasant Valley area in the western part of the plateau (Plate 6-3). The Hiawatha seam ranges in thickness from 6.0 to 11.0 feet, averaging 7.0 feet within the lease block. A thin rider seam overlies the Hiawatha in the southwestern part of the lease. Plate 6-4 is an isopach of the Hiawatha seam.

The floor rock of the Hiawatha seam ranges from the competent littoral Spring Canyon of the Star Point Sandstone to fluvial overbank shales and siltstone and channel sandstones.

6.4.2.2 Gordon Coal Zone

The Gordon seam is stratigraphically located about 80 feet above the Hiawatha. It is very lenticular and generally less than 5.0 feet in thickness with multiple splits. It is not economically mineable in the Gordon Creek area. The roof and floor consist essentially of shale and because of this, the outcrop is often covered by slump and soil.

6.4.2.3 Castlegate "A" Seam

The Castlegate "A" seam is stratigraphically located 150 to 230 feet above the Hiawatha seam. The seam ranges 4.0 to 14.0 feet in thickness. The average thickness in this area is 8.3 feet. Plate 6-5 is an isopach map of the thickness of the Castlegate "A" seam. The Castlegate "A" seam nearly pinches out and becomes unmineable in areas near the southwestern lease boundary.

The floor of this seam appears to vary from a carbonaceous silty shale to a fine grained fluvial sandstone. Water production from this floor strata has not been observed in other mining operations in the area.

The roof consists essentially of overbank carbonaceous silty shales (approximately 80%). In the northeastern part of the lease a persistent rider seam is present. The remainder of the mine roof consists of fluvial channel sandstones. The frequency of channeling increases to the west. Local scouring of the seam occurs in some of the channels. The general channel trend is NE-SW and range 100 to 500 feet in width. During mining, some channels may initially produce water which will, more than likely, dry within weeks. However, if sustained flows are encountered during mining operations, the water will be managed as described in Section 7.

Poor top conditions generally are located adjacent to channel margins due to differential compaction of the adjacent shale units. This is indicated by the abundance of slickenside features in the shale.

6.4.2.4 Bob Wright Seam

The Bob Wright seam lies about 120 feet above the Castlegate "A" seam. It is very lenticular and contains abundant partings. It does not achieve minable thickness (4.0 ft.) within the Gordon Creek area. However, the seam does thicken above 4.0 feet southwest of the lease. Within the Blue Blaze No. 1 and 2 Mine leases, the seam contains a shale roof and floor. Locally, sandstone occurs in the roof.

6.4.3 Oil and Gas Wells

No oil and gas exploration or production wells are located in the permit area.

6.4.4 Detailed Cross Sections

Plates 6-2 and 6-3 are geologic cross sections which show the general stratigraphic relations through the Blue Blaze No. 1 and No. 2 Mine areas. The stratigraphic relationships of the Castlegate "A" and Hiawatha seams are illustrated in these sections. Tables 6-3 and 6-4 list the borings and their locations used to construct the cross sections.

6.4.5 Coal Reserves

Summarized below are the reserve calculations of the minable in-place, run-of mine recoverable coal for the Blue Blaze No. 1 & 2 mines.

TABLE 6-3
CROSS SECTION BORING LOCATIONS
NORTH-SOUTH CROSS SECTION

Boring	Location (BY SECTION)	Location (BY U.S. CADASTRAL SYSTEM)
BCCC MC-2-2	T13S R8E SW NE sec. 18	(D-13-8) 18ac
ARCO (1980) GC-8	T13S R8E NW SW sec. 8	(D-13-8) 8cb
Blue Blaze Coal Co. Consumers (1927) DH-3	T13S R8E NW NE sec. 8	(D-13-8) 8ab
USGS (1976) W-BC-4-S	T13S R8E NE NE sec. 8	(D-13-8) 8aa
ARCO (1980) GC-7	T13S R8E SE SE sec. 5	(D-13-8) 5dd
ARCO (1980) GC-6	T13S R8E NE SE sec. 6	(D-13-8) 6da
USGS (1976) W-BC-5-S	T12S R8E SW SW sec. 32	(D-12-8) 32cc

