area are presented on Map 3, Coal Ownership and Cultural Resource Survey Areas.

(j) EACH PUBLIC OR PRIVATE CEMETERY OR INDIAN BURIAL GROUND LOCATED IN OR WITHIN 100 FEET OF THE PROPOSED PERMIT AREA;

RESPONSE:

There are no private cemeteries or Indian burial grounds identified within the permit area.

(k) ANY LAND WITHIN THE PROPOSED MINE PLAN AREA AND ADJACENT AREA WHICH IS WITHIN THE BOUNDARIES OF ANY UNITS OF THE NATIONAL SYSTEM OF TRAILS OR THE WILD AND SCENIC RIVERS SYSTEM, INCLUDING STUDY RIVERS DESIGNATED UNDER SECTION 5(A) OF THE WILD AND SCENIC RIVERS ACT; AND

RESPONSE:

There are no areas within the permit boundary which are units of the national system of trails or the wild and scenic rivers system, including study rivers designated under Section 5(A) of the Wild and Scenic Rivers Act.

(l) OTHER RELEVANT INFORMATION REQUIRED BY THE DIVISION.

RESPONSE:

All other relevant information presented in this permit renewal application is contained on the various maps and figures included in the plan.

UMC 783.25 CROSS-SECTIONS, MAPS, AND PLANS

THE APPLICATION SHALL INCLUDE CROSS-SECTIONS, MAPS, AND PLANS SHOWING-

(a) ELEVATIONS AND LOCATIONS OF TEST BORINGS AND CORE SAMPLINGS;

RESPONSE:

Elevations and locations of test borings and core samplings are presented on maps as referenced in response to UMC 783.14.

(b) ELEVATIONS AND LOCATIONS OF MONITORING STATIONS USED TO GATHER DATA ON WATER QUALITY AND QUANTITY, FISH AND WILDLIFE, AND AIR QUALITY, IF REQUIRED, IN PREPARATION OF THE APPLICATION.

RESPONSE:

Appropriate elevations and locations of monitoring stations used to gather data on water quality and quantity, and fish and wildlife are presented on Maps 31 and 37, Ground and Surface Water Monitoring Stations and Wildlife Land Use Map, respectively.

*(c) NATURE, DEPTH, AND THICKNESS OF THE COAL SEAMS TO BE MINED, ANY COAL OR RIDER SEAMS ABOVE THE SEAM TO BE MINED, EACH STRATUM OF THE OVERBURDEN, AND THE STRATUM IMMEDIATELY BELOW THE LOWEST COAL SEAM TO BE MINED;

(d) ALL COAL CROP LINES AND THE STRIKE AND DIP OF THE COAL TO BE MINED WITHIN THE PROPOSED MINE PLAN AREA;

RESPONSE:

Nature, depth, and thickness of the coal seams to be mined, any coal or rider seams above the seam to be mined, each stratum of the overburden, and the stratum immediately below the lowest coal seam to be mined; and, all coal crop lines and the strike and dip of the coal to be mined within the proposed mine plan area is presented on maps as referenced in response to UMC 783.14.

(e) LOCATION AND EXTENT OF KNOWN WORKINGS OF ACTIVE, INACTIVE, OR ABANDONED UNDERGROUND MINES, INCLUDING MINE OPENINGS TO THE SURFACE WITHIN THE PROPOSED MINE PLAN AND ADJACENT AREAS;

RESPONSE:

Location and extent of known workings of active, inactive, or abandoned underground mines, including mine openings to the surface within the proposed mine plan and adjacent areas are presented on Maps 1 and 4 through 6, Pre-Law Mining activity (3 sheets), and Hiawatha, Third and Wattis Seams Mine Plan.

(f) LOCATION AND EXTENT OF SUB-SURFACE WATER, IF ENCOUNTERED, WITHIN THE PROPOSED MINE PLAN OR ADJACENT AREAS, INCLUDING, BUT NOT LIMITED TO AREAL AND VERTICAL DISTRIBUTION OF AQUIFERS, AND PORTRAYAL OF SEASONAL DIFFERENCES OF HEAD IN DIFFERENT AQUIFERS ON CROSS-SECTIONS AND CONTOUR MAPS;

(g) LOCATION OF SURFACE WATER BODIES SUCH AS STREAMS, LAKES, PONDS, SPRINGS, CONSTRUCTED OR NATURAL DRAINS, AND IRRIGATION DITCHES WITHIN THE PROPOSED MINE PLAN AND ADJACENT AREAS;

RESPONSE:

Elevations and locations of surface and ground water monitoring stations are shown on Map 31, Ground and Surface Water Monitoring Stations. A description of aquifers and ground water within and adjacent to the mine plan area is presented in Section 783.15. As stated earlier, no significant lakes or ponds exist within, or in the immediate vicinity of the mine plan area. Some ditches and channels have, however, been constructed as a result of the mine runoff conveyance plan.

*(h) LOCATION AND EXTENT OF EXISTING OR PREVIOUSLY SURFACE-MINED AREAS WITHIN THE PROPOSED MINE PLAN AREA;

RESPONSE:

There are no previously or proposed surface-mined areas within the permit area.

*(i) LOCATION AND DIMENSIONS OF EXISTING AREAS OF SPOIL, WASTE, COAL DEVELOPMENT WASTE, AND NON-COAL DEVELOPMENT WASTE, AND NON-COAL WASTE DISPOSAL, DAMS, EMBANKMENTS, OTHER IMPOUNDMENTS, AND WATER TREATMENT AND AIR POLLUTION CONTROL FACILITIES WITHIN THE PROPOSED PERMIT AREA;

RESPONSE:

Location and dimensions of existing areas of spoil, waste, coal development waste, and non-coal development waste, and non-coal waste disposal, dams, embankments, other impoundments, and water treatment and air pollution control facilities within the permit area are presented on Map 44, Surface Facilities (4 sheets).

(j) LOCATION, AND DEPTH IF AVAILABLE, OF GAS AND OIL WELLS WITHIN THE PROPOSED PERMIT AREA AND WATER WELLS IN THE MINE PLAN AREA AND ADJACENT AREAS;

RESPONSE:

There are no oil and gas wells within the permit area. Water well locations are presented on Map 30, Groundwater Rights.

(k) SUFFICIENT SLOPE MEASUREMENTS TO ADEQUATELY REPRESENT THE EXISTING LAND SURFACE CONFIGURATION OF THE AREA AFFECTED BY SURFACE OPERATIONS AND FACILITIES, MEASURED AND RECORDED ACCORDING TO THE FOLLOWING:

(1) EACH MEASUREMENT SHALL CONSIST OF AN ANGLE OF INCLINATION ALONG THE PREVAILING SLOPE EXTENDING 100 LINEAR FEET ABOVE AND BELOW OR BEYOND THE COAL OUTCROP OR THE AREA TO BE DISTURBED OR, WHERE THIS IS IMPRACTICAL AT LOCATIONS SPECIFIED BY THE DIVISION.

(2) WHERE THE AREA HAS BEEN PREVIOUSLY MINED, THE MEASUREMENTS SHALL EXTEND AT LEAST 100 FEET BEYOND THE LIMITS OF MINING DISTURBANCES, OR ANY OTHER DISTANCE DETERMINED BY THE DIVISION TO BE REPRESENTATIVE OF THE PREMINING CONFIGURATION OF THE LAND.

(3) SLOPE MEASUREMENTS SHALL TAKE INTO ACCOUNT NATURAL VARIATIONS IN SLOPE, TO PROVIDE ACCURATE REPRESENTATION OF THE RANGE OF NATURAL SLOPES AND REFLECT GEOMORPHIC DIFFERENCES OF THE AREA TO BE DISTURBED.

RESPONSE:

Sufficient slope measurements have been made and adequately presented on appropriate maps and figures of this permit revision application.

RESPONSE:

Location and dimensions of existing areas of spoil, waste, coal development waste, and non-coal development waste, and non-coal waste disposal, dams, embankments, other impoundments, and water treatment and air pollution control facilities within the permit area are presented on Map 44, Surface Facilities (4 sheets).

(j) LOCATION, AND DEPTH IF AVAILABLE, OF GAS AND OIL WELLS WITHIN THE PROPOSED PERMIT AREA AND WATER WELLS IN THE MINE PLAN AREA AND ADJACENT AREAS;

RESPONSE:

There are no oil and gas wells within the permit area. Water well locations are presented on Map 30, Groundwater Rights.

(k) SUFFICIENT SLOPE MEASUREMENTS TO ADEQUATELY REPRESENT THE EXISTING LAND SURFACE CONFIGURATION OF THE AREA AFFECTED BY SURFACE OPERATIONS AND FACILITIES, MEASURED AND RECORDED ACCORDING TO THE FOLLOWING:

(1) EACH MEASUREMENT SHALL CONSIST OF AN ANGLE OF INCLINATION ALONG THE PREVAILING SLOPE EXTENDING 100 LINEAR FEET ABOVE AND BELOW OR BEYOND THE COAL OUTCROP OR THE AREA TO BE DISTURBED OR, WHERE THIS IS IMPRACTICAL AT LOCATIONS SPECIFIED BY THE DIVISION.

(2) WHERE THE AREA HAS BEEN PREVIOUSLY MINED, THE MEASUREMENTS SHALL EXTEND AT LEAST 100 FEET BEYOND THE LIMITS OF MINING DISTURBANCES, OR ANY OTHER DISTANCE DETERMINED BY THE DIVISION TO BE REPRESENTATIVE OF THE PREMINING CONFIGURATION OF THE LAND.

(3) SLOPE MEASUREMENTS SHALL TAKE INTO ACCOUNT NATURAL VARIATIONS IN SLOPE, TO PROVIDE ACCURATE REPRESENTATION OF THE RANGE OF NATURAL SLOPES AND REFLECT GEOMORPHIC DIFFERENCES OF THE AREA TO BE DISTURBED.

RESPONSE:

Sufficient slope measurements have been made and adequately presented on appropriate maps and figures of this permit application.

(1) MAPS, PLANS AND CROSS SECTIONS INCLUDED IN A PERMIT APPLICATION AND REQUIRED BY THIS SECTION SHALL BE PREPARED BY, OR UNDER THE DIRECTION OF AND CERTIFIED BY A QUALIFIED REGISTERED PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST, WITH ASSISTANCE FROM EXPERTS IN RELATED FIELDS SUCH AS LAND SURVEYING AND LANDSCAPE ARCHITECTURE AND SHALL BE UPDATED AS REQUIRED BY THE DIVISION.

RESPONSE:

All maps, plans and cross sections have been prepared under the direction of and certified by registered professional engineers.

UMC 783.27 PRIME FARMLAND INVESTIGATION

(a) THE APPLICANT SHALL CONDUCT A PRE-APPLICATION INVESTIGATION OF THE AREA PROPOSED TO BE AFFECTED BY SURFACE OPERATIONS OR FACILITIES TO DETERMINE WHETHER LANDS WITHIN THE AREA MAY BE PRIME FARMLAND.

(b) LAND SHALL NOT BE CONSIDERED PRIME FARMLAND WHERE THE APPLICANT CAN DEMONSTRATE ONE OF MORE OF THE FOLLOWING:

(1) THE LAND HAS NOT BEEN HISTORICALLY USED AS CROPLAND;

(2) THE SLOPE OF THE LAND IS 10 PERCENT OR GREATER;

(3) THE LAND IS NOT IRRIGATED OR NATURALLY SUBIRRIGATED, HAS NO DEVELOPED WATER SUPPLY THAT IS DEPENDABLE AND OF ADEQUATE QUALITY, AND THE AVERAGE ANNUAL PRECIPITATION IS 14 INCHES OR LESS;

(4) OTHER FACTORS EXIST, SUCH AS A VERY ROCKY SURFACE, OR THE LAND IS FREQUENTLY FLOODED DURING THE GROWING SEASON MORE OFTEN THAN ONCE IN 2 YEARS AND THE FLOODING HAS REDUCED CROP YIELDS; OR

(5) ON THE BASIS OF A SOIL SURVEY OF THE LANDS WITHIN THE MINE PLAN AREA THERE ARE NO SOIL MAP UNITS THAT HAVE BEEN DESIGNATED PRIME FARMLAND BY THE U.S. SOIL CONSERVATION SERVICE.

RESPONSE:

An investigation of the permit area has determined that the lands within the area are not prime farmland for the following reasons:

- There is no evidence to indicate that any croplands existed within or adjacent to the permit area.
- Slopes within the permit area range from 5 to 65 degrees.
- The land has no irrigated or subirrigated areas; average annual precipitation at the nearest monitoring station (Hiawatha) is 13.18 inches.
- Permit area consists of terrain ranging from steep ledged escarpments to stratified layers of friable sandstone and soft silt and clay shales.
- There are no soil map units that have designated land within the mine plan area as prime farmland by the SCS.
- There is no water available for irrigation in the permit area.
- Exhibit 20, Prime Farmland Determination Correspondence, includes two letters from the SCS giving negative determinations on prime farmland. The July 7, 1981 letter covers the permit area as it existed in 1981. The Jan. 31, 1983 letter covers the Corner Canyon Fan Breakouts.

The only disturbed area added to the permit has been the Unit Train Loadout Area. Only one additional soil type was affected which was not already included within the previous permit boundary. This soil type is the Badlands type. It is classified by SCS as geologic material derived from weathered Mancos shale and sandstone without agricultural qualities. The portion of this soils type affected by the Unit Train Loadout varies in slope from 20% to 60%, therefore, no potential prime farmland exists in this area.

(c) IF THE INVESTIGATION ESTABLISHES THAT THE LANDS ARE NOT PRIME FARMLAND, THE APPLICANT SHALL SUBMIT WITH THE PERMIT APPICATION A REQUEST FOR A NEGATIVE DETERMINATION WHICH SHOWS THAT THE LAND FOR WHICH THE NEGATIVE DETERMINATION IS SOUGHT MEETS ONE OR MORE OF THE CRITERIA IN PARAGRAPH (B) OF THIS SECTION.

(d) IF THE INVESTIGATION INDICATED THAT LANDS WITHIN THE PROPOSED AREA TO BE AFFECTED BY SURFACE OPERATIONS AND FACILITIES MAY BE PRIME FARMLANDS, THE APPLICANT SHALL CONTACT THE U.S. SOIL CONSERVATION SERVICE TO DETERMINE IF THESE LANDS HAVE A SOIL SURVEY AND WHETHER THE APPLICABLE SOIL MAP UNITS HAVE BEEN DESIGNATED PRIME FARMLANDS. IF NO SUCH SOIL SURVEY HAS BEEN MADE FOR THESE LANDS, THE APPLICANT SHALL CAUSE SUCH A SURVEY TO BE MADE.

(1) WHEN A SOIL SURVEY AS REQUIRED IN PARAGRAPH (D) OF THIS SECTION CONTAINS SOIL MAP UNITS WHICH HAVE BEEN DESIGNATED AS PRIME FARMLANDS, THE APPLICANT SHALL SUBMIT APPLICATION, IN ACCORDANCE WITH UMC 785.17 FOR SUCH DESIGNATED LAND.

(2) WHEN A SOIL SURVEY AS REQUIRED IN PARAGRAPH (D) OF THIS SECTION CONTAINS SOIL MAP UNITS WHICH HAVE NOT BEEN DESIGNATED, AFTER REVIEW BY THE U.S. SOIL CONSERVATION SERVICE, AS PRIME FARMLAND, THE APPLICANT SHALL SUBMIT A REQUEST FOR NEGATIVE DETERMINATION FOR NON-DESIGNATED LAND WITH THE PERMIT APPLICATION ESTABLISHING COMPLIANCE WITH PARAGRAPH (B) OF THIS SECTION.

RESPONSE:

Based on the above information, it is requested that the DOGM makes a negative determination regarding the existence of prime farmland within the mine plan area.

It is assumed since PMC has an approved permit that the DOGM has made a negative determination previously, although no formal documentation can be found in PMC's files.

PART UMC 784 - UNDERGROUND COAL MINING PERMIT APPLICATIONS - REQUIREMENTS FOR RECLAMATION AND OPERATION PLAN

UMC 784.1 SCOPE

THIS PART PROVIDES THE REQUIREMENTS FOR THE MINING OPERATIONS AND RECLAMATION PLANS PORTIONS OF APPLICATIONS FOR PERMITS FOR UNDERGROUND COAL MINING ACTIVITIES, EXCEPT TO THE EXTENT THAT DIFFERENT REQUIREMENTS FOR THOSE PLANS ARE ESTABLISHED UNDER UMC 785.

UMC 784.2 OBJECTIVES

THE OBJECTIVES OF THIS PART ARE TO ENSURE THAT THE DIVISION IS PROVIDED WITH COMPREHENSIVE AND RELIABLE INFORMATION ON PROPOSED UNDERGROUND COAL MINING ACTIVITIES, AND TO ENSURE THAT THOSE ACTIVITIES ARE ALLOWED TO BE CONDUCTED ONLY IN COMPLIANCE WITH THE ACT, THIS CHAPTER AND THE REGULATORY PROGRAM.

UMC 784.4 RESPONSIBILITIES

(a) IT IS THE RESPONSIBILITY OF THE APPLICANT TO PROVIDE TO THE DIVISION ALL OF THE INFORMATION REQUIRED BY THIS PART, EXCEPT WHERE SPECIFICALLY EXEMPTED IN THIS PART.

(b) IT IS THE RESPONSIBILITY OF STATE AND FEDERAL GOVERNMENTAL AGENCIES TO PROVIDE INFORMATION TO THE DIVISION WHERE SPECIFICALLY REQUIRED IN THIS PART.