TABLE 6-4
CROSS SECTION BORING/MEASURED SECTION LOCATIONS
EAST-WEST CROSS SECTION

Boring/Measured Section	Location (BY SECTION)	Location (BY U.S. CADASTRAL SYSTEM)
ARCO Measured Section No. 3 & No. 6 Mines at Portals	T13S R8E NE SW sec. 16	(D-13-8) 18ac
Beaver Creek Coal Co. Mine Core MC-3-1	T13S R8E NW SW sec. 16	(D-13-8) 8cb
Beaver Creek Coal Co. No. 3 Mine Workings MW-3-2 (1976)	T13S R8E SW SW sec. 16	(D-13-8) 8ab
LMC Resources (1976) C & W Coal Co. Submittal LMC-4	T13S R8E SW NE sec. 17	(D-13-8) 8aa
ARCO (1980) Measured Section Near National Mine	T13S R8E SE SW sec. 17	(D-13-8) 5dd
Beaver Creek Coal Co. (1976) Certified Point OC-2-1	T13S R8E SE SE sec. 18	(D-13-8) 6da
Beaver Creek Coal Co. (1976) No. 2 Mine Core MC-2-2	T12S R8E SW NE sec. 18	(D-12-8) 32cc
Beaver Creek Coal Co. (1976) Certified Point OC-2-2	T13S R8E SE SW sec. 18	(D-13-8) 18cd
USGS (1976) W-BC-3-S	T13S R7E SE SW sec. 12	(D-13-7) 12cd
ARCO (1980) GC-3	T13S R7E NW SW sec. 13	(D-13-7) 13cb
ARCO Measured Section N. Fork Gordon Creek	T13S R7E NE NE sec. 23	(D-13-7) 23aa
Arco (1980) GC-2A	T13S R7E SW SE sec. 15	(D-13-7) 15dc
USGS (1980) UGC-3	T13S R7E SE SE sec. 16	(D-13-7) 16dd
USGS (1980) UGC-5	T13S R7E NE NE sec. 16	(D-13-7) 16aa

RESERVE SUMMARY - BLUE BLAZE No. 1 and No. 2 MINES

Seam	Minable In-Place	Run-of-Mine Recoverable
Castlegate "A"	3.00 MMT	1.50 MMT
Hiawatha	6.30 MMT	3.15 MMT
Total	9.30 MMT	4.65 MMT

6.4.6 Coal Quality and Characteristics

Summarized below is the coal quality of the Castlegate "A" and the Hiawatha coal seams. The analysis was performed on core samples from drill hole LMC-4. Supporting laboratory data sheets are provided in Appendix 3B.

Seam	Moisture %	Ash %	Sulfur %	BTU	Volatile Matter	Fixed Carbon
Castlegate "A"	6.52	18.54	0.61	10,189	36.26	38.68
Hiawatha	5.38	7.63	0.47	12,488	42.51	44.48

Summarized below are the sulfur forms found in the Castlegate "A" and Hiawatha coal seams. Samples were obtained from drill hole LMC-4. Supporting laboratory data sheets are provided in Appendix 3B.

Seam	Pyrite Sulfur + Marcasite %	Pyrite %	Marcasite %
Castlegate "A"	.04	.039	.001
Hiawatha	.04	.038	.002

6.4.7 Adjacent Units (Overburden and Underburden)

6.4.7.1 Rock Characteristics, Acid-toxic, Pyrite, Clay and Alkalinity

Table 6-5 lists the analytical results of test performed for pH and pyritic sulfur for samples obtained from LMC-4 three feet above and below the coal seams. Also listed in Table 6-5 are the analytical results of tests performed for the principal minerals, conductivity, and pH of a sample taken immediately below the Castlegate "A"

TABLE 6-5

ANALYSIS OF OVERBURDEN 3 FEET ABOVE THE COAL SEAMS TO THE COAL SEAM

Seam	Acidity, pH			Pyritic Sulfur
Castlegate "A"	1:1	1:5	1:20	0.04
	8.03	8.92	9.19	
Hiawatha	1.1	1:5	1:20	0.24
	7.12	8.00	8.54	

ANALYSIS OF UNDERBURDEN FROM COAL SEAM TO 3 FEET BELOW THE SEAMS

Seam	Acidity, pH			Pyritic Sulfur
Castlegate "A"	1:1	1:5	1:20	0.02
	5.05	5.72	6.62	
Hiawatha	1:1	1:5	1:20	0.05
	8.09	8.69	9.22	

COMPLETE ANALYSIS OF SAMPLE TAKEN
IMMEDIATELY BELOW THE CASTLEGATE "A" SEAM

Minerals	Results (ppm)
Arsenic Total	2.400
Barium	16.000
Boron	20.000
Cadmium Total	.320
Calcium	99.800.00
Carbonate CO_3 mg/l	<.01
Chloride	970.80
Chromium Total	7.930
Conductivity umhos/cm	280
Copper	14.500
Fluoride	9.320
Iron Total	10,700.000
Lead Total	16.000
Magnesium	3,650.00
Manganese Total	235.000
Mercury	<.0002
Molybdenum	.599
Nickel Total	16.770
Nitrate NO_3-N	2.284.10
Potassium	1,600.000
Selenium Total	<.001
Sodium	700.000
pH Units	7.90

seam in LMC-4. An underburden sample taken from three feet below the Castlegate "A" seam was analyzed for its clay content from LMC-4. The results of the analysis indicate the clay content is 16.5 percent. The samples indicate that no inherent toxic material should be generated as a result of mining the seams. Supporting laboratory data sheets are included in Appendix 3B.

To monitor conditions of the overburden and underburden, samples will be taken at 2,000 ft intervals throughout the mine and will be tested according to the Divisions requirements.