UMC 784.11 OPERATION PLAN: GENERAL REQUIREMENTS

EACH APPLICATION SHALL CONTAIN A DESCRIPTION OF THE MINING OPERATIONS PROPOSED TO BE CONDUCTED DURING THE LIFE OF THE MINE WITHIN THE PROPOSED MINE PLAN AREA, INCLUDING, AT A MINIMUM, THE FOLLOWING:

(a) A NARRATIVE DESCRIPTION OF THE TYPE AND METHOD OF COAL MINING PROCEDURES AND PROPOSED ENGINEERING TECHNIQUES, ANTICIPATED ANNUAL AND TOTAL PRODUCTION OF COAL, BY TONNAGE, AND THE MAJOR EQUIPMENT TO BE USED FOR ALL ASPECTS OF THOSE OPERATIONS; AND

RESPONSE:

Active mining at the Star Point No. 1 Mine has ceased and reclamation has begun. The Star Point No. 2 Mine is an underground mine which utilizes room and pillar and longwall methods to extract coal. PMC strives to maximize recovery of the coal resource while producing an economic product. PMC anticipates approximately 2 million tons of coal to be produced annually from the Star Point Mines. This figure will fluctuate yearly depending upon market conditions. Full production will continue at least through 2010.

Surface Openings

The existing Star Point Mines Mining and Reclamation Plan indicates that three active portal areas exist on the property. Two of these portal sets, Star Point No. 1 and second South Wattis portals, were to be sealed in 3 to 4 years from the initial application. These two portal sets have been sealed and are presently in the reclamation phase. Revegetation success for these areas is discussed in responses to UMC 784.13. The remaining active portals for men and material transport and coal transport are located on the upper operations deck, the Lion Deck. Personnel access to all areas of the mine is from these portals. All coal production is currently from the Star Point No. 2 Mine at the Lion Deck.

The drift openings from the Lion Deck extend westward through the Wattis Seam workings of the Lion Coal Company approximately 4,600 feet to two interior rock slopes which ramp down to the Third Seam mine workings. An interior ventilation shaft also connects the two seams at this point.

At the bottom of the slopes in the Middle Seam a fork occurs in the main entries. The northerly fork extends to the Mudwater area (Federal Lease U-37045), an active area of room and pillar mining. Also on this northerly fork is the Mudwater Fan Deck, a ventilation breakout, at the head of Mudwater Canyon. The westerly fork is Main West. Main West is a major travelway in the Middle Seam to access the coal reserves in Federal Coal Lease SL-031286 and the planned expansions to the south and west.

Three separate mineable seams occur in Federal Coal Lease SL-031286. Plans are to mine the Wattis Seam, Middle Seam, and Hiawatha Seam in this area. Slopes and ventilation raises connect Main West to these three seams in this area. The Wattis Seam is currently being mined with longwall methods in this lease. The Third Seam will also be mined with the longwall method. The Hiawatha Seam will be extracted by continuous miners with room and pillar methods.

In the Wattis Seam at the top of the slopes in Lease SL-031286, 1st Main South was developed approximately 5,000 feet to the intersection with 2nd West Mains. The 2nd West Mains extend approximately 4,300 feet to the eastern boundary fault of the "Bear Canyon Graben". Planned development from this point will involve rock tunnels across the Bear Canyon Graben to Federal Coal Lease U-13097. Upon encountering the coal, main entry development will begin with a 5-entry set to the west for approximately 4,000 feet. A 5-entry set will also be driven approximately 10,000 feet to the south. The area blocked by these areas will be developed for coal extraction with longwall methods. It may be necessary to develop a vertical shaft in the vicinity of SE 1/4 to Section 14 in lease U-13097 to allow extraction of the coal reserves within this lease.

Access to the Wattis Seam in Section 18 will be from 1st Main South in Lease SL-031286 with a set of submains driven easterly and turned to the north and south. Development of mining panels will continue easterly from these submains.

Access to the Third Seam in Section 18 will be from Main West in Lease U-37045 with a set of submains driven to the south. Development of mining panels will continue easterly from these submains.

The Graben Crossing will consist of two or three tunnels as shown on Map 45, Graben Crossing Plan, with crosscuts on 500 foot centers. The tunnels will be approximately 9 to 14 feet high by 16 to 18 feet wide as shown on Map 46, Graben Crossing Tunnels. The tunnels will cross through solid rock to access coal reserves in Lease U-13097 on the west side of the Bear Canyon Graben. Roof support will vary with conditions in the tunnels: consisting of steel supports or other methods as deemed necessary at the time. Groundwater inflow, if encountered, will be prevented by pressure grouting fractured areas as shown on Map 46, Graben Crossing Tunnels, and as discussed in response to UMC 784.14.

The Corner Canyon fan breakout is accessed from the Wattis Seam in Lease SL-031286. This breakout was created to facilitate proper mine ventilation.

Mining Method

PMC utilizes the standard methods of mining to extract coal from the three coal seams occurring on our property. PMC uses room and pillar, longwall, and continuous miner development methods to extract coal. These methods have been used throughout the western United States to successfully extract coal when mining conditions were similar.

Room and Pillar Mining

Room and pillar mining refers to the extraction of rooms (mine openings) and pillars using a continuous mining machine. Rooms are mined on development and the pillars are extracted on retreat. This mining method has been the backbone of the U.S. coal industry and owes its popularity to its relatively low cost and flexibility. This method easily adapts to changes in the geological and physical conditions of the mine. Continuous miners may be used to recover remnant coal in old mine works.

Continuous miners can negotiate tectonically disturbed areas of the mine and adapt to seam variations and uneven reserve blocks. The continuous miner section equipment can easily be transported to different locations within the mine and total production is only proportionately affected by stoppages of any one unit.

The productivity of a continuous miner unit in room and pillar extraction is less than longwall mining under most conditions and thus more expensive in operation cost per ton. The overall coal recovery seldom exceeds 55 to 60 percent due to the necessity to leave barriers and remnant pillars.

Longwall Mining

Longwall mining has gained great acceptance and is increasing in popularity in the U.S., primarily because of its inherent advantages for high productivity, low operating cost, high reserve recovery, controlled subsidence, and good safety record. Longwall mining derived its name from the several hundred foot long face from which coal is cut. Longwall panels are huge, solid blocks of coal laid out several thousands of feet long by several hundreds of feet wide. Extraction is by a powerful cutting machine with large drums that rips slices of coal from the block. All activities occur under a canopy of hydraulic steel supports. The roof supports are placed in a straight line with skin-to-skin contact separating the work area from the caved material near the longwall face. The cutting step is followed by advance of the steel supports in a continuous cycle of operation. Longwall mining achieves upward of 75 percent recovery because the entire seam is extracted in major blocks. PMC has used the longwall method of mining coal successfully for the past 3 years. PMC anticipates continued use of the longwall method to insure maximum resource recovery.

Engineering Techniques

PMC is using and will continue to use good engineering judgment in designing mine layouts, pillar sizing, entry widths and heights, and surface facilities. Various engineering disciplines are represented at PMC. When a particular engineering discipline is not available within our ranks, outside firms may be contracted to provide assistance.

Production

The annual amount of production is dictated by market demand and as such, is subject to yearly adjustments and fluctuation. The Star Point No. 2 Mine has a nominal annual coal capacity of 2 million tons. Raw coal is prepared for market, yielding saleable product tonnage less than the amount of raw coal produced. Production capacity can be increased with a little difficulty; however, increased capacity over 2-1/2 million tons per year is not anticipated prior to acquisition of additional coal reserves. Table 66, Planned Production Schedule, shows the current estimated annual production tonnages for the life of the existing operation and reserves.

Major Equipment

PMC will continue to use standard mining methods and equipment commonly used in the Western U.S. coal industry.

The longwall section contains the following representative list of equipment:

Shield Roof Supports
Armored Face Conveyor
Shearer
Stage Loader
Electrics
Hydraulic System
Miscellaneous Pumps and Tools

A typical continuous miner section contains the following equipment:

Continuous Miner
Haulage Cars
Roof Bolter
Feeder Breaker
Electrics
Mantrip Vehicle
LHD Scoop
Parts Car
Rock Duster
Miscellaneous Pumps and Tools

The following types of utility and support equipment will be utilized in and about the PMC operation:

Electrical Distribution System
Conveyor Systems
Rock Dust Distribution System
Personnel First Aid and Safety Equipment
Supply Tractors and Trailers
Personnel Carriers
Lubrication Trailers
Air Compressor
Welder
Shield Roof Support Carriers
Generator
Fork Lift
Front End Loaders
Dozers
Motor Graders
Crushers
Trucks

(b) A NARRATIVE EXPLAINING THE CONSTRUCTION, MODIFICATION, USE, MAINTENANCE, AND REMOVAL OF THE FOLLOWING FACILITIES (UNLESS RETENTION OF SUCH FACILITY IS NECESSARY FOR POSTMINING LAND USE AS SPECIFIED IN SECTION UMC 817.133)-

(1) DAMS, EMBANKMENTS, AND OTHER IMPOUNDMENTS;

RESPONSE:

Numerous sediment ponds, treatment facilities and sediment traps have been constructed, and are in use at the present time. These facilities will continue to be used to treat runoff water throughout the life of the mine. Upon final reclamation and at the end of the post mining liability period, the facilities will be removed and the areas reclaimed. Sediment pond designs and additional information is contained in response to UMC 784.16. Dams, embankments and other impoundments are inspected on a regular basis and maintained to operate as designed. Sediment ponds 4, 5 and 6 have been modified since initial construction as discussed in response to UMC 784.16. Pictures of the Treatment Facility and Sediment ponds can be seen in Exhibit 15, Mine Structure Photographs.

(2) OVERBURDEN AND TOPSOIL HANDLING AND STORAGE AREAS AND STRUCTURES;

RESPONSE:

Topsoil storage areas will be reclaimed after all topsoil has been removed. Pictures of the topsoil piles and refuse pile can be seen in Exhibit 15, Mine Structure Photographs.

(3) COAL REMOVAL, HAULING, STORAGE, CLEANING AND TRANSPORTATION AREAS AND STRUCTURES;

RESPONSE:

Coal handling facilities have been designed for the most efficient movement of materials. These designs are presented in Exhibit 21, Coal Handling Facilities, and pictures of these structures can be seen in Exhibit 15, Mine Structure Photographs.

A 55 foot diameter, 200 feet deep cylindrical hole just outside of the portal feeds coal from the mine to a 42 inch x 800 foot long underground belt conveyor that discharges onto a 4,400 foot long, 42 inch overland belt to the raw coal stockpile in the vicinity of the washing plant. This overland conveyor, which has a carrying capacity of 1000 ton per hour (limited by the feeders), is covered to protect it and the coal from wind and the elements.

At the lower operations area, sufficient space is provided for direct storage of 15,000 tons of raw coal where the overland conveyor discharges through a stacking tube. A 42 inch belt conveyor 1,400 feet long carries coal from this stockpile to the 350 ton per hour jig and cyclone washing plant. Refuse from the cleaning plant (approximately 20% of feed) is trucked to a large disposal area.

New facilities constructed in 1983-1986 begin with a new screening building located to the north of the existing preparation plant. This building houses chutework to direct the coal either to the crushing and screening building or to the preparation plant. The cleaned and sized coal then goes to a new crushing and screening building which will contain a new secondary crusher. Clean coal will take one to two paths through this building:

1. It will be bypassed, via flop gate and chute, to a 40,000 ton conical stockpile formed by stacking tube; or,

2. It will pass over the screens where the stoker size (1¼ x ¼) will be removed and sent to a 5,000 ton stockpile via chute and radial stacking conveyor.

Run-of-mine coal may also report to the crushing and screening building where it is sized with the new secondary crusher. After sizing, the raw coal goes to a 40,000 ton conical stockpile formed by a stacking tube.

Both the clean coal and the run-of-mine coal stockpiles will be formed by concrete stacking tubes which are equipped with bin activators at the bottom. The bin activators will be used to periodically empty the tubes to prevent spontaneous combustion of the coal within the tube. A common reclaim tunnel will serve both stockpiles to allow for the blending of run-of-mine and clean coal prior to shipment. To assist reclaim, four variable rate vibrating feeders have been installed beneath each pile; these feeders will discharge into the reclaim conveyor.

The stockpile reclaim conveyor delivers coal to a sampling and transfer tower. The conveyor runs south of and parallel to the mine access road and is equipped with a self-cleaning magnet at the head pulley. A belt plow has been installed on this conveyor just after it crosses the mine access road. The belt plow will give PMC emergency stockpiling capability in the event more than 55,000 tons of stockpiled product coal is required. When actuated, it will "plow" the coal off of the stockpile reclaim conveyor and onto a radial stacking conveyor which will form an emergency stockpile.

Reclaim from this stockpile will be accomplished with mobile equipment pushing to a feed hopper; the hopper will discharge onto a short reclaim conveyor to the main stockpile reclaim conveyor.

The sample and transfer tower is an enclosed building which will be insulated and heated. It houses an electrical equipment room, a control room, and a two stage sampling system.

After being sampled, the coal is carried by conveyor to a transfer point and then into the silo. The chutework at the top of the silo is designed so that a flop gate can divert the coal onto a future conveyor that will feed into a second silo that may be constructed at a later date. The silo measures approximately 70 feet in diameter and 210 feet in height and has a capacity of 10,500 tons. A small penthouse is atop the silo enclosing the conveyor drive and discharge chutework.

The silo includes a batch weigh loadout system that is capable of loading a 10,000 ton unit train in three hours. Coal is loaded into 100 ton, cars via a telescoping chute from the batch weigh bin.

Silo Access Road

The silo access road is an existing maintenance road owned by Utah Railway Company; it will be used by PMC under license from the Utah Railway Company. The road is a single lane 15 feet wide and approximately 3,700 feet long, having a finished surface of 6" to 12" of gravel and a uniform grade of 0.75%. It commences at the intersection of the Utah Railway mainline and the existing county road and parallels the loading spur to the silo.

Transfer Tower Access Road

A transfer tower road commences at the silo, crosses both railroad tracks, and terminates at the transfer tower. The road is a single lane

15 feet wide and approximately 1,000 feet long, having a finished surface of 6" of gravel and a maximum sustained grade of 7.4%.

Transfer Tower

A transfer tower, located between the sample transfer tower building and the storage silo, is an uncovered structural frame 16' square by 11' high, supported on spread footing foundations and having a 6" slab on grade. Stairs are provided for access to the grating platform around the discharge chute. The discharge area will be enclosed to prevent dust from escaping to the atmosphere.

Storage Silo

The storage silo is a slip-formed concrete structure 70' I.D. by 210' high supported on a concrete mat foundation. At the base of the silo are openings for the entry and exiting of the unit trains. Structural steel framework will support the load cells, the weigh bin, and the loadout control room.

Stacking Tube

The stacking tubes are 100' high concrete structures having an inside diameter of 12 feet. They support the discharge ends of the stockpile feed conveyors as well as a 12' x 16' structural steel access platform with steel grating decks.

Reclaim Tunnel

The reclaim tunnel is a tube of reinforced concrete which encloses portions of the stockpile reclaim conveyor. The metal portions consist of 10' diameter CMP; the concrete portions, located beneath the stacking tubes and at the vibrating feeders, are approximately 11' wide, 13' high, and various lengths. A 4' diameter CMP escape tunnel provides a secondary means of exit from the reclaim tunnel.

Sample and Transfer Building

This building is a custom designed four-story structure using hot rolled structural shapes. The main building is approximately 30' long x 22' wide having approximate eaves heights of 48' on the low end and 52' on the upper end.

Silo Penthouse

The silo penthouse, located on top of the storage silo, is roughly 20' wide x 26' long with a 22' minimum eaves height. The upper level of this two-story structure is enclosed with uninsulated corrugated steel roofing and siding; enclosed chutework penetrates the lower level and into the silo. A set of stairs provides access to the upper grating level.

Conveyor Support System

A truss and bent support system of hot roller structural steel shapes will be provided for the conveyors when the relative distance between the conveyor and ground requires it. The trussed system will consist of two parallel open web vertical trusses structurally laced in the top and bottom chord horizontal planes. The trussed system will be supported on steel bents having a laced A-frame construction. Each leg of the bent will be anchored to a reinforced concrete foundation.

Wash Plant Modification

The project design allows for a fine coal cleaning circuit to be added, at a later date, to the exiting preparation plant. This new circuit would recover an additional 7% of the coal that is sent through the preparation plant. The circuit would be housed in a 4 to 5 story building located adjacent to the existing preparation plant.

Crushing and Screening Building

The crushing and screening building is a custom designed, four story structure using hot rolled structural shapes and corrugated galvanized steel for siding and roofing. It will measure 45' x 25' x approximately 60' high.

Raw Coal Screening Building

The raw coal screening building is a custom-designed, four story structure using hot rolled structural shapes and corrugated steel for siding and roofing. It will measure roughly 21' x 56' x 70' high and will be located adjacent to the existing preparation plant.

If the fine coal cleaning circuit is added later, this building would house a wet screening system (screens, slurry pumps, slurry holding tanks, etc.). In the meantime, however, it will house chutework that will direct the run-of-mine coal either to the preparation plant or to the crushing and screening building.

Clean Coal and Raw Coal Stockpiles

The clean coal and raw coal stockpiles are formed by circular concrete stacking tubes and will be reclaimed by variable rate vibrating feeders in a common reclaim tunnel. There will be four feeders beneath each pile and they will discharge onto a single reclaim conveyor. This will give PMC the capability of shipping all raw coal or all clean coal or a blend of the two.

Stoker Coal Stockpile

Stoker coal will be conveyed from the crushing and screening building to a stockpile located near the existing tipple. A radial stacking conveyor capable of being raised and lowered will be utilized to form the pile. The conveyor will be 36" wide and about 100' long. Reclaim from the pile will be by front-end loader.

Emergency Stockpile

The project design allows for the emergency stockpiling of coal in the event that all other stockpiles are full. This is accomplished with the addition, to the west of the sample and transfer building, of a "belt plow" on the stockpile reclaim conveyor. When activated, the plow pushes the coal off of the main conveyor and onto a 42" x 150' radial stacking conveyor which forms the pile. Reclaim from the emergency stockpile is with mobile equipment pushing to a buried hopper which discharges onto a 48" x 150' reclaim conveyor which, in turn, discharges back onto the main conveyor. Both the hopper and the 48" conveyor are currently in use.

Refuse Bin and Conveyor

A new refuse bin has been constructed on the south side of the mine access road south of the existing preparation plant; a new refuse conveyor has also been constructed connecting the new bin with the existing preparation plant. The refuse bin has a capacity of 100 tons and is heat taped to prevent icing in the winter; the conveyor is 36" wide and approximately 235' long.

Water Storage Tank

A new 15,000 gallon steel tank was buried near the existing 250,000 gallon storage reservoir. This storage tank will ensure an uninterrupted supply of water for the dust suppression systems.

Laboratory

A new coal laboratory has been constructed in the lower bathhouse building. This new lab houses all of the equipment necessary to perform contractual quality analyses on samples of shipments from PMC.

Control Room

The new facilities, except for actual rail car loading operations, are controlled through a programmable logic controller and monitor which is housed in a new control room. This control room is of cinder block or metal construction, is located adjacent to the existing preparation plant, and measures 15' x 30' x 12' high. The loading operation will be controlled through a programmable logic controller located in a control room beneath the silo.

MCC Building

Another building, of cinder block construction, has been constructed near the stacking tubes to house the motor control centers for the equipment in the reclaim tunnel. This building measures 8' x 16' x 10' high.

Substation and Power Distribution

PMC's existing power distribution system has been upgraded to handle the new facilities. The 1500 KVA transformer, from the abandoned Star Point

No. 1 Mine, has been refurbished and relocated into the existing substation.

Maintenance of these facilities consists of:

1. Periodic watering of gravel and dirt roads for dust suppression.
2. Periodic grading of gravel and dirt roads to eliminate mudholes and maintain drainage.
3. Removal of coal or processing waste from paved roads to prevent particulate matter escape.
4. Routine inspection of all facilities to insure operation as intended.
5. Routine inspection of coal stockpiles for fires and removal of hot spots.

(4) SPOIL, COAL PROCESSING WASTE, MINE DEVELOPMENT WASTE, AND NON-COAL WASTE REMOVAL, HANDLING, STORAGE, TRANSPORTATION, AND DISPOSAL AREAS AND STRUCTURES;

RESPONSE:

The refuse pile for the PMC preparation plant is located south and east of the plant site. Currently the waste pile is in Phase II as described in Exhibit 33, Star Point Mines Refuse Pile Evaluations, Operation and Monitoring Plan. This plan contains a detailed operation and maintenance plan and other required information. The following operation, monitoring and maintenance plans incorporate the recommendations of the two consultants involved in the preparation of Exhibit 33, Vaughn Hansen Associates and Chen and Associates. A previous study, Exhibit 22, Coal Processing Waste Pile Expansion Plan and Feasibility Study prepared by Vaughn Hansen Associates, incorporated data from Dames and Moore and Rollins, Brown and Gunnel. Exhibit 22 is to be retained in the PAP for background information.

Operation Plan

1. Prior to placing refuse material, topsoil and subsoil will be removed according to discussions in response to UMC 784.13(b)(4), Topsoil Removal Plan in the PAP.

2. Freshly dumped refuse material will be allowed to drain prior to spreading and compaction; the amount of time required for draining depends on coarseness, moisture content and weather conditions.
3. The refuse is spread in lifts not exceeding 2 feet.
4. Compaction will achieve the 90% of the maximum dry density requirement suggested by Dames and Moore and Chen and Associates.
5. Maximum depth of the pile will be 150 feet unless future investigation of particle crushing indicates depths greater than 150 feet are allowable, refer to Dames and Moore report in Exhibit 22.
6. Side slopes are constructed in Phases II and III at a maximum of 2 horizontal to 1 vertical.
7. The pile is graded to prevent major ponding or impounding of water.
8. Piezometers to monitor water level in the pile are maintained at 4 locations.
9. Drainage around and on the pile is established to reduce erosion of the pile.

Monitoring Plan

1. Compaction of the refuse is measured after each five foot of vertical rise.
2. Piezometers are monitored every two months.
3. Side slopes are measured concurrently with compaction testing.
4. Visual monitoring is conducted quarterly for evidence of structural weakness, ponding or impounded water and general appearance.

Inspections will be conducted by a qualified Registered Engineer or other person approved by the Division. PMC may utilize qualified persons with certification as Impoundment Inspectors through the M.S.H.A. to conduct these inspections.

Maintenance Plan

Maintenance of the refuse pile conforms with the design recommendations outlined in Exhibit 33, Star Point Mines Refuse Pile Evaluation, Operation and Monitoring Plan.

1. Side slopes are maintained at 2 horizontal to 1 vertical.
2. Water is not allowed to pond or impound to any significant depth or extent.
3. Peizometers are maintained.
4. Drainage patterns are maintained.

When the coal processing waste pile is full or no longer needed, it will be reclaimed as discussed in response to ICR UMC 784.13 by covering with a suitable material, and revegetating the area with the approved seed mixture. The exact method of waste pile reclamation is currently under study by PMC. A series of test plots were constructed to determine vegetation success with differing soil material at various depths. While the study is still incomplete, preliminary results indicate a 10 inch soil or subsoil covering of the refuse pile is the advised seedbed for reclamation of the refuse piles. Final results of the soil revegetation study will be incorporated into the reclamation plan for the refuse disposal area. Available topsoil and subsoil exists to reclaim the refuse pile with a covering of 17 inches.

Since Star Point Mine No. 2 is an underground mine, no soil is generated in the mining of coal. Waste rock generated from miscellaneous underground projects such as the Graben Crossing is either backfilled in old mine workings or is transported to the surface mixed with coal, washed out of the coal at the preparation plant and deposited in the coal refuse pile, or is transported separately to the refuse pile.

Mine development waste is deposited on the refuse pile with coal waste from the coal cleaning plant as discussed in response to UMC 784.19. Non-coal waste is collected in a central collection area and periodically removed to the Carbon County Landfill.

Spoil disposal areas as shown on map 44, sheets E12 and E13, Surface Facilities labeled as number 74, (Table 67) are used to store overburden material from various sources, including, sloughage from road cuts, high-walls and miscellaneous surface clean up projects. This material

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is stored for indefinite periods and is used for various projects such as, rip rap for ditches and erosion protection, and fill material for reclamation or road maintenance.

The spoil disposal area drainages can be seen on Map 42, Surface Water and Sedimentation Control Facilities Map A. Sediment loss from the disposal areas will be controlled by constructing berms around the piles to contain runoff.

The spoil disposal areas are located on existing roads and will require no special reclamation efforts. The areas will be reclaimed at the time the roads are reclaimed as discussed in response to UMC 784.13.

A 12 inch (min.) high earthen berm will be maintained around spoil disposal areas to minimize erosion.

(5) MINE FACILITIES; AND

RESPONSE:

Coal handling facilities have been discussed under responses to UMC 784.11(b)(3). The remaining facilities can be described as ancillary to the actual mining of coal. Surface facilities are located on two different areas of the mine; the upper or Lion Deck and the lower operations area. Photographs of these facilities are presented in Exhibit 15, Mine Structure Photographs, and the locations seen on Map 44, Surface Facilities (4 sheets).

Coal Processing Waste Pile

Coal processing waste (refuse) is transported from the refuse bin to the waste pile in the lower operations area. The waste pile is being constructed in 3 phases and will eventually cover 65 acres and be a maximum of 150 feet deep. Refuse is spread in 2 foot lifts or less and compacted to achieve stability. Drainage from the pile is passed through sediment ponds.

Equipment Storage Buildings

Two single story cinder block buildings are used to store equipment and parts in the lower operations area. Another concrete and rock single story building next to the lower operations bathhouse is also used to store equipment.

Surface Operations Office

The lower operations office is a single story cinder block building with a mobile office trailer attached.

Coal Preparation Plant

Coal is washed to remove rock and waste materials in a structural steel 3 story building. An 80 foot diameter, 13 foot deep thickener tank sits beside the preparation plant to settle out fines from the plant process water.

Watchmans House

Security people are housed in a mobile home sitting on a cinder block foundation near the lower operations office building.

Snowplow Garage

A single story brick building houses the mine snow plow.

Substations

Three substations serve the mining operation; one in the lower operations area, one at the Lion Deck, and one which is no longer operational at the No. 1 Mine portal area. The substations consist of on grade concrete pads, steel supports, transformers and poles surrounded by chain link fence.

Lower Shop

The lower operations shop is a 2 story structural steel building housing maintenance machinery.

Lower Operations Warehouse

A concrete poured in place, two story building attached to the shop houses the lower operations warehouse.

Mine Access Road

The access road to the mine is approximately 21 feet wide and the grade ranges from 3% to 10%. Metal guard rails are placed on the outside edge to prevent vehicles from going over the steep side.

All other roads on the permit area are dirt and gravel and range in grade from 0% to 17%.

Fuel Storage and Dispensing

Numerous fuel storage tanks are used to store diesel fuel and gasoline. Three underground diesel and two underground gasoline tanks are used for surface equipment. Two underground diesel tanks are located at the Corner Canyon Fan for the emergency diesel motor. Two used oil tanks are located at the mine shop.

There are five above ground portable fuel tanks: four at the mine and one at the lower operations area.

Powerlines

Numerous powerlines serve all areas of the mine.

Stoker Coal Bin

A small employee stoker coal bin made of structural steel sits at the lower operations area.

Mine Ventilation Fans

Mine ventilation fans are located at the No. 2 Portal, Mudwater Canyon and Corner Canyon, constructed of structural steel and cinder block.

Mine Bathhouse/Office

The mine is served by a precast double T concrete 2 story building housing the main offices and miners bathhouse.

Mine Warehouse Office

The mine warehouse office is a mobil office trailer with a snow roof added, which is connected to a cinder block entranceway to the underground warehouse constructed in old mine workings near the outcrop.

Oil Shed

Motor oil and hydraulic fluid for the mining machinery is stored in a cinder block shed near the mine warehouse.

Rock Dust Bin

Rock dust for mine fire suppression is stored in bulk in a bin at the Lion Deck from which it is pumped by pipe underground for use.

Gravel Bin

A reinforced concrete pad and backstop are used to store washed gravel for use on roadways inside the mine.

Non-Coal Waste Bin

A reinforced concrete pad with wing walls is used to temporarily store non-coal waste at the Lion Deck Area until the waste is taken to the County landfill.

Explosives Magazines

Two steel boxes are used to store explosives; one for powder and one for caps. The boxes are located on the road between the Lion Deck and the No. 1 Mine Portal Area.

Mine Shop

The mine shop is a precast double T concrete, two story building located at the Lion Deck.

Buildings will be maintained throughout the life of the mine. All buildings will be removed during final reclamation.

(6) WATER POLLUTION CONTROL FACILITIES.

RESPONSE:

Seven sedimentation ponds and one treatment facility have been constructed in conjunction with the PMC runoff control plan and serve as on site water pollution control facilities. These structures have been designed to contain the 10-year 24-hour design storm runoff event from disturbed areas and to remove excess suspended sediments picked up from disturbed areas of the mine as required by UMC 817.45 and 817.46 of this report. These facilities will remain in place throughout present and post mining activities. After mine reclamation, they will be removed, and the area reclaimed as required in UMC 784.16.

Sediment ponds have also been constructed to receive flows from a thickener tank located northwest of the coal waste refuse pile. Details related to these thickener underflow settling ponds is found in response to UMC 784.14 and in Exhibit 23, Treatment of Underflow from Thickener Tank Using Settling Ponds. Discharge from these thickener underflow treatment ponds is recycled back to the coal wash plant, and is not released back into natural stream courses.

Plans for continued use and reclamation of the present coal mine waste pile are presented and discussed in response to UMC 784.16. Overburden and topsoil will be stored at the present waste pile facility as required by UMC 817.21 through 817.24. Waste pile surface runoff is collected and routed through existing sedimentation pond No. 5. Overall surface drainage patterns meet the requirements of UMC 817.43.

Mine Shop

The mine shop is a precast double T concrete, two story building located at the Lion Deck.

Buildings will be maintained throughout the life of the mine. All buildings will be removed during final reclamation.

(6) WATER POLLUTION CONTROL FACILITIES.

RESPONSE:

Eight sedimentation ponds and one treatment facility have been constructed in conjunction with the CPMC runoff control plan and serve as on site water pollution control facilities. These structures have been designed to contain the 10-year 24-hour design storm runoff event from disturbed areas and to remove excess suspended sediments picked up from disturbed areas of the mine as required by UMC 817.45 and 817.46. These facilities will remain in place throughout present and post mining activities. After mine reclamation, they will be removed and the area reclaimed as required in UMC 784.16.

Settling ponds have also been constructed to receive flows from a thickener tank located northwest of the coal waste refuse pile. Details related to these thickener underflow settling ponds are found in response to UMC 784.14 and in Exhibit 23, Treatment of Underflow from Thickener Tank Using Settling Ponds. Discharge from the thickener underflow treatment ponds is recycled back to the coal wash plant, and is not released back into natural stream courses.

Plans for continued use and reclamation of the present coal mine waste pile are presented and discussed in response to UMC 784.16. Overburden and topsoil will be stored at the present waste pile facility as required by UMC 817.21 through 817.24. Waste pile surface runoff is collected and routed through Sedimentation Ponds No's. 5 and 9. Overall surface drainage patterns meet the requirements of UMC 817.43.

UMC 784.12 OPERATION PLAN: EXISTING STRUCTURES

(a) EACH APPLICATION SHALL CONTAIN A DESCRIPTION OF EACH EXISTING STRUCTURE PROPOSED TO BE USED IN CONNECTION WITH OR TO FACILITATE THE UNDERGROUND COAL MINING ACTIVITIES.

THE DESCRIPTION SHALL INCLUDE-

(1) LOCATION;

(2) PLANS OR SKETCHES OR PHOTOGRAPHS OF THE STRUCTURE WHICH DESCRIBE ITS CURRENT CONDITION;

(3) APPROXIMATE DATES ON WHICH CONSTRUCTION OF THE EXISTING STRUCTURE WAS BEGUN AND COMPLETED; AND

RESPONSE:

Table 67, Existing Structures, lists the structures currently in use at PMC and their construction dates. The structure locations can be seen on Map 44, Surface Facilities (4 sheets). The numbers on Table 67, Existing Structures, correspond with the location numbers on the maps. In addition, pictures of the structures can be seen in Exhibit 15, Mine Structure Photographs, which show their current condition.

(4) A SHOWING, INCLUDING RELEVANT MONITORING DATA OR OTHER EVIDENCE, WHETHER THE STRUCTURE MEETS THE PERFORMANCE STANDARDS OF SUBCHAPTER K OF THIS CHAPTER OR, IF THE STRUCTURE DOES NOT MEET THE PERFORMANCE STANDARDS OF SUBCHAPTER K OF THIS CHAPTER, A SHOWING WHETHER THE STRUCTURE MEETS THE PERFORMANCE STANDARDS OF SUBCHAPTER B OF CHAPTER VII, 30 CFR.

RESPONSE:

All structures are in compliance with DOGM Regulation UMC Subchapter K, Performance Standards. In 1978, the DOGM inspected structures existing at that time and found only one structure or facility to be out of compliance, the mine access road to the Number 1 Mine. Refer to a copy of the compliance letter dated April 27, 1978, Exhibit 24, Pre-existing, Non-conforming Structures at the Wattis Mine Site. The case was made that to bring the road into compliance would create excessive disturbance. This disturbance could not be justified for the Number 1 Mine since it had only a short life remaining. A new road was planned and constructed to the Lion Deck area where the remainder of the life-of-mine operations will be conducted. This new road was constructed to meet the requirements of UMC Subchapter K, Performance Standards.

The access road to the No. 1 Mine area will be retained for the Life of Mine to provide access for the public to Gentry Mountain where private property, Carbon County property, and Manti LaSal Forest property exists, and to provide secondary access to the Lion Deck operations area.

Since 1978, all newly constructed facilities have been permitted through DOGM and meet the requirements of UMC Subchapter K, Performance Standards. Hydrologic structures such as sediment ponds and ditches are addressed under UMC 784.16, as required by UMC 817.43, UMC 817.44, and UMC 817.46.

(b) EACH APPLICATION SHALL CONTAIN A COMPLIANCE PLAN FOR EACH EXISTING STRUCTURE PROPOSED TO BE MODIFIED OR RECONSTRUCTED FOR USE IN CONNECTION WITH OR TO FACILITATE THE UNDERGROUND COAL MINING ACTIVITIES. THE COMPLIANCE PLAN SHALL INCLUDE-

(1) DESIGN SPECIFICATIONS FOR THE MODIFICATION OR RECONSTRUCTION OF THE STRUCTURE TO MEET THE DESIGN AND PERFORMANCE STANDARDS OF SUBCHAPTER K OF THIS CHAPTER.

(2) A CONSTRUCTION SCHEDULE WHICH SHOWS ANTICIPATED DATES FOR BEGINNING AND COMPLETING INTERIM STEPS AND FINAL RECONSTRUCTION.

(3) PROVISIONS FOR MONITORING THE STRUCTURE DURING AND AFTER MODIFICATION OR RECONSTRUCTION TO ENSURE THAT THE PERFORMANCE STANDARDS OF SUBCHAPTER K OF THIS CHAPTER ARE MET; AND

(4) A SHOWING THAT THE RISK OF HARM TO THE ENVIRONMENT OR TO PUBLIC HEALTH OR SAFETY IS MINIMIZED DURING THE PERIOD OF MODIFICATION OR RECONSTRUCTION.

RESPONSE:

Modification of the preparation plant to remove additional fine coal from the refuse product is the only planned modification at this time. As modifications become necessary, a compliance plan will be submitted to the DOGM addressing the requirements of UMC 784.12(b) and UMC Subchapter K, Performance Standards.

UMC 784.13 RECLAMATION PLAN: GENERAL REQUIREMENTS

(a) EACH APPLICATION SHALL CONTAIN A PLAN FOR THE RECLAMATION OF THE LANDS WITHIN THE PROPOSED PERMIT AREA, SHOWING HOW THE APPLICANT WILL COMPLY WITH SECTIONS 40-10-17 AND 40-10-18 OF THE ACT, SUBCHAPTER K OF THIS CHAPTER, AND THE ENVIRONMENTAL PROTECTION PERFORMANCE STANDARDS OF THE DIVISION. THE PLAN SHALL INCLUDE, AT A MINIMUM, ALL INFORMATION REQUIRED UNDER UMC 784.13 - 784.25.

RESPONSE:

The reclamation plan will include all the information required under UMC 784.13 through 784.25.