6.4.7.2 Roof and Floor Properties

As discussed in section 6.4.2, the roof and floor rock of the Castlegate "A" and Hiawatha seams varies from shale to competent sandstone. Information obtained from the LMC drill holes and selected drill holes from the Beaver Creek Coal Company permit application for their mines in the area have been utilized to determine roof and floor conditions that can be anticipated while mining the Castlegate "A" and Hiawatha seams. The location of the of the Beaver Creek drill holes are included on Plate 7-2 of section 7. Logs of the wells used to determine the properties of the roof and floor rock are included in Appendix 3A.

The logs of drill hole LMC-3 and LMC-4 indicate the floor rock of the Hiawatha consists of five feet of carbonaceous silty shale and silty sandstone overlying the massive sandstone of the Spring Canyon Member of the Star Point Formation. No cores were obtained from LMC-3 and LMC-4 to determine the geotechnical properties of roof or floor rock. However, uniaxial strength tests were performed by Beaver Creek Coal Company on samples of shales and sandstones obtained from drill holes GCD-4, 7, and 10. These drill holes are located approximately one mile west-southwest of the Blue Blaze mine portals. The results of the tests are provided in Table 6-6.

The logs from drill hole LMC 1 indicate the roof of the uppermost split of the Castlegate "A" seam is approximately 35 feet of sandstone. The floor of the seam consists of four feet of shale overlying approximately 30 feet of sandstone. In LMC-2, the upper split roof rock consists of 42 feet of carbonaceous shale and the floor consists of 38 feet of shaly silty sandstone. In LMC-3, the upper split roof rock consists of 4.5 feet of shale overlain by 19 feet of silty sandstone and the floor rock consists of four feet of shale overlying 8.5 feet of sandstone. In LMC-4, the roof rock consists of 15 feet of sandstone and the floor rock is five feet of siltstone overlying 26 feet of sandstone. Information from Beaver Creek Coal Company GCD-4 indicates that the roof rock of the Castlegate"A" seam in the area of the drill hole consists of sandstones interbedded with shales and the floor consists of shale. The results of uniaxial strength tests for samples obtained from the roof and floor rock of the Castlegate "A" seam in drill hole GCD-4 is provided in Table 6-6.

TABLE 6-6
Uniaxial Strength Test Results
Beaver Creek Coal Company
Drill Holes GCD-10, 4, and 7

Sample I.D.	Depth Interval (feet)	Diameter (inches)	Length (inches)	Description	Compressive Strength (psi)	Young's Module (psi x 10^6)
GCD-10	80.0 - 85.0	1.85	3.86	Shale	14327	1.0994
GCD-10	76.2 - 76.8	1.85	3.74	Shaly sandstone	8448	2.9047
GCD-10	20.0 - 20.5	1.86	3.64	Shaly sandstone	16874	2.4769
GCD-10	29.7 - 30.2	1.86	3.75	Shaly sandstone	N/A	5.0169
GCD-10	35.8 - 36.9	1.85	3.75	Shaly sandstone	15977	2.0718
GCD-10A	26.4 - 27.6	1.85	3.67	Shale	7772	1.1189
GCD-10B	26.4 - 27.6	1.85	3.71	Shale	16601	1.753
GCD-4	364.0 - 366.0	2.87	5.20	Roof rock, sandstone interbedded w/shale	9130	1.1977
GCD-4	366.0 - 368.0	2.58	4.73	Roof rock, sandstone interbedded w/shale	5860	1.0791
GCD-4	369.0 - 370.0	2.41	4.91	Roof rock, sandstone interbedded w/shale	10606	1.9149
GCD-4	381.0 - 382.0	2.40	4.93	Floor rock, shale	10616	1.7017
GCD-7	122.0 - 122.5	1.85	3.80	Sandstone interbedded w/shale	11257	1.6076
GCD-7	124.4 - 125.1	1.85	3.74	Sandstone interbedded w/shale	7795	1.2610

6.5 Geologic Effects of Mining

6.5.1 Mining Hazards

The types of mining hazards which have been encountered at other mines in the immediate area and within the Wasatch Plateau are anticipated to be encountered while mining in the Blue Blaze Mines. Roof conditions vary from excellent to poor depending upon the type of rock overlying the coal. Methane has never been detected in the mine workings in this area. The maximum thickness of overburden is not excessive: therefore, explosive rock bursts and "rib rolls" are not expected to occur.

6.5.2 Surface Hazards

Rockfalls occur naturally, but can be more frequent with activities associated with mining such as increased men, machinery, noise, and bulk movement of soil using tractors and mining equipment. This is a relatively minor problem and nothing of any more concern is expected to occur.

6.5.3 Impacts of Mining

There will be no geologic effects other than the possible disturbance of the ground water and surface subsidence. These potential problems have been discussed in Sections 7.0 and 3.4.8.

6.5.4 Subsidence

Subsidence of the sediments overlying the mining area will be monitored. A detailed description of the subsidence monitoring plan, including a map illustrating the location of monitoring stations, is presented in Section 3.5.8.

6.6 Post Mining Reclamation

Reclamation of the mine site following completion of the mining operations as required by state regulations R645-301 and R645-302 will be accomplished. The reclamation plan is discussed in detail in Section 3.5 of this permit application.

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6.7 References

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