(b) EACH PLAN SHALL CONTAIN THE FOLLOWING INFORMATION FOR THE PROPOSED PERMIT AREA;

(1) A DETAILED TIMETABLE FOR THE COMPLETION OF EACH MAJOR STEP IN THE RECLAMATION PLAN;

RESPONSE:

A detailed timetable for the completion of each major step in the reclamation plan is included as Table 68, Reclamation Time Table. This timetable is predicated on predicted coal sales, and the present estimate of coal reserves controlled by PMC. Changes in the production rate or acquisition of reserves will modify the milestone dates, but the relative schedule will be valid.

(2) A DETAILED ESTIMATE OF THE COST OF THE RECLAMATION OF THE PROPOSED OPERATIONS REQUIRED TO BE COVERED BY A PERFORMANCE BOND UNDER SUBCHAPTER J OF THIS CHAPTER, WITH SUPPORTING CALCULATIONS FOR THE ESTIMATES;

RESPONSE:

The bond calculations for the entire mine disturbance area was calculated to incorporate all minor revisions to the mining permit. All figures used reflect 1982 dollars to simplify combining the various calculations. The figures were combined to determine the reclamation cost in 1982 dollars (Table 68, Summary of Bond Calculations). A 10% contingency was added and the bond amount was then determined to be $2,797,000.

The $2,797,000 was escalated into 1986 dollars using the Means Historical indices for 1982 and 1986.

$$\$2,797,000 \times \frac{180.8\ (1986)}{157.5\ (1982)} = \$3,210,800$$

Presently PMC has a bond for $3,407,222 with the Aetna Casualty and Surety Company for reclamation of 221.65 acres of disturbed land. PMC is not requesting partial bond release at present, even though Mine No. 1 is partially reclaimed.

(3) A PLAN FOR BACKFILLING, SOIL STABILIZATION, COMPACTING AND GRADING, WITH CONTOUR MAPS OR CROSS SECTIONS THAT SHOW THE ANTICIPATED FINAL SURFACE CONFIGURATION OF THE PROPOSED PERMIT AREA, IN ACCORDANCE WITH UMC 817.101 - 817.106;

RESPONSE:

The proposed final surface contour plan would allow portions of the side hill cuts and operational benches at the minesite to remain after abandonment. The objective of the proposed backfilling, contouring and grading process is to achieve a reclaimed surface which will provide a variety of topographic features enhancing the postmining land use.

The silo area and the lower leg of the conveyor will be regraded using dozers or backhoes to achieve the final configuration and to blend the contours into surrounding topography. Final surface configuration is presented on Map 47, Post-Disturbance Topography and Cross-Section Locations-Sheet F-12, and on Map 48, Plateau Unit Train Loadout Pre-Disturbance and Post-Disturbance Cross-Sections.

Backfilling operations, utilizing equipment such as rubber-tired scrapers, front-end loaders, and dump trucks, will be conducted in the portal, sedimentation pond, and stope hole areas. Holes or depressions will be filled when the mining operation is concluded. Compaction operations will be conducted to stabilize all filled holes and depressions. The portal fill material will be put in place with a LHD (load-haul-dump) unit or front end loader to ensure proper backfilling. Mechanical tamping will not be used in the stope hole excavation area.

The pre-mining topography in the area contains long steep slopes with numerous natural benches. The backfilling plan includes leaving modified highwalls and the associated benches. The post-mining topography is graphically represented on Map 47, Post-Disturbance Topography and Cross-Section Locations - 4 Sheets, Map 49, Reclamation Cross Sections; Map 67, Mud Water Canyon Reclamation Plan; and, Map 68, Corner Canyon Reclamation Plan.

Highwalls will be reduced by dragging a portion of the fill material from the outslope of the operation benches to the toe of the highwall.

Roads will be reclaimed by pulling fill back up from the downslope and placing it in the cuts. The replaced fill material will be rounded or shaped to conform to the adjacent terrain and to meet natural drainage patterns. Natural drainages will be re-established and erosion protection across the fill provided. Culverts will be removed, water bars and cross drains will be constructed to minimize erosion where necessary.

Road surfacing materials such as asphalt will be removed or buried under 2 feet of material prior to backfilling. The entrance to reclaimed roads will be blocked by barriers of native rock or earth berms to prevent vehicular access.

Topsoiling of the roads has been addressed in response to UMC 784.13(b)(4) on pages 784-28 and 784-34 of the PAP.

The refuse pile will be reclaimed according to the following plan: Following completion of mining, the pile will be ripped or scarified to insure a good, stable contact between the refuse and the cover material.

Test plots were established in 1982 on the east end of the refuse pile to evaluate various topsoil and subsoil depths for final reclamation of the refuse pile. So far, data is showing a favorable trend toward the adequacy of as little as 10 inches of soil for final reclamation. As discussed in response to UMC 784.13(b)(4), we have available enough topsoil and subsoil to provide the refuse pile with 17 inches of cover.

Since the test plots have not been established for an adequate period to prove conclusively that 10 or 17 inches of material are acceptable for final reclamation, PMC commits to reclamation according to the applicable regulations. However, PMC desires consideration of alternate reclamation methods when the final results of test plots are available. The Division's concerns with the potential for processing waste to become acidic or toxic-forming also dictates that PMC commits to reclamation of the refuse pile with a 4 foot cover as per UMC 817.85(d). When and if a lesser amount is proven to be adequate, this commitment may be modified.

Following ripping or scarifying, a suitable cover material will be spread on the pile at the approved depth. Revegetation will then be conducted as discussed in response to ICR UMC 784.13(b)(5).

The Corner Canyon Fan site will be reclaimed using the original excavated subsoil which is stored in the mine close to the site. Topsoil from this site is stockpiled adjacent to other topsoil and will be returned to the fan site. This topsoil is segregated and marked for use only at the fan site. The re-topsoiled area will be left in a rough condition to reduce erosion and to promote revegetation. Water bars or contour trenches may also be used to prevent erosion. Seeding will be done upon completion of re-topsoiling. All work will be done from within the mine; no new disturbance will be made to reclaim this site.

(4) A PLAN FOR REMOVAL, STORAGE, AND REDISTRIBUTION OF TOPSOIL, SUBSOIL, AND OTHER MATERIAL TO MEET THE REQUIREMENTS OF UMC 817.21-817.25;

RESPONSE:

As described in the response to UMC 783.22, mining activities have been conducted in the Wattis area since 1917. Due to this past history of mining, large areas were disturbed without topsoil salvaging. Areas that have been disturbed subsequent to the passage and implementation of the Surface Mining and Reclamation Control Act of 1977 and subsequent regulations and associated permits have had topsoil removed and stored. The first topsoil removal activities conducted at the Star Point Mines were associated with the construction of sedimentation ponds initiated in 1980. Therefore, from the initiation of mining activities in 1917 until PMC's permit was initiated in 1980, no total removal was attempted. This point is presented to document that significant areas have been disturbed without topsoil salvage. These areas include the Lion Deck Portal Area and associated access roads, the Star Point Mine No. 1 complex and associated access roads, the overland conveyor from the Lion Deck to the Wash Plant, the entire Wash Plant and lower office complex, the majority of the Refuse Pile Area, the Mudwater Canyon Fan Site, and other miscellaneous areas. The only areas disturbed subsequent to the requirement to salvage topsoil include the Refuse Expansion Area, the Unit Train Loadout conveyor, the Corner Canyon Fan Site and certain sedimentation ponds. The results of the field investigations and laboratory data collected from the areas wherein topsoil was salvaged are described in this response.

TOPSOIL REMOVAL PLAN

As required by UMC 783.21 and 817.22, with the exception of the tract proposed for the Gentry Mountain Shaft Site which will constitute less than one acre of disturbance and the 14.67 acres of topsoil to be removed from the Refuse Expansion Area, all of the topsoil on areas proposed to be disturbed was either spoiled in place or else has been removed according to PMC's approved permit.

On the 14.67 acres of PL2, soil remaining to be stripped at the Southwest Corner of the Refuse Expansion Area topsoil averages 8 inches in depth and subsoil averages 28 inches in depth. Total removal depth will average 36 inches which will yield approximately 71,000 cubic yards of soil. To the extent that adequate reclaimed acreage is available, this material will be live-handled and placed on areas ready to be revegetated. If all cannot be used in reclamation, then the balance will be hauled to the subsoil stockpile for storage. Soil stabilization practices will involve temporary revegetation using the interim seed mixture. PMC does not anticipate the need to construct additional terraces since this material will be deposited on top of the existing pile. Due to documented adverse effects of annual weed growth dominating segregated topsoil stands, PMC proposes to remove topsoil and subsoils in a combined lift.

Removal operations will be supervised by PMC personnel. By depositing this 71,000 cubic yards of topsoil onto the existing stockpile, the elevation of the pile will raise approximately 13 feet.

Although PMC does not propose to use topsoil substitutes or supplements in the course of revegetation, and additional topsoil removal is not planned, it is possible that additional topsoil could be uncovered during the reclamation activities associated with the current facilities areas and access roads. During the reclamation of portions of Mine No. 1 in the fall of 1985, it was discovered that in certain areas, topsoil had been buried by sidecast fill material cast downhill during road construction. In this area, adequate topsoil was recovered to cover all 10.10 recontoured acres to a depth of approximately 17 inches. It is unknown whether or not areas similar to the Portal No. 1 area will exist, but it is possible. Fortunately from an operational standpoint, there is little, if any, additional cost involved in recovering these materials. In fact, these areas cannot be bonded because they are already calculated as a regrading cost, plus there is no reasonable method available to quantify exactly how much of this material is potentially available. PMC sees no need to attempt to quantify the potential amount of topsoil that might be available for salvage under such conditions and because ample evidence is available to document that the available stockpiled soil materials are sufficient for reclamation.

The Gentry Mountain Topsoil Removal Plan cannot be presented at this time due to the lack of detailed planning. However, due to climatic constraints, it is extremely unlikely that plans will be made to construct the proposed shaft facilities at any time except during summer or fall. Once specific information becomes available, PMC will submit detailed plans outlining the exact location of the shaft facilities, topsoil removal depths, sediment control plans and detailed reclamation plans. Although detailed information is lacking, sufficient site specific information is available to allow DOGM to evaluate the conceptual plan and make a preliminary decision regarding the suitability of the baseline data available to characterize the proposed site.

TOPSOIL STORAGE PLAN

REFUSE EXPANSION AREA

Since the topsoil will be applied to the same areas from which it was removed, the only alternative available is to remove the topsoil into stockpiles where it must remain until mining activities have ceased and the areas can be reclaimed.

With the exception of the first topsoil removal efforts associated with the sediment pond construction in 1980, all topsoil stockpiling efforts have been closely coordinated with DOGM personnel. Topsoiling plans for the proposed refuse expansion areas and associated topsoil and subsoil stockpile construction were closely reviewed during the permitting process. In PMC's initial submittal requesting approval to expand the Refuse Pile Area and construct the subsoil stockpile, PMC committed to DOGM on May 28, 1982 to construct the piles in 2 foot lifts or to maintain a maximum slide slope ratio of 2:1 or, in a valley fill situation, the pile would blend into the existing topographic configuration. The side slopes were to be terraced.

In response to this submittal, DOGM issued the following stipulations in connection with the construction and revegetation of these stockpiles.

Refuse Pile Expansion Plan - DOGM Stipulations Issued June 15, 1982
-Stipulation 6-14-82-2 (DWH)
(Final Reclamation Plan)
-Stipulation 4-14-82-3 (LK)
(Seed Mixture)
-Stipulation 6-14-82-4 (LK)
(Vegetation Sampling)

-Stipulation 6-14-82-5 (TLP)
(Terracing of Outstlopes)
-Stipulation 6-14-82-6 (TLP)
(Detention Basin Site)
-Stipulation 6-14-82-7 (TLP)
(Wind and Water Erosion Control
-Stipulation 6-14-82-8S (TLP)
(Repair of Rills and Gullies)

Subsequent site inspections and DOGM enforcement action verified that the topsoil and subsoil stockpiles were constructed according to the proposed 2:1 slope standard and DOGM stipulation that terraces be pitched to the inside to decrease erosion and prevent slumping.

Topsoil has been removed from all areas projected to be disturbed within the PMC Permit Area with the exception of the proposed Gentry Mountain Shaft location and the remaining Refuse Expansion Area. To date, the detailed planning necessary to locate the exact area and extent of disturbance associated with the Gentry Mountain Shaft site have not been completed. Once this information has been finalized, an appropriate plan will be submitted to DOGM describing the exact schedule and extent of topsoil removal. The other remaining area wherein topsoil is scheduled to be removed is a 14.67 acre tract on the southwest corner of the Refuse Expansion Area. According to the detailed Order 1 Soil Survey conducted in this area by EPS in 1981, this soil to be stripped corresponds to the PL2 soil mapping unit. Average removal depth of soil in this area is approximately 3 feet with an A horizon (topsoil) of approximately 8 inches and a C horizon (subsoil) averaging 28 inches in thickness.

Based upon data obtained from the 5 years of test plot work on the refuse pile evidence strongly indicates that a serious annual weed problem exists at this site wherever topsoils and subsoils are segregated. Therefore, PMC proposes to remove this soil in a single lift. Removal operations will be supervised by PMC personnel. The material will be stockpiled on the approved subsoil stockpile and stabilized with the same measures previously used.

There are currently 2 topsoil storage areas; one immediately north of the refuse pile and a small pile located just northwest of the Unit Train Loadout along the conveyor. Two subsoil stockpiles exist: one just northeast of the wash plant and another located underground near the Corner Canyon Fan Site. Topsoil from the small topsoil stockpile and the subsoil material near the silo will be respread on the disturbed area associated with the Unit Train loadout and conveyor. Approximately 8500 cubic yards of topsoil exist in the topsoil stockpile immediately north of the refuse test plots. This topsoil came from: sedimentation ponds constructed in 1980, the Refuse Expansion Area, the Unit Train Loadout Conveyor and Silo, and the Corner Canyon Fan Site. In the large subsoil stockpile approximately 277,227 cubic yards of subsoil are stored. All of this material was removed from the refuse expansion area.

Each of these stockpiles was located and approved by DOGM personnel prior to construction. The normal soil stabilization practices suggested by PMC including siting to protect them from wind and water erosion, unnecessary compaction and the planting of rapidly growing plant species were implemented. However, due to DOGM concerns over erosion and slope stability, the subsoil stockpile had extensive sloping and terrace measures were constructed to provide geotechnical stability and to provide for suitable stabilization with respect to wind and water erosion.

PMC does not foresee any reason why the currently established stockpiles will need to be moved prior to final reapplication.

The locations of all existing topsoil and subsoil stockpiles are shown on the appropriate disturbed area topsoil maps. Topsoil in these stockpiles will remain there until the mining operations are no longer being conducted, the surface facilities have been removed and the areas appropriately regraded, then the topsoil in these stockpiles will be replaced and revegetation activities will commence. Since all existing topsoil stockpile locations and protection measures were approved prior to construction and regularly monitored since, no additional measures are needed to protect this stockpiled resource.

CORNER CANYON FAN SITE

Topsoil and subsoil stockpiles for reclaiming the Corner Canyon Fan Site are located in two locations. Topsoil amounting to approximately 200 cubic yards was removed from the proposed fan site and hauled through the mine and stored adjacent to the existing topsoil stockpile. This small pile is physically separated from topsoil removed from the facilities areas due to USFS stipulations that this topsoil be removed from the site and transported to PMC's existing approved stockpile area. To assure that this topsoil will be returned to its origin in Corner Canyon, it is marked with a durable metal sign which reads: "Topsoil - Corner Canyon Fan - Use only at Corner Canyon". Erosion control for this stockpile is accomplished by use of a small perimeter ditch and long term perennial vegetation seeded with a straw mulch and stabilized to the site with stapled nylon netting.

Subsoil removed from this site was removed according to PMC's approved plan and stored underground in a stable location near the Corner Canyon Fan Site.

GENTRY MOUNTAIN SHAFT SITE

As has been previously explained in the response to UMC 784.13(b)(4), detailed planning has not progressed sufficiently to delineate the exact extent or location of the proposed shaft site. However, baseline inventories conducted in the Gentry Mountain Shaft Area reveal that 2 of the 4 soil types present in this area possess A horizons thinner than 6 inches. If it is elected to place the shaft site in either the shrub or grass-shrub areas, then the uppermost 6 inch lift would have to include approximately one inch of subsoil (B horizon) material. In the event that it becomes operationally necessary to construct this facility within the permit term of this application, then a detailed permit modification will be submitted describing the exact topsoil management plan for this area.

UNIT TRAIN LOADOUT AREA

Soils removed from suitable slopes during the construction of the Unit Train Loadout project were stored in two different locations. As allowed for in the permit, soils materials were not segregated and all removed soils were placed into designed storage piles. Soils from the southern end of the conveyor, Sediment Pond 8 and Silo Area were placed in a stockpile east of the sedimentation pond. This stockpile contains an estimated 1500 cubic yards of soil. It must be emphasized that soil materials removed from this area do not possess generic soil horizons and that these soils are classified by SCS as undifferentiated geologic materials. Soils removed from the northern end of the conveyor were stockpiled in a separate pile located north of the refuse test plots adjacent to the existing topsoil stockpiles. An estimated 200 cubic yards of soil from the disturbance associated with the Unit Train conveyor were placed into this stockpile. Once constructed, berms were placed at the toe of the slopes and the site mulched and seeded.

SOIL REDISTRIBUTION PLAN

There have long been regulatory concerns expressed regarding the availability of adequate topsoil to assure long term revegetation success. Numerous stipulations have been issued and exchanges of correspondence have taken place between DOGM and PMC. As has been previously acknowledged, extensive areas were disturbed prior to environmental regulations requiring topsoil salvage and replacement for reclamation. PMC acknowledges this concern, but believes that existing scientific literature on the subject, site specific research conducted by PMC and PMC's success in past reclamation all demonstrate that the conditions of the area are relatively amenable to successful reclamation. PMC recognizes that past reviews have somehow ignored the fact that in the area many of the existing soils are naturally poorly developed, due to the steep topographic condition encountered at this locale.

With this background, PMC wishes to point out that considerable acreages have been disturbed on areas lacking developed soil profiles. Mention is made of the fact that examination of the site specific soil mapping unit descriptions found in Exhibit 19, Soils Information, documents that certain soil mapping units (i.e. BY - Badland-Rubble Complex and numerous Rock Outcrop areas) have no developed soil horizons. At the scale of mapping used many series contain significant amounts of Rock Outcrop which also lacks a developed soil profile. This discussion is presented to document that for many areas to be reclaimed, it is nothing more than a matter of academic interest to state how much topsoil will be returned to these areas. The concept of topsoil supplements or substitutes does not apply to these areas because in the reclamation of these areas, PMC will be restoring a site to the same state that existed prior to being disturbed. For such areas, since little or no topsoil existed prior to disturbance, none can reasonably be returned. The native species growing on such sites have evolved under such conditions and by mandating that topsoil be returned to these areas a set of ecological conditions could be established that would preclude the species that originally existed on these sites.

With this background, PMC points out that numerous roadcut areas such as both the north and south access roads to the Lion Deck Portal contain areas which were disturbed without topsoil being salvaged. Many acres of the roads did not even possess topsoil and that during the final reclamation of such areas, they will be reclaimed using the fill material used to construct these roads. In some instances, buried topsoils may be encountered and will be used whenever possible for topsoiling. The Mudwater Canyon Fan Site is another area disturbed without topsoil removal. Past reclamation operations have been successful and at this site, PMC proposes to reclaim the site using existing fill material. Reclamation along the Unit Train Loadout Conveyor was also successfully conducted on areas lacking developed topsoil and using available fill material.

In order to reduce the extent of potential slippage on the interface between the regraded fill and the respread topsoil, PMC will attempt to scarify or rip the spoil prior to replacement of topsoil. To the extent that slope permits, ripping will be done on the contour. Whenever slope conditions do not allow for the safe operation of men and equipment, PMC will endeavor to reapply the topsoil in an uneven and in a roughened condition to achieve an end result similar to ripping.

Existing volumetric estimates indicate that approximately 17 inches of stockpiled soil material are available for redistribution. This thickness is consistent with proposed postmining land use concerns. In order to avoid unnecessary compaction to respread soil materials, PMC will implement the following operational procedures:

1. Topsoils will not be respread during winter or spring when moisture will increase the likelihood of compaction;

2. Once redistributed onto regraded slopes, every attempt will be made to avoid the trafficking of heavy equipment across these areas; and

3. To the extent that slopes allow, topsoil to be reapplied with trucks, loaders, dozers or scrapers, topsoil will be ripped to alleviate compaction.

CORNER CANYON FAN SITE

Areas where topsoil replacement will be employed include the Corner Canyon Fan Site. Soil materials salvaged at this site are discussed in the previous discussion on Topoil Storage. Estimates at this site indicate that topsoil amounting to 200 cubic yards and subsoil amounting to 5000 cubic yards are available for redistribution considering that the planimetered acreage of this site equals 0.44. This means that ample topsoil quantities are available to sustain long term reclamation.

43560 x .44 = 19166 ÷ 27 = 709.86 cy yds

UNIT TRAIN LOADOUT AREA

Stockpiled soil materials for the Unit Train Loadout are located in stockpiles previously discussed, at the north and south ends of the conveyor. Once the mine is no longer active and the conveyor is removed, the stockpiled soil materials will be removed from storage using appropriate equipment and replaced onto the regraded area. Along the conveyor and associated areas, it is estimated that in the lower stockpile there are 1500 cubic yards of soil material, while 200 cubic yards of soil material exist in the upper stockpile. This yardage translates into an average laydown thickness of 6 inches of topsoil on the reclaimed Unit Train Loadout Area.

REFUSE EXPANSION AND LOWER FACILITIES AREAS

No soil materials were removed from the lower facilities area which includes the lower office complex, the wash plant and tipple area, overland conveyor and miscellaneous roads. The Refuse Expansion Area disturbed since 1982 involved soil removal operations. Estimates on the volume of topsoil removed from this area have been the topic of considerable discussion. The contractor who removed the soil estimated based upon load counts that 269,160 total cubic yards of topsoil were removed and placed into stockpiles and 8,067 cubic yards were placed on the refuse test plot studies. The contractors estimate was countered by surveyed cross sections of the stockpiles which yielded 192,065 cubic yards. PMC resolved this difference by using an engineering compaction factor of 0.30.

110610.13

LION DECK ACCESS ROAD TOPSOIL

The reclamation and topsoiling requirements for the Lion Deck Portal Access Road were subjected to intense regulatory review as a result of ten notices of violations issued by DOGM and OSM on January 9, 1979. Formal DOGM board hearings on June 27, 1979 and July 27, 1979 address the reclamation problems including topsoil removal and reapplication associated with this road. The findings of the Board were submitted to

PMC on August 8, 1979 and specifically approved a variance from normal topsoil removal and redistribution methods. Therefore, PMC does not propose to respread topsoil onto any of the acreage disturbed in the construction of this road. Revegetation of this area as approved by this Board action will consist of using the resulting cut and fill slope material as a plant growth media.

TOPSOIL HANDLING

Published research on the compaction of stockpiled topsoils is rather extensive on this subject. Miller and Cameron (1976) reported that compaction of the topsoil stockpiles averaged 40 percent from the Indian Head Mine in North Dakota. Gee and Bauer (1976) studied 6 topsoil stockpiles at the same mine site. Although they did not collect baseline bulk densities, using the baseline data of Miller and Cameron from this same site, average compaction can be calculated to equal 28.9% with a range of between 0% and 69.5% compaction. These data are presented to show the calculations previously submitted to DOGM in connection with the Unit Train Loadout Permit wherein it was estimated that 17 inches of topsoil exists for ultimate reclamation of these sites might well be a conservative estimate. Considering the fact that original estimates apparently under estimated the volume of soil materials that would be recovered from the Refuse Expansion Area and since more topsoil was removed (approximately 277,227 cubic yards) and PMC estimates that 71,000 cubic yards remain to be salvaged, it is likely that reclamation can be accomplished much easier than was originally anticipated. Conservative estimates both in the amount of material available for salvage and quantities available for reapplication appear to have been made.

Since nearly 150 soil samples have been analyzed within the past 7 years along with 2 on-site long term fertilizer studies, ample response information is available to formulate a soil fertilization program and forgo the unnecessary testing of additional soil samples. The primary basis for this opinion is the detailed soils survey conducted by PMC in

Response to Stipulation UMC 817.24-1-TLP - Item #3, DOGM letter of March 28, 1985 and submitted by PMC on May 21, 1985.

Utilizing the DOGM "Guidelines for Supplying Soil Amendments" the following conclusions can be drawn.

Nitrate-Nitrogen

As are reported in the PMC response submitted May 21, 1985, nitrate-nitrogen has been analyzed in 69 samples, all of which tested below 9 ppm. Upon adding the interaction of organic matter and nitrogen as suggested in the DOGM guidelines, 40 samples were analyzed for both of these parameters. Of these 40 samples, 57.5 percent required 40 pounds per acre of supplemental nitrogen, 22.5 percent required 20 pounds per acre of supplemental nitrogen and 20 percent required 10 pounds per acre of supplemental nitrogen. It is noteworthy that all of these samples yielded a nitrogen deficiency.

Phosphorus

A total of 69 samples were tested for plant available phosphorus, of which only 1 (1.45 percent) tested adequate. Sixty-two samples (89.86 percent) were reported to require 30 pounds per acre of supplemental phosphorus and 6 samples (8.7 percent) required 20 pounds per acre of supplemental phosphorus of these samples 98.55 percent demonstrated an obvious phosphorus deficiency.

Potassium

A total of 69 samples were tested for plant available potassium, of which only 4 (6 percent) tested at a level low enough to benefit from supplemental potassium.

Iron and Zinc

According to the Utah State University, Utah Fertilizer Guide these nutrients are also never known to be deficient in Utah. The DOGM guidelines also do not recommend these parameters for topsoil sampling.

Conclusion

Based upon examination of a large data base and comparison with published standards, additional soil testing of respread topsoil is unnecessary. In view of the consistent values obtained wherein we are 100 percent certain all future sampling for nitrate-nitrogen will yield a deficiency, 98.55 percent certain that phosphorus will be deficient, 94 percent certain that potassium is adequate and nearly 100 percent certain that iron and zinc are adequate, PMC proposes the following fertilization program for all future reclaimed areas.

Supplemental nitrogen will be applied at the rate of 40 pounds per acre and supplemental phosphorus will be applied at the rate of 30 pounds per acre active ingredient. In order to maximize application efficiencies, topsoiled areas will be fertilized prior to scarification or mulching. Given this program, a plan capable of satisfying the needs of the growing plants and the DOGM regulations can both be satisfied.

(5) A PLAN FOR REVEGETATION AS REQUIRED IN UMC 817.111 -817.116, INCLUDING BUT NOT LIMITED TO, DESCRIPTIONS OF THE-

(i) SCHEDULE OF REVEGETATION;

RESPONSE:

Revegetation efforts will be initiated following the backfilling and regrading activities described in response to UMC 784.13(b)(3). Following regrading, the site will be scarified or similarly treated to assure that redistributed topsoil forms a good bond with the regraded landscape. This roughened state will aid in reducing the possibility of slippage occurring at the spoil-topsoil interface. The roughness of this bond will promote moisture retention and tend to increase root penetration.

Topsoil reapplication will be conducted whenever conditions allow for safe operation of equipment on the site. Based upon research conducted in the Northern Great Plains (Gee and Bauer, 1976) and in Wyoming (Miller and Cameron, 1976), PMC does not anticipate compaction of redistributed topsoil posing a problem for revegetation efforts. These studies document that compaction of stockpiled topsoils is largely alleviated as the materials are respread. To the extent that conditions allow, redistribution of topsoil will be conducted along the slope to reduce the possibility of surface runoff. As soon as possible following topsoiling and as conditions allow, the respread topsoil will be scarified or contoured. These activities will be conducted parallel to the slope contours.

Following completion of topsoiling and seedbed preparation, reseeding activities will commence. Sites level enough to be safely transversed with equipment will perhaps be drill seeded using the mixtures corresponding to each specific vegetation type. These mixtures have also been formulated to correspond to different aspects of plant communities found in the areas disturbed in the PMC Mine Permit Area. If the areas are drill seeded they will be seeded at a rate of one-half that given in the seed mixture tables. On areas too steep to be drill seeded, these sites will be broadcast seeded either with a hydromulch machine or by cyclone seeders. Areas out of reach of the hydromulcher will be hand seeded. Areas to be broadcast seeded will be seeded at the rates given in the seed mixture tables.

The normal periods for seeding in the area of the Plateau Permit Area are either spring or fall. Spring time plantings are made as soon after snowmelt as possible and prior to the drier summer season. Fall plantings can be made any time after the fall frosts arrive and until snowfall makes it too difficult to operate. In this light, fall plantings can realistically be made any time during the winter provided there exists a good likelihood of the seed being adequately covered and the ground is not frozen.

Previous experience obtained by PMC, the BLM, UDWR, USFS and mines operating in this immediate area document that the species included in the proposed seed mixtures are capable of self-regeneration in this ecosystem and are compatible with existing plant successional patterns.

No postmining cropland land use areas are being proposed as part of the reclamation at Star Point Mines.

The vegetative cover on all reclaimed areas will be statistically compared to the natural vegetative cover. Each reference area corresponding to each corresponding plant community that was disturbed will be used as a standard to determine revegetation success

As are described in the response to UMC 784.13, it is PMC's intention to reclaim all disturbed areas except the surfaces of roads approved as a

part of the postmining land use to a permanent vegetative cover. If interest is shown by either BLM or UDWR in leaving behind existing sediment ponds, then the water areas of these ponds will not be reseeded. All associated surface disturbance areas except the surface of roads and sedimentation ponds, if any, will be reseeded.

(ii) SPECIES AND AMOUNTS PER ACRE OF SEEDS AND SEEDLINGS TO BE USED;

(iii) METHODS TO BE USED IN PLANTING AND SEEDING;

RESPONSE:

The species and seeding rates proposed to be used in each seed mixture are presented for each specific area. Separate seed mixtures have been developed for each area. The Corner Canyon Fan Site (Table 70, Mudwater Canyon and Corner Canyon Fan Site Seed Mixture), Unit Train Loadout (Table 71 , Unit Train Loadout Seed Mixture), Star Point No. 1 Mine Area and Lion Deck Portal Area (Table 72, Mountain Grassland and Douglas Fir Seed Mixture) and refuse, topsoil stockpile, lower office, wash plant, conveyor and Lion Deck Portal Access Road will be seeded with a separate seed mixture (Table 73, Disturbed Area Seed Mixture). The proposed Gentry Mountain Shaft Site will be reclaimed using the same seed mixture proposed for reclamation of the Star Point No. 1 Area Mountain Grassland plant community (Table 72, Mountain Grassland and Douglas Fir Seed Mixture). An interim seed mixture for topsoil stockpiles is presented in Table 74, Topsoil Stockpile Interim Seed Mixture. Exploration roads in Section 18, T15S, R8E, are to be seeded with the seed mixture presented in Table 93, Seed Mix-Exploration Permit 86-1. The location of areas proposed to be seeded are found on Map 73, Revegetation Plan.

If areas are drill or broadcast seeded they will be seeded at the appropriate rates given in the seed mixture tables. All areas to be drill seeded will contain between approximately 52 and 87 pure live seeds per square foot. Areas to be broadcast seeded will be seeded at rates ranging from approximately 90 to 174 pure live seeds per square foot.

Regulations allow for the planting of introduced plant species on reclaimed land if approved by DOGM. In order for DOGM to approve the use of introduced plant species, it must be established that the introduced species is capable of achieving a diverse, effective, and permanent cover consistent with the postmining land use; the species are necessary to achieve a quick, temporary, and stabilizing cover to control erosion and measures to establish a permanent vegetation are part of the approved plan; the species are compatible with the plant and animal species in the area; and the species meets the State and Federal introduced species statutes.

The specific introduced species proposed for seeding on the Plateau Permit area include: smooth brome, timothy, intermediate wheatgrass, Kentucky bluegrass, alfalfa, meadow foxtail, yellow sweetclover, Regar meadow brome, small burnet, tall wheatgrass, Russian wildrye, cicer milkvetch, crested wheatgrass, pubescent wheatgrass, and orchardgrass. Specific reasons for the desirability of each introduced species on a site specific basis are presented in the following discussion.

Mudwater Canyon Fan Site

At the Mudwater Canyon Fan Site the USFS and USGS stipulated in their lease and mine plan approvals that smooth brome, timothy, intermediate wheatgrass, alfalfa and meadow foxtail would be seeded in the revegetation seed mixture. These species were apparently stipulated to be planted because they have proven themselves to be superior to natives in terms of initial plant establishment and hence in providing better erosion control. Alfalfa is a known nitrogen fixer and a deep rooting species that is superior in promoting soil development on the reclaimed site. According to the UDWR (Plummer et. al. 1968), smooth brome "grass is the most widely adapted species on western ranges". Although the species is commonly considered to be introduced, Weber (1976), in his Rocky Mountain Flora considers our native counterpart, Pumpelly Brome to be variety of the introduced species. Holmgren and Reveal (1966) also suggest this possibility. Given the value of smooth brome, the fact it is stipulated to be planted and considered by some to be the source genotype for the native, Pumpelly Brome, Plateau believes ample justification is provided to plant smooth brome.

Timothy is considered by most taxonomists to be an introduced species. Dayton (1937) in the Range Plant Handbook states "whether it is native to parts of the North American continent is still somewhat in controversy, although the preponderance of belief is that timothy was presumably accidentally introduced into America in early colonial times from Europe. All authorities, however, seem to be agreed that it was first cultivated on this continent; it bears an American name (timothy) and it was introduced into the Old World as a cultivated plant from this country". Plateau presents this information to demonstrate there is inconclusive evidence to suggest timothy is an introduced species. According to data in Plummer et. al. (1968), timothy appears to readily establish on disturbed areas, yet declines in composition over time. This evidence suggests timothy is a good nurse plant that encourages long term succession.

Intermediate wheatgrass is reported by Plummer et. al. (1968) to be a particularly well adapted shade-tolerant species suited for seeding in forested areas such as the Mudwater Canyon Fan Site. Due to its relative ease of establishment and ability to serve as a nurse crop and promote long term natural plant succession, Plateau suggests ample justification is available to utilize this species at this site.

According to Plummer et. al. (1968), meadow foxtail is known to be a shade tolerant species that has a very dense deep rooting system, and is ideal for site stabilization in areas like the Mudwater Canyon Fan Site. It is also reported to be particularly valuable as early spring forage for big game and forest grouse. Plateau is unaware of any native species adapted to this area that would be suitable for this specific purpose. Plateau believes given the apparent lack of suitable native species with these characteristics, ample justification is provided to utilize this species at this site.

Corner Canyon Fan Site

The presently approved Corner Canyon seed mixture includes timothy, Kentucky bluegrass, and alfalfa. The Division has already made the formal determination that these species satisfy the requirements of UMC 817.112.

Timothy is included in this mixture because of its ease of initial establishment and ability to promote long term plant succession. It is noted as a shade tolerant species that is particularly suited to such sites. Due to the presence of all potentially suitable native species being included in the present seed mixture, the presence of timothy also adds significantly to the species diversity to the site and improves the initial likelihood of establishing a vegetative cover capable of stabilizing the site with respect to erosion and long term plant succession. Plateau also believes since there is inconclusive evidence to suggest timothy is actually an introduced species, ample justification is presented to continue to use this species on this site.

Alfalfa is included in the Corner Canyon Fan Site Seed Mixture due to its nitrogen fixing abilities, the deep taproot and generally short term persistence on the reseeded site. No known native legume is available that is suitable for these revegetation needs. Recent research in western Colorado (Biondini and Redente, 1968) have documented the overall rates of plant succession are higher in association with alfalfa than any other native or introduced grass, forb or shrub species evaluated. Given its value to enhance the overall natural successional process, Plateau feels ample justification is presented to continue to use this species in the revegetation seed mixture at the Corner Canyon Fan Site.

Kentucky bluegrass is commonly believed to be an introduced species. Dayton (1937) reports: "The common belief that Kentucky bluegrass is indigenous in the United States probably is erroneous. Some agrostologists believe that certain bluegrass forms unquestionably native in the northern and cooler parts of North America may be varieties or subspecies of Kentucky bluegrass." Recent studies of this species have concluded Kentucky bluegrass is actually comprised of apomictric races, one of which is far ranging native of the western United States (Biorin and Love, 1960). Plateau presents this evidence to document that scientific evidence is not conclusive to document that Kentucky bluegrass is an introduced species.

Plateau is proposing to seed Kentucky bluegrass because it is widely present in natural plant communities. Table 17 documents this species as common in the Gentry Mountain Shaft Site area, the Aspen and Mountain Shrub areas. Given its widespread occurrence in this area, Plateau feels this is ample justification for its inclusion in the Corner Canyon Fan Site Area. Given its existing occurrence on this site, Plateau feels sufficient evidence is available to document it sill eventually occur naturally on this site. Plateau feels this demonstration is ample justification to continue planting this species on this site.

Unit Train Loadout Seed Mixture

Three introduced species are proposed for seeding in the Unit Train Loadout Seed Mixture. They include alfalfa, yellow sweet clover and desert wheatgrass. Alfalfa and yellow sweetclover were approved by the Division on September 5, 1984 for the Unit Train Loadout because they "meet the requirements of UMC 817.112". They were originally included in the original seed mixture because they are both valuable nitrogen fixing legumes with deep taproots with relatively short persistence on such sites. These valuable characteristics make them ideal candidates for initial site stabilization. Their ability to establish on harsh sites and promote native plant succession mean they are idela nurse crop and soil building species. They also provide an abundance of high quality forage for wildlife. Plateau believes these characteristics qualify them for continued use on this site and their use is justified.

Desert wheatgrass is proposed for reseeding at this site due to the lack of developed diagnostic soil horizons on this harsh salt desert shrub site. Previous research in reseeding the salt desert shrub zone in eastern Utah, Bleak et. al. (1965) and Ferguson and Frischknecht (1985) has demonstrated the relatively few species adapted for suitable revegetation in areas similar to those encountered in the Unit Train Loadout area. Plateau is proposing to seed this species due to the necessity to achieve rapid site stabilization of the revegetated site, but yield to long term succession. Desert wheatgrass has been documented to possess these characteristics. No suitable natives could be found that are so valuable in short term stabilization.

Since extensive vegetation monitoring in 1981 documented desert wheatgrass was a common component of the undisturbed vegetation of the Plateau mine site and due to the value of desert wheatgrass to serve as a valuable nurse plant and enhance long term succession in this area, Plateau believes ample evidence is presented to justify the continued seeding of this species.

Mountain Grassland and Douglas Fir Seed Mixture

Regar meadow brome is contained in this previously approved seed mixture due to the value this species will provide as a rapid ground cover immediately following seeding, but one which is not as persistent in the seeded stand as much as smooth brome. Plummer et. al. (1968) considered meadow brome to be superior to smooth brome in this regard. McGinnies and Crofts (1986) reported for a mountain browse site in northwest Colorado, the initial establishment of meadow brome was superior to smooth brome. Since meadow brome is a bunchgrass, it should greatly compliment the native mountain brome, a species of somewhat lower seedling vigor. Plateau believes its value as an initial stabilizer, a nurse crop and its ability to disappear with the seeded stand over time greatly adds to the value in promoting stand diversity. These characteristics and bunchgrass habitat of this species justify its inclusion into the Mountain Grassland and Douglas Fir Seed Mixture.

Disturbed Area Seed Mixture

Small burnet, alfalfa, yellow sweetclover, tall wheatgrass, Russian wildrye and cicer milkvetch are the introduced species that have previously been approved by the Division for revegetation of the active facilities and most mine areas.

Small burnet is an introduced forb included in this seed mixture because of its almost unsurpassed ability to become established on disturbed sites, promote natural plant invasion and ultimate succession on this area. According to Plummer et. al. (1968), small burnet is also a preferred plant of wildlife during the late winter and early spring. Its ability to become established on particularly harsh sites and start the successional process is unmatched by almost all native forbs. Its relatively short persistence makes this species an ideal nurse crop and successional species. It is Plateau's experience that only the native Lewis flax comes close to small burnet as a revegetative species. Plateau suggests these characteristics are ample justification for continued use of this species in this seed mixture.

Alfalfa and yellow sweetclover are included in this seed mixture due to their nitrogen fixing, deep taproot, high quality forage and ability to encourage natural plant succession. Since documentation previously cited has demonstrated these characteristics are associated with the highest overall rates of plant succession on revegetated sites, Plateau submits that continued usage of these species is justified.

Tall wheatgrass is included in this seed mixture because of its excellent ability in initial establishment, tall growth habitat and propensity to decrease in persistence over time. The nurse crop ability, tall growth habit and lack of stand prrsistence will promote long term succession by retaining soil on the reclaimed site, trapping wind blow seed, and serving a nurse crop function for ultimate long term succession. Plateau believes these characteristics are particularly valuable for revegetation on this site andthese traits justify continued use of the species.

Russian wildrye is included in the Disturbed Area Seed Mixture due to the unsurpassed ability to become established on harsh sites. Plummer et. al. (1968) reports this species has an "unusual adaptation" to adverse conditions. Since the regraded spoil and respread topsoil will contain such conditions, Plateau feels it is essential that a species capable of stabilizing and ameliorating such conditions be included in the seed mixture. Data collected by Ferguson and Frischknecht (1985) on the Emery Coal Field suggest this species is excellent in initial establishment, but over time, its importance tends to decrease. Plateau feels these characteristics justify the continued utilization of this species on these sites.

Cicer milkvetch is an introduced legume included into the Disturbed Area Seed Mixture due to its nitrogen fixing abilities, deep taproot and overall ability to promote natural plant succession. Ferguson and Frischknecht (1985) reported cicer milkvetch steadily decreased over time at their Alton Study Site. The decrease of such a nutritious succulent forage plant makes this species ideal in ameliorating the initial adverse site conditions, enhancing the nutrient pool in the soil and promoting long term plant succession. Since alfalfa and Utah sweet-vetch are included in the seed mixture, the presence of cicer milkvetch should enhance the overall diversity and prospects of long term plant succession. Plateau believes these characteristics are ample justification for continued utilization of cicer milkvetch in the Disturbed Area Seed Mixture.

Topsoil Stockpile Interim Seed Mixture

For reasons stated on pages 49 through 52 of Plateau's January 7, 1987 submittal, a number of introduced species are proposed for reseeding in the Topsoil Stockpile Interim Seed Mixture. These species include desert wheatgrass, pubescent wheatgrass, orchardgrass, Russian wildrye, alfalfa and yellow sweetclover. The primary basis for inclusion of the grasses and forbs stem from their ability to be deep rooting species that will promote long term viability of the biological properties of the stockpiled soil material. Although comprehensive rooting depth studies have not been performed on these species in this immediate area, Plateau feels ample evidence is available to document the current proposal. In preparing this review, Plateau concentrated on the two most important rooting characteristics which we believe might affect maintenance of the stockpiled soil materials, the overall depth of rooting and the overall amount of the root biomass.

Desert Wheatgrass

Using the P32 tracer technique, Wyatt et. al. (1980) reported the maximum detectable rooting depth in southeastern Montana for desert wheatgrass was 76 cm and thickspike wheatgrass was 46 cm. Power et. al. (1981) reported desert wheatgrass grown on reclaimed mine soils in North Dakota extracted moisture to a depth of approximately 135 cm. They considered this to be an indicator of rooting depth.

Holechek (1982) evaluated root biomass of four species in a greenhouse and laboratory study conducted in southeastern Montana. In unfertilized conditions, the root/shoot ratios of desert wheatgrass were significantly higher than the root/shoot ratios of thickspike, fourwing saltbush or alfalfa. Hull (1962) evaluated root growth of desert wheatgrass on soils collected from sagebrush and shadscale soils from northwestern Utah. In a greenhouse study he reported desert wheatgrass had a very high root/shoot ratio of 2.00 on shadscale topsoil sand 1.55 on sagebrush topsoil.

Nicholas (1979) and McGinnies and Nicholas (1982) compared desert wheatgrass in a greenhouse study using topsoil and spoil from northwest Colorado. Using their 25 cm of topsoil over spoil data they obtained identical results to those reported by Holechek (1982) between thickspike and desert wheatgrass. Nicholas (1979) reported the desert wheatgrass root/shoot was 0.37 while the root/shoot ratio of thickspike wheatgrass was 0.40. She reported 33.11% of the total plant biomass was below the 25 cm depth for desert and 27.99% of the thickspike biomass was below this depth. Given the data of Wyatt et. al. (1980), Holechek

(1982) and Power et. al. (1981), it appears desert wheatgrass is superior in rooting to thickspike and hence Plateau feels justified in proposing this species for seeding on the topsoil stockpile.

Smooth Brome

The maximum reported rooting depth for smooth brome given by Wyatt et. al. (1980) was 76 cm. Nicholas (1979) reported of the 17 grass species she evaluated, smooth brome had the highest overall root/shoot ratio (0.87). Dayton (1937) reports roots of smooth brome commonly penetrate to depths of 5 feet or more. Nicholas (1979) reported the average root/shoot ratio of mountain brome was 0.37. Bauer et. al. (1976) reported on an area at the Baukol-Noonan mine in North Dakota, seeded to a mixture of alfalfa, sweetclover, intermediate wheatgrass, crested wheatgrass and smooth brome in October 1974 the following year root distribution was sampled to a depth of greater than 5 feet.

Plateau believes all available evidence suggests smooth brome is a deep rooting species that is ideally suited for planting onto the topsoil stockpile. In addition to its deep rooting system, its sod forming growth habitat are ideally suited to control erosion from this site. These characteristics justify its continued usage for inclusion into the Topsoil Stockpile Interim Seed Mixture.

Intermediate Wheatgrass

Plateau was unable to quantitive data on the rooting depth of this species in the literature. Nicholas (1979) reported this species ranked fourth of seventeen species using in a greenhouse study involving 25 cm of topsoil over spoil in terms of overall root/shoot ratio with a value of 0.75. She also reported the species ranked second of the seventeen species studied in terms of the amount of root biomass (40.15%) growing below the 25 cm topsoil layer into spoil. In another greenhouse study using similar materials from the same field site (McGinnies and Crofts, 1986) intermediate wheatgrass was found to have higher root/shoot ratios (1.29) in the unfertilized treatment than smooth brome (0.49) or slender wheatgrass (0.19). McGinnies and Nicholas (1982) reported intermediate wheatgrass produced the highest root yields of seventeen species tested on raw spoil.

Plateau submits the outstanding root growth characteristics of intermediate wheatgrass made this species an ideal species to seed on the topsoil stockpiles to maintain the viability of the soil biota. Plateau believes these characteristics are ample justification to continue to seed this important species on the topsoil stockpiles.

Pubescent Wheatgrass

Schafer et. al. (1979) confirmed pubescent wheatgrass roots growing to a depth of 46 cm. Nicholas (1979) reported the average root/shoot ratio of this species averaged 1.08 on spil (fourth highest) and 0.82 on topsoil over spoil (second highest). This species was reported to produce the second highest percentage of roots below the 25 cm depth (51%) on spil and the highest percentage of roots below the 25 cm depth on topsoil (44%).

Plateau suggests even though this species is commonly considered to be a shallow sod farming plant, this information documents it is an ideal candidate for reseeding on topsoil stockpiles. Plateau is of the opinion this documentation justifies its continued use as a revegetation species on the topsoil stockpiles.

Orchardgrass

Plateau was unable to obtain definite rooting depth information on this species. Nicholas (1979) reported the average root/shoot ratio (0.34) ranked tenth of seventeen species tested on raw spoil and fifteenth (0.51) on topsoil over spoil.

Plateau concedes this introduced species is probably the weakest rooting of the introduced species being proposed. Based upon data reported by Nicholas (1979) streambank wheatgrass appears to have a greater capability for root growth than does orchardgrass. Therefore, provided the Division approves, Plateau would be willing to directly substitute streambank wheatgrass for orchardgrass in Table 74.

Russian Wildrye

Rootings depths in excess of 105 cm were reported by Buckner (1985) from processed oil shale sites in wester Colorado for this species. Hull (1962) reported root/shoot ratios averages 1.66 on shadscale topsoils and 1.25 on sagebrush topsoils. Nicholas (1979) reported this species ranked third outof seventeen species on both raw spoil and topsoil over spoil in terms of root/shoot ratios. The species ranked third in terms of total root biomass on raw spoil and first in terms of root biomass into spoil below topsoil.

Plateau believes Russian wildrye is an outstanding rooting species and is ideally suited for reseeding onto the topsoil stockpiles to preserve active soil biota. These characteristics we feel justify the planting of this species at this site.

Alfalfa

Power et. al. (1981) documented rooting activity on alfalfa plots to a depth of 135 cm. Wyatt et. al. (1980) reported alfalfa rooting depths of 76 cm. Holechek (1982) reported unfertilized root/shoot ratios for alfalfa in the field averaged 0.99 for the green house study and 1.21 for the field study. The field rooting depth was reported to be 23.1 cm. Nicholas (1979) reported root/shoot ratios averaged 3.59 on raw spoil and 1.03 on topsoil over spoil. She reported 43% of the roots were found in spoil and 52.8% of the root in the topsoil over spoil treatment were found in the greater than 25 cm depth zone. The USDI-OSM (1983) summarized numerous rooting depth studies dealing with alfalfa. They reported root depths of upwards of 129 feet have been documented, but under dryland conditions, the bulk of alfalfa roots are usually confined to the upper 13 feet of soil.

Plateau believes alfalfa is the single most important species being proposed for planting onto the topsoil stockpiles. Its root/shoot ratios and amount of growth below 25 cm are greter than any of the grasses tested by Nicholas (1979). Since this species has been repeatedly approved by the Division in several pervious submittals and due to its excellent rooting characteristics, Plateau feels it is necessary to plant this species on this site.

Yellow Sweetclover

Plateau was unable to find technical literature quantifying the potential rooting depth of this species, but observations by Plateau's consultant in northwest Colorado indicate yellow sweetclover commonly roots to depths greater than 8 feet. Due to its similarity with alfalfa and the prior approval by the Division in previous permit submittals by Plateau, it is obvious a combination of deep rooted nitrogen fixing plants would improve the overall possibility of maintaining the biologic activity of stockpiled topsoil to a greater level than using a simple monoculture of alfalfa. Plateau respectfully submits that this is ample justification to include yellow sweetclover as a revegetation species in the Topsoil Stockpile Interim Seed Mixture.

Conceptually, the acceptance of native species and the exclusion of introduced plant species in a reclamation seed mixture has been a source of great concern by both the regulatory agencies and by industry. Monsen, in a paper titled "Selecting Plants To Rehabilitate Disturbed Areas", Improved Range Plants Symposium, Society for Range Management, 1975, Denver, Colorado, made reference to the issue of introduced species versus native species. He states that "in contradiction to the premise of native plant superiority, several introduced shrubs are showing promise on Idaho ranges," with "some plantings approaching 20 years of age." He makes reference to erosion control with this statement:

> "Exotics like smooth brome (Bromus inermis) and intermediate wheatgrass (Agropyron intermedium) greatly improve the ground cover and reduce erosion when planted on disturbed ponderosa pine-

bunchgrass habitat types. Although native grasses, bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis), and the grasslike elk sedge (Carex geyeri) are capable of reestablishing, they do not provide the desired soil protection that exotics supply."

Also, that "the range of adaptation of a plant is difficult to predict, particularly for sites that have been dramatically disturbed, exotics can significantly aid revegetation". Numerous field trials have demonstrated that the introduced species can establish a diverse, effective, and permanent cover, and to control erosion.

In general, introduced species have been documented as being superior for forage and erosion control. This is reflected in the fact that they have been introduced, tested, propagated, and used extensively in pasture and range improvements. Various researchers have demonstrated the desirability of introduced species under wildland conditions. Some of these studies are as follows:

Colorado State University (1974) recommends desert wheatgrass, hard fescue, intermediate and pubescent wheatgrasses, Russian wildrye, and smooth brome for seeding the mountain browse type in Colorado. The species recommended by Hull, et. al. (1952) for reseeding the mountain brush type include desert, pubescent, and intermediate wheatgrasses, hard fescue, smooth brome, Russian wildrye, alfalfa, and orchardgrass.

McGinnies, et. al. (1963) working on rangeland two miles south of Hayden, Colorado, reported that 15 species were planted in a test plot in 1945 and evaluated until 1958. The most outstanding species on the plot was pubescent wheatgrass followed by intermediate wheatgrass. These species produced the greatest amount of soil protection and forage. Desert wheatgrass was the next best species.

Beardless wheatgrass was inferior in initial establishment, but appeared to be improving. Species performing fair to poor included green needlegrass, big bluegrass, and western wheatgrass. Species considered failures were tall wheatgrass, stiffleaf wheatgrass, blue wildrye, and short-awned barley.

Working on disturbed soils at Axial Basin, Colorado, Draves and Berg (1978) reported the results of 24 grass and 16 forb species. Of the 24 species planted, second highest plant cover was produced by intermediate wheatgrass, pubescent wheatgrass ranked fourth, smooth brome ranked fifth, and desert wheatgrass ranked fourteenth. Of the forbs, alfalfa produced the highest plant cover. Cicer milkvetch also produced an abundance of cover. These two forbs are included in the proposed seed mixture because native legumes cannot be expected to provide adequate erosion control and forage production.

After four growing seasons, Sim (1977) reported the results of 25 grass and 19 forb species seeded on test plots in the Piceance Basin. The best producing grass was pubescent wheatgrass, the third best was meadow brome, fourth best intermediate wheatgrass, seventh best was desert wheatgrass, ninth best was smooth brome. Timothy ranked 21st. Among the legumes, alfalfa ranked second, while cicer milkvetch ranked fifth.

Merkel, et. al. (1974) reported that of ten species planted at Meeker SCS Plant Material Center, the best performing species were intermediate and pubescent wheatgrasses. The western wheatgrass of the native species planted could be considered successful.

Upon evaluation the establishment of various plants seeded on unleveled spoils at the Seneca Mine, Berg (1975) found that of the species planted, orchardgrass produced the highest frequency based upon the amount of seed planted. Following orchardgrass, in descending order, were desert wheatgrass, smooth brome, and alfalfa.

Additional field trials by the SCS and Energy Fuels on Energy Mine No. 1 at an elevation of 7,500 feet and 16 inches of annual precipitation, found the species most suitable for erosion control on reclaimed lands were meadow brome, smooth brome and intermediate wheatgrass. Cicer milkvetch also performed exceptionally well.

As concluded in the above cited reports, the best soil stabilization from reseeded plants is produced by introduced species. These species control erosion better because they are better able to establish themselves under adverse conditions, provide more rapid growth and also provide a more dependable early plant cover than the slower developing native species. These same reports also document that, unlike some of the recommended native species, introduced species have a longer life span, are able to reproduce more efficiently, and are better able to provide permanent vegetation. Once the introduced species have established themselves, the native species will have a more stable environment in which to grow and where plant succession can occur.

Almost all introduced species are deemed desirable from a range seeding and wildlife management standpoint in as much as the introduction, development and subsequent use of these species was based on their superiority. Nutritional value of introduced species for livestock and wildlife are well documented. Mule deer preferences for intermediate wheatgrass, desert wheatgrass, orchardgrass, timothy, brome grass, alfalfa, and milkvetch are documented by Kufeld, et. al. (1973). Elk preferences are reported by Kufeld (1973) to include desert wheatgrass, timothy brome, alfalfa, milkvetch, and small burnet. Plummer, et. al. (1968) report that studies in Utah have shown big game prefer alfalfa, small burnet, desert wheatgrass, intermediate wheatgrass, pubescent wheatgrass, smooth brome and orchardgrass.

Livestock forage preference for the proposed introduced species has been documented by Marquiss, et. al. (1974). Palatability ratings in order of descending preferences were: smooth brome, intermediate wheatgrass, pubescent wheatgrass, desert wheatgrass, western wheatgrass and beardless wheatgrass.

In a study spanning almost 30 years in which some 127 species of grasses were planted, Gomm (1969) documents the livestock preferences for introduced species. He concluded his studies with the following statement: "Generally the introduced species have been more palatable than the native in areas where range seeding is a common practice."

The nutritional value of introduced species is predictable and is largely independent of geochemical changes resulting from disruption of the topsoil and overburden. Cook and Harris (1950) state that: "environmental factors and soil moisture are more important in determining the nutrient content of range forage plants under various site conditions than the chemical content of the soil...". Reclaimed vegetation quality, as reported by DePuit, et. al. (1977) was found not to differ significantly from that occurring on undisturbed sites.

It is the opinion of PMC that the introduced plant species, Regar meadow brome, is important to the integrity of the reclamation plant community in terms of effective erosion control. PMC plans to continue the use of this introduced species in reclamation activities.

Meadow brome was introduced to the United States from southwestern Asia. The variety "Regar" was released cooperatively by Idaho and Washington Agricultural Experiment Stations and the SCS in 1966. It has been reported by the University of Wyoming (U of W Agriculture Experiment Station, publication B-621, May 1975, Guidelines For Seeding Range Pasture And Disturbed Lands) that Regar meadow brome would "do well at any location in Wyoming where precipitation exceeds 15 inches". Regar is further described in the University of Wyoming, Agricultural Experiment Station publication B-608, 1974, Dryland Grass Variety Trials In Wyoming, as a rapidly germinating seed with good seedling establishment. Favorable characteristic is given as its ability to recover quickly from grazing. It is predominantly basal with weak rhizomes which causes it to be slow and to become sod-bound.

Regar meadow brome is described by SCS (SCS-TP-157, 1982, Plant Materials For Use On Surface-Mined Lands In Arid And Semi-Arid Regions) as becoming rapidly established, dominantly basal leaves and an excellent forage plant. SCS recommends it for use in the Northern Great Plains, Northern and Central Rocky Mountains, and the Intermountain Regions. In the Colorado State University Agricultural Experiment Station Bulletin 73, 1963, A Summary Of Range Grass Seeding Trials In Colorado, meadow brome was rated as "excellent" thirteen years after seeding at the Manitou Experimental Forest. Elevation at the station is 7,000 feet and the annual precipitation is 16 inches. It was also given a rating of "excellent" after nine years at a site in southern Colorado where it was planted at an elevation of 8,000 feet with 20 inches of annual precipitation. At two other sites in Colorado, both at an elevation of 7,500 feet and 12 inches of annual precipitation was rated "fair" and "excellent" nine years after seeding. It appears that it is well suited for medium and higher elevation sites with good soil moisture, such as the Douglas fir or aspen type. Based on intensive trials conducted in Ephraim Canyon for the Utah State Division of Fish and Game and the USDA, Intermountain Forest and Range Experiment Station by A. Perry Plummer and others (Restoring Big Game Range in Utah, Pub. No. 68-3, Utah Division of Fish and Game) meadow brome is recommended for the aspen and associated conifer vegetation types.

The objective of all of the proposed seed mixtures is to supply sufficient cover to stabilize the site and to control erosion. Meadow brome is included in the seed mixture because of its quick initial cover and regrowth following grazing which along with its spreading growth form, which makes it necessary for erosion control while the trees and shrubs become established. It meets the requirements of UMC 817.112 as described above.

The topsoil interim seed mixture closely follows the mixture proposed by Plummer et. al. (1968) for the saltbush plant communities. Desert wheatgrass is included in this mixture because it is so well adapted to critical area stabilization and has been previously used with UDOGM's approval for this specific purpose. Baseline inventories also demonstrate that this species was a common component of certain predisturbance communities prior to mining disturbance.

Various other researchers have found that the same species do well in revegetating the saltbush vegetation type. Bleak (1965) found that in a heavy clay loam derived from Mancos shale, that a "very good stand of crested wheatgrass persisted" for 17 years after seeding in the shadscale zone at Cisco in eastern Utah. He also reported that out of 121 species tested at Cisco, Thompson, Castle Dale, Buckhorn Flat, fair to good stands of crested fairway, intermediate pubescent wheatgrasses, Russian wildrye and squirreltail on all sites...".

On a site near Ely, Nevada, Bleak reported that of the 25 species planted, crested wheatgrass and Russian wildrye did the best. He also found that, "Selection of adapted species was difficult. Seed of native grasses and shrubs collected on one site in the shadscale zone and planted on another site perished...", and that, "variation of native species was often pronounced over relatively small distances." He commented that "introduced grasses and forb species exhibited variation in physiology." He concluded that "direct planting of both introduced and native species usually failed. Good seedling stands usually were obtained with the wheatgrasses, but most plants perished during the first summer. A few plants of the introduced crested wheatgrass, Siberian wheatgrass, and Russian wildrye maintained stands for 10 or more years".

Hull (1962) reported that "crested wheatgrass and Russian wildrye produced significantly more root growth than the other species tested". They were exceeded only by fourwing saltbush in the amount of top growth produced. Hull (1963) found that on 18 salt desert shrub areas in Wyoming, 14 species were experimentally seeded, Russian wildrye was the best with crested wheatgrass only slightly inferior. He stated that "other species either failed or were reduced to very poor stands".

The other two introduced species, alfalfa and small burnet are included because of the need to at least attempt to get a legume established. These species are recommended by Plummer (1968) for revegetating this vegetation type. It is reasoned that with the higher precipitation that is received on this particular site that these and the other species in the mixture will respond to the more favorable conditions and become established.

Additional long term species evaluations on reclaimed sites at Emery in the salt desert shrub zone and at several sites in the pinyon-juniper zone near Alton have confirmed the findings reported elsewhere from the western states. Ferguson and Frischnecht (1985) reported that at the Emery site among the best performing species evaluated after six years of growth included crested wheatgrass and Russian wildrye. At the Alton sites, drylander alfalfa was the most outstanding species tested. Smooth brome, small burnet, tall wheatgrass, and cicer milkvetch were among the most outstanding species tested and were recommended for seeding in similar sites.

The normal periods for seeding in the area of the PMC Permit Area are either spring or fall. Spring time plantings are made as soon after snowmelt as possible and prior to the drier summer season. Fall plants can be made anytime after the fall frosts arrive and until snowfall makes it difficult to operate. In this light, fall plantings can realistically be made anytime during the winter provided there exists a good likelihood of the seed being adequately covered and the ground is not frozen.

Whenever possible all reclaimed areas will be seeded as contemporaneously as practicable with regrading operations. No current plans exist to seed temporary cover crops in any of the reclamation plans at PMC.

In addition to the planting of seeds, several areas will be transplanted using commercially grown tree and shrub seedlings. The Mudwater Canyon Fan Site will receive a total of 350 plants per acre of 2-0 Engleman Spruce and 2-0 Intermountain Douglas Fir to satisfy USFS and USGS stipulations. The Corner Canyon Fan Site will be transplanted with the currently approved shrub density standard submitted by PMC. The target shrub density of 900 plants or shrubs per acre on all south and west facing slopes and 2,200 plants or shrubs per acre on north and east facing slopes. Justification for these standards can be found in Exhibit 45, Shrub Standard Justification.

This standard is based on the woody plant densities found on the Topsoil Reference Area which was established under the field supervision of DOGM in order to determine the reclamation success standards for the Refuse Pile Expansion Area. The location of the reference area is shown as the Pinyon-Juniper Reference Area on Map 34, Disturbed Area Vegetation-Sheet 6. A summary of the data is included in the current submission as data relating to the Pinyon-Juniper Area found in Table 38, Pinyon-Juniper West Aspect Reference Area Woody Plant Density.

Spatial distribution of the woody plants will be random across the landscape with the exception of clump planting of seedlings and mature shrubs and trees in the central area of the refuse pile. Mature transplants, composed of serviceberry and young pinyon pine and Utah juniper may be transplanted using a front-end loader. The hand planted seedlings will be composed of serviceberry, curlleaf mountain mahogany, Utah juniper, golden currant, and mountain big sagebrush. Clumps will occupy approximately 225 square feet and will be arranged randomly about 150 feet apart and placed no further than 400 feet from the upper slope of the refuse pile. The purpose of the clumps and their position relative to the outslopes is to provide security and escape cover for large game animals that use the area.

Seedlings of reclaimed sites will be accomplished using both drill and broadcast methods. Where shrub seeds are to be drilled, PMC will attempt to plant them in a separate application in drill rows that diverge with those of the grasses. By planting the shrubs in the interspaces between grass rows, competition between grasses and shrubs will be reduced and shrub establishment should be enhanced. At the estimated establishment rate of one shrub per 1,000 PLS (personal communication with DOGM), the previously approved seed mixture should produce approximately 1,291 shrubs per acre. This figure should significantly be increased where shrubs are seeded separately from grasses or where all seeds are broadcasted.

If during the monitoring of the revegetated sites, a deficiency in the woody plant performance standard is observed, PMC will confer with DOGM regarding the need to implement corrective action. At the present time, PMC does not foresee a need to implement additional plantings if the proposed woody plant density standard for shrubs appears not likely to be achieved with the suggested plan. Due to the problems with restarting the bonded liability period and certainty associated with the State regulations being changed to coincide with the recent Federal regulatory changes, PMC does not believe it is wise to propose additional shrub plantings. If monitoring shows a deficiency with respect to the proposed standard, then PMC will immediately initiate a grazing management plan to increase shrub densities to an acceptable standard. Extensive research exists for central Utah which documents that grazing management can easily be used to manipulate shrub densities. In view of the dangers associated with restarting the liability period, PMC proposes managed grazing as the primary means to supplement transplanted and seeded shrub densities.

Transplants will be made using commercially grown planting stock propagated from seeds or cuttings known to be adapted to this area.

(iv) MULCHING TECHNIQUES;

RESPONSE:

Numerous test plots have been constructed by PMC since 1980 to evaluate various aspects of the reclamation program. The location of each of these test plots is shown on the three sheets of Map 34, Disturbed Area Vegetation.

Studies completed by PMC to satisfy various agency and company concerns include: the 1980 Native Plants Test Plots, the 1982 Mulch Study Plots, the 1982 Refuse Study Test Plots, and the 1982 Wildlife Mitigation Study Area.

1980 Native Plants Test Plots

These were the first series of test plots established by PMC. They were established in October, 1980 at three sites: on the refuse pile, in the barrow area adjacent to the overland conveyor and on the steep fill slope immediately south of the Lion Deck Office. The experimental design of these studies was previously submitted to the Division as Appendix 9B, Test Plot Experimental Design, found in Volume III of Permit ACT/007/006. The basic treatments involved seeding various rates of grass, forbs and shrubs, shrub transplanting techniques and mulching practices.

First growing season results were presented in Appendix 91, Experimental Test Plot Studies at Star Point Mine, Wattis, Utah, found in Volume III of Permit ACT/007/006.

Third growing season results from these plots were collected by Getty Mining Company personnel in July of 1983. All plots were evaluated with the exception of the Refuse Test Plot which had been destroyed due to expansion of the Refuse Pile. A complete summary of the 1983 data was presented to DOGM in PMC's 1983 Annual Reclamation Report.

Fourth year growing season results from these plots were collected during July of 1984 and presented to DOGM in PMC's 1984 Annual Reclamation Report. Fifth year results were collected in July and August of 1985. These monitoring results were submitted to DOGM in the 1985 Annual Reclamation Report. Based upon plot trends, PMC requested permission in the 1985 Annual Reclamation Report to discontinue monitoring these plots. DOGM approved PMC's request to discontinue monitoring these plots in June of 1986.

1982 Roadside Mulch Study Plots

In March of 1982, PMC implemented a mulching study on an extremely unstable road cut along the Lion Deck Portal Access Road. First year seedling density counts were collected on July 7, 1982. This data was submitted to DOGM as part of PMC's 1982 Annual Reclamation Report.

Second year results from the Mulch Study Plots were collected in July 1983 and submitted to DOGM in PMC's 1983 Annual Reclamation Report. Due to the unstable nature of the test site and high degree of soughing that had destroyed many of the plots, PMC discontinued sampling the Mulch Study Plots after the 1983 monitoring.

1982 Wildlife Mitigation Area

To satisfy BLM, UDWR and DOGM concerns relative to the Refuse Expansion and Unit Train Loadout, PMC treated a stand of Pinyon Juniper to enhance wildlife forage production. A detailed discussion of the treatments utilized and first year results are presented in PMC's 1983 Annual Reclamation Report.

Second and third year monitoring results are presented in PMC's 1984 and 1985 Annual Reclamation Reports. The Wildlife Mitigation Area was not monitored in 1986 because it did not need to be monitored during the fourth growing season as per the monitoring schedule negotiated with DOGM in May of 1986. PMC anticipates future monitoring of the area will be made according to the monitoring schedule presented in current response to UMC 784.13(a)(5)(vi).

1982 Refuse Study Plots

PMC initiated an extensive test plot study during the fall of 1982 on a completed portion of the refuse pile to obtain site specific information on the type, depth and fertility requirements of various plant growth mediums. A detailed experimental plan is presented in PMC's 1983 Annual Reclamation Report.

First year monitoring results from these test plots were presented in PMC's 1983 Annual Reclamation Report. Third year results were submitted in PMC's 1985 Annual Reclamation Report. Fourth year results will be submitted to DOGM in PMC's 1986 Annual Reclamation Report.

PMC anticipates monitoring the Refuse Test Plots according to the monitoring frequencies agreed upon during the permitting of the Unit Train Loadout. This monitoring schedule agreed to and summarized in a letter from PMC dated April 23, 1985 states PMC would sample the Refuse Test Plots during years 1, 2, 3, 4, 5, 7 and 10, unless the Division and PMC mutually agreed to modify this sampling schedule. PMC continues to abide by the schedule with the exception of the straight coal refuse plots which will be sampled only in years 5 and 10 as approved by the DOGM in a June 3, 1986 letter to PMC. Plateau discontinued the sampling of slope segments in 1986 based upon approval from the Division that this sampling was not yielding meaningful data. Future sampling of the refuse test will not be done according to slope segments as negotiated with the Division for the 1986 Sampling Program.

Two previous mulching studies have been implemented by PMC to test the effectiveness of various kinds and application rates of mulches. In 1980, native plants established three test plot areas to compare the effectiveness of mulching on plants. Results from this study have been presented to DOGM on two separate occasions, originally in 1981 as Appendix 9I in the existing permit application and in the 1983 Annual Reclamation Report. First year results presented in 1981 demonstrated that mulching was not consistent or justified based upon first year data.

Third year results presented in the 1983 Annual Reclamation Report indicated overall mulching was documented as having a detrimental effect on plant legume establishment, native plant succession and species diversity. Higher exotic plant densities were in all cases associated with mulched sites.

During the Spring of 1982, PMC established another mulching study on a steep road cut on the Lion Deck Access Road. Monitoring results for these plots were presented to DOGM in 1982 and 1983. Since this regulation specifically states that mulching is necessary to control "air and water pollution" and since extensive documentation is available to demonstrate that "air and water pollution" are always more serious immediately following site disturbance, PMC believes that the available monitoring data is adequate to address the validity of mulching as an effective means of erosion control. Monitoring results from both 1981 and 1983 document that significantly higher plant establishment was associated with the unmulched sites. Since plant cover is responsible for controlling erosion, PMC believes that ample site specific evidence is available to demonstrate that mulching is not necessary for adequate soil stabilization. Also, PMC received various letters in 1981 from DOGM questioning the desirability of applying hydromulch to these arid sites. Given this site specific monitoring data and numerous recently issued approvals by OSM to discontinue mulching, PMC requests approval to discontinue mulching as a standard practice on all reclaimed areas.

All areas that are drill seeded or dragged with a harrow or drag chain to assure adequate seed coverage will not have an organic mulch applied whenever conditions allow. Stabilization practices to be employed on these areas will consist of a combination of treatments involving chisel plowing or shallow ripping. Whenever possible, final regrading and the respreading of topsoil will be conducted parallel to the contours in such a manner that the recontoured landscape is left in a rough condition to minimize slippage and erosion. Grading will also be conducted in such a way that small depressions or pits are conducted to aid in moisture retention. Contour furrows will be constructed, whenever possible, to reduce runoff and enhance moisture infiltration and plant growth. Whenever conditions allow, these sites will then be drill seeded or broadcast seeded and harrowed or dragged on the contour to minimize the potential of erosion and rilling.

On areas that cannot be drill seeded or broadcast seeded and dragged, mulch in the form of a weed free straw, native hay mulch, wood fiber or a planted annual grain or other commonly used organic mulches will be applied. Application of organic mulches will be applied at a rate of approximately 2,000 pounds of mulch per acre. When annual grains are seeded as mulch, they will be planted at the rate of approximately 20 pounds pure live seed per acre.

Mulching may be used for critical site stabilization where stabilization poses a potential problem. If mulching is necessary, PMC will apply weed free straw mulch, native hay mulch or wood fiber hydromulch at a rate of 2,000 pounds per acre.

Following mulch application and where the potential exists for the mulch to be either washed or blown away, an acceptable tackifer will be applied. As the slope allows, the hay or straw mulches will be anchored to the site through disking, crimping or ripping.

Annual grains have been seeded in connection with almost all reclamation seeding made since 1980 at PMC. PMC believes that experience gained from these plantings and specifically the Roadside Mulch Plots established in 1982 amply document the desirability of using annual grains as a mulch. Due to the need to establish a rapid vegetative cover and to incorporate organic matter into the soil, these species are unsurpassed. Therefore, PMC proposes to seed annual grains (rye, oats, barley or other suitable species will be used as a mulch jointly with the perennial mixture. Mulch applied in this manner will be planted at the rate of 20 pounds pure live seed per acre or approximately 7 pure live seeds per square foot.

PMC submits that since prior regulatory approval for this practice has been granted and since the species being planted have never been documented to reseed in subsequent years, perennial species approved for the postmining land use will eventually dominate the site, usage of these species is totally consistent with this section.

A detailed discussion of mulching is presented in Exhibit 40. As indicated in the review in the articles by Jacoby 1969, May et.al. (1971)

Hodder et.al. (1972) and Kay (1982) mulches cannot provide landscape stability and were never intended to, regardless of how well people expect them to perform. PMC recognizes that the sloughing occurred on this site, it was specifically selected because it is one of the most difficult sites present on the mine site. PMC is uncomfortable with the Division's statement that "these problems indicate that neither mulch nor the absence of it is sufficient to stabilize Star Point's steep road cuts". This statement strongly infers that PMC cannot successfully reclaim the steep road cuts at this site. This inference is contrary to extensive monitoring data collected continuously at PMC since 1982. The monitoring data from this specific area when based upon a more random and larger sample size, clearly documents that as a whole, these areas can be successfully reclaimed. Monitoring data from this area collected in 1985 (Page 6, 1985 PMC Annual Reclamation Report) and yet to be submitted 1986 monitoring data clearly document that using the cover and production revegetation success criteria in this area of "steep road cuts" would presently qualify for bond release. PMC believes that the overall picture must be considered when examining this issue and not a worst case scenario as seemingly was suggested by the Division.

Other than tackifers that may be applied to stabilize straw or hay mulch, PMC does not propose to apply any chemical soil stabilizers in conjunction with any other mulching agents.

(v) IRRIGATION, IF APPROPRIATE, AND PEST AND DISEASE CONTROL MEASURES, IF ANY;

RESPONSE:
PMC has no plans to use irrigation in the revegetation of any areas proposed for reclamation in the PMC Permit Area. Past experience with reclamation has not encountered a need to implement pest and disease control measures to achieve successful reclamation and at the present

time, no such need is anticipated. In the event that such a need develops to control pest or disease, PMC will contact the Utah State University Extension Office for appropriate treatment measures. Upon receipt of proposed control measures, PMC will send appropriate notification to DOGM.

(vi) MEASURES PROPOSED TO BE USED TO DETERMINE THE SUCCESS OF REVEGETATION AS REQUIRED IN UMC 817.116; AND

RESPONSE:
The successfulness of past and future revegetation efforts will be monitored according to the following schedule:

YEARS FOLLOWING SEEDING	PARAMETERS TO BE MONITORED
1	seedling density and establishment
2	cover and shrub density
3	cover and shrub density
5	cover and shrub density
9	cover, shrub density and production
10	cover, shrub density and production

Sampling techniques will be similar to those previously utilized by PMC during the past four years or as concerns change other suitable techniques approved by DOGM prior to sampling. Reclaimed areas will not be sampled to satisfy sampling adequacy requirements until years 9 and 10 of the reclaimed areas are monitored. The results of annual monitoring will be submitted to DOGM annually. If changes to this monitoring program are deemed necessary, PMC will initiate such requests in the Annual Reclamation Reports.

It is currently PMC's intention to utilize established reference areas as the basic means of determining revegetation success with respect to cover and production. Reference area standards for woody plant density will generally not apply to reclaimed areas. The woody plant standard for the Corner Canyon Fan Site Reference Area will apply to the

0.44 acres to be reclaimed at this site. The revegetation success standard for the Mudwater Canyon Fan Site will not be based on a reference area standard. The USFS and USGS stipulations for this area mandates the woody plant density is 350 trees per acre and herbaceous ground cover be equal to at least 50 percent. The production revegetation success standard for the Mudwater Canyon Fan Site will be the SCS and/or USFS range site production standard for this specific site.

The revegetation success standard for woody plant density for all areas disturbed from the Refuse Expansion and Unit Train Loadout areas westward to the Lion Deck Portal will be covered by the previously approved woody plant density. This woody plant density sets the target density of 900 plants per acre on all south and west facing slopes and 2,200 stems per acre on all north and east facing slopes. Map 73, Revegetation Plan correlates all areas to be disturbed to the proposed revegetation success standard. Justification for these shrub density standards can be found in Exhibit 45, Shrub Standard Justification.

(vii) A SOIL TESTING PLAN FOR EVALUATION OF THE RESULTS OF TOPSOIL HANDLING AND RECLAMATION PROCEDURES RELATED TO REVEGETATION.

RESPONSE:

Past sampling of nearly 150 soil samples have established physical and chemical characteristics of the soil materials in excess of the 90 percent level of probability. The nutritive characteristics of the soils proposed for reclamation in the PMC Permit Area. Since this level exceeds current regulatory sampling requirements, additional soils sampling is unnecessary. Therefore, PMC proposes to forgo additional future sampling and apply soil nutrients according to the levels recommended in DOGM Soils Guidelines. Nitrogen and phosphorus will be applied at the rates previously discussed.

(6) A DESCRIPTION OF THE MEASURES TO BE USED TO MAXIMIZE THE USE AND CONSERVATION OF THE COAL RESOURCE AS REQUIRED IN UMC 817.59;

RESPONSE:

Maximum resource recovery has always been and will continue to be a goal of PMC. Coal seams will be mined to a minimum thickness of five feet which is the lower limit for continuous mining equipment currently in use. The longwall method (equipment currently in use) can mine to a minimum seam thickness of 6½ feet.

Mining sequences have been established by seam to extract the uppermost seam prior to the underlying economic coal beds. This method will prevent damage to overlying coal seams permitting maximum recovery of the resource, safety of operation and protection of the environment.

Longwall methods will be used whenever possible to extract the coal resource. This method allows high resource recovery and is a full recovery method. Room and pillar mining will be used when the longwall method is not feasible. PMC generally practices "full pillar recovery" whenever possible. PMC has also rehabilitated some older sections of the mine which were not fully recovered. This practice, which is more costly than producing from virgin areas, has produced a sizable quantity of coal which may not have been recovered under most circumstances.

PMC will endeavor to use modern mining methods and techniques to recover the highest percentage of inplace coal reserves possible. PMC will continue to follow sound engineering principles and sound mining practice.

Copies of approval letters from MMS and USGS approving PMC's Resource Recovery and Protection Plan can be found in Exhibit 39, Resource Recovery and Protection Plan Approvals.

(7) A DESCRIPTION OF MEASURES TO BE EMPLOYED TO ENSURE THAT ALL DEBRIS, ACID-FORMING AND TOXIC-FORMING MATERIALS, AND MATERIALS CONSTITUTING A FIRE HAZARD ARE DISPOSED OF IN ACCORDANCE WITH UMC 817.89 AND 817.103 AND A DESCRIPTION OF THE CONTINGENCY PLANS WHICH HAVE BEEN DEVELOPED TO PRECLUDE SUSTAINED COMBUSTION OF SUCH MATERIALS;

RESPONSE:

Coal waste from the washing plant and long-term storage coal is transported by truck from the plant to the disposal and storage areas shown on Map 44, Surface Facilities-Sheet F-12. It is deposited on the surface of the pile and then spread in layers less than 2 foot thick to prevent gravity segregation (a primary source of spontaneous combustion). Travel of trucks, dozers and rubber tired heavy equipment over this surface compacts the material sufficiently to reduce air circulation, alleviating the danger of spontaneous ignition. Side slopes are maintained in compliance with regulations. A more detailed description of the waste pile procedures is contained in the response to UMC 784.11(b)(4).

The coal and waste piles are monitored on a regular basis. In the event that routine monitoring and inspection reveals hot spots in the material, that material will be excavated, removed to a safe place, and spread out to stop further heating.

Noncoal materials such as paper, used oil, wood, trash and discarded conveyer belting are collected routinely, transported to a central collection area and periodically removed by a contracted disposal service.

Diesel fuel and gasoline are stored in tanks with capacities of 10,000 gal (4), 4,000 gal (1), 2900 gal (3), 1000 gal (1), 500 gal (1) and 275 gal (1). In addition, two tanks are used to store used motor oil at the mine shop, these tanks have capacities of 550 gals. and 260 gals. The tanks are located and positioned so as not to affect any mine slope or shaft opening. The storage tanks are protected from corrosion by cathodic coat protection or other effective methods considered most compatible with existing soil conditions. The tanks are regularly inspected to ensure no leakage into the surrounding soil.

Buildings and structures are protected against fire by the location of adequate numbers, sizes, and types of fire extinguishers in compliance with regulations. Water is available from the surface water distributing system.

(8) A DESCRIPTION, INCLUDING APPROPRIATE CROSS-SECTIONS AND MAPS, OF THE MEASURES TO BE USED TO SEAL OR MANAGE MINE OPENINGS, AND TO PLUG, CASE

OR MANAGE EXPLORATION HOLES, OTHER BORE HOLES, WELLS AND OTHER OPENINGS WITHIN THE PROPOSED PERMIT AREA, IN ACCORDANCE WITH UMC 817.13 -817.15; AND

RESPONSE:

PMC will notify the Minerals Management Service of the BLM prior to the sealing of mine openings and holes to arrange an on-site inspection. The following sealing procedure will be appropriately updated if changes occur in the next 20 years.

Upon abandonment of drilling operations, all drill holes, except those to be left open for monitoring, are to be cemented with an approved slurry. The slurry mixture will consist of 5.2-5.5 gallons of water per bag of cement. An appropriate slurry device will be lowered to the bottom of the hole and sufficient slurry pumped through the device to fill 200 ft. The device will then be raised 200 ft. and the process repeated. The holes will be completely plugged from the bottom to within 3 ft. of the collar in this manner. A monument will be erected over sealed holes.

Shafts will be filled from bottom to collar with noncombustible material. A cap consisting of a 6 in.-thick reinforced concrete slab will be used as a seal. The cap will be equipped with a 2 in.-diameter vent pipe and will extend for a distance of 15 ft. below the surface of the shaft collar.

Seals will be installed in all portal entries as soon as mining is completed and the mine is to be abandoned. The seals will be located at least 25 ft. inside the portal mouth. Prior to installation, all loose material within 3 ft. of the seal area will be removed from the roof, rib, and floor. The mine portal seals will be made of solid concrete blocks (average minimum compressive strength of 1,800 lbs/in^2 tested in accordance with ASTM C140-70) and mortar (1 part cement, 3 parts sand, and no more than 7 gal. of water per sack of cement) to form a wall two blocks thick.

Seals will be installed in the following manner: The seal will be recessed at least 16 in. deep into the rib and 12 in. deep into the floor. No recess will be made into the roof. The blocks will be at least 6 in. high, except in the top course, and 8 in. wide. The blocks will be laid and mortared in a transverse pattern. In the bottom course, each block will be laid with its long axis parallel to the rib. The long axis in succeeding courses will be perpendicular to the long axis block in the preceding course. An inter-laced pilaster will be constructed in the center. The seals will have a total thickness of 16 in. Where conditions permit, the portal seals will be backfilled and graded to conform with existing surface contours and planted. In those instances where sizable highwalls established in preparing the portal site cannot be returned to original contours, the opening in front of the wall will be filled with noncombustible material as above, and the portal and entire exposed seam on the highwall will be covered with 6 to 8 ft. of noncombustible material, graded, covered with suitable material, and seeded. For illustration of a typical seal, see Figure 20, Typical Permanent Entry Seal Design. The following portal areas will be sealed upon final reclamation: Lion Deck, two portals; Mudwater Canyon, seven portals; Corner Canyon, three portals; Portal Area No. 2, two portals.

Temporarily inactive mine entrances will be fenced or barricaded to prevent access. Any other measures deemed necessary by PMC to protect humans, wildlife, and livestock will be utilized. Signs will be posted warning people of hazards associated with these openings. These protective measures will be inspected periodically and maintained in a functional condition.

Boreholes retained during operation of the mine for water monitoring wells will be temporarily sealed by providing them with security devices. These devices will be either locking caps or the top of the well will be enclosed in a manhole which is locked, bolted, or covered with soil to disguise its location.

For final reclamation, monitoring wells will be sealed from bottom to top.

(9) A DESCRIPTION OF STEPS TO BE TAKEN TO COMPLY WITH THE REQUIREMENTS OF THE CLEAN AIR ACT (42 U.S.C. SEC. 7401 ET SEQ.), THE CLEAN WATER ACT (33 U.S.C SEC. 1251 ET. SEQ.), AND OTHER APPLICABLE AIR AND WATER QUALITY LAWS AND REGULATIONS AND HEALTH AND SAFETY STANDARDS.

RESPONSE:

PMC has and will continue to make every effort to comply with requirements of the Clean Air Act, the Clean Water Act, and the laws pertinent to this section. The information presented in response to UMC 784.14 in this permit renewal application will describe how the hydrologic resource will be protected. NPDES permit UT-0023736 will continue to be in effect for the PMC operations. The information presented in response to UMC 784.26 will describe how air quality will be maintained. The applicable air quality permit issued by the Utah State Department of Health will be maintained and PMC will endeavor to comply with these permits.

(9) A DESCRIPTION OF STEPS TO BE TAKEN TO COMPLY WITH THE REQUIREMENTS OF THE CLEAN AIR ACT (42 U.S.C. SEC. 7401 ET SEQ.), THE CLEAN WATER ACT (33 U.S.C SEC. 1251 ET. SEQ.), AND OTHER APPLICABLE AIR AND WATER QUALITY LAWS AND REGULATIONS AND HEALTH AND SAFETY STANDARDS.

RESPONSE:

PMC has and will continue to make every effort to comply with requirements of the Clean Air Act, the Clean Water Act, and the laws pertinent to this section. The information presented in response to UMC 784.14 in this permit application will describe how the hydrologic resource will be protected. NPDES permit UT-0023736 will continue to be in effect for the PMC operations. The information presented in response to UMC 784.26 will describe how air quality will be maintained. The applicable air quality permit issued by the Utah State Department of Health will be maintained and PMC will endeavor to comply with these permits.

 Revised 4/15/87

UMC 784.14 RECLAMATION PLAN: PROTECTION OF HYDROLOGIC BALANCE

(a) EACH PLAN SHALL CONTAIN A DETAILED DESCRIPTION, WITH APPROPRIATE MAPS AND CROSS-SECTION DRAWINGS, OF THE MEASURES TO BE TAKEN DURING AND AFTER THE PROPOSED UNDERGROUND COAL MINING ACTIVITIES, IN ACCORDANCE WITH UMC 817, TO ENSURE THE PROTECTION OF:

(1) THE QUALITY OF SURFACE AND GROUND WATER, BOTH WITHIN THE PROPOSED MINE PLAN AREA AND ADJACENT AREAS, FROM ADVERSE EFFECTS OF THE PROPOSED UNDERGROUND COAL MINING ACTIVITIES;

(2) THE RIGHTS OF PRESENT USERS TO SURFACE AND GROUND WATER;

(3) THE QUANTITY OF SURFACE AND GROUND WATER BOTH WITHIN THE PROPOSED MINE PLAN AND ADJACENT AREA FROM ADVERSE EFFECTS OF THE PROPOSED UNDERGROUND COAL MINING ACTIVITIES, OR TO PROVIDE ALTERNATIVE SOURCES OF WATER, IN ACCORDANCE WITH UMC 783.17 AND 817.54, WHERE THE PROTECTION OF QUANITY CANNOT BE ENSURED; AND

(4) WATER QUALITY BY LOCATING OPENINGS FOR MINES IN ACCORDANCE WITH UMC 817.50.

RESPONSE:

MEASURES FOR PROTECTION OF SURFACE AND GROUND WATER QUALITY

Water quality conditions for both ground and surface waters are presented in UMC 783.15 and 783.16, respectively. Measures for the protection of the quality of ground and surface waters include: the sealing of underground openings in accordance with UMC 817.13 through 817.15, the removal, storage, and redistribution of topsoil in accordance with UMC 817.21 through 817.25; the stabilization of disturbed areas as required in UMC 817.111; the control and treatment of disturbed area runoff by diversion channels and sedimentation ponds; the diversion of undisturbed area runoff in stream channels around treatment facilities in accordance with UMC 817.44; the location of underground mine entries to prevent uncontrolled gravity discharge of water from the mine; the planning and conducting of underground mining activities that will maximize coal extraction and minimize changes to the prevailing hydrologic balance; and the conducting of a surface and ground water monitoring program to monitor the effects from mining of the hydrologic balance in accordance with UMC 817.52.

Each exploration hole or drill hole has or will be either cased or permanently sealed (by grouting from the bottom of the hole to the surface) to prevent surface drainage from entering the hole and potentially contaminating the ground water system and to prevent migration of waters from the upper perched aquifer systems to lower aquifer systems via the exploration or drill hole.

Mine entries and openings are likewise managed to prevent drainage into the ground water system via these entries or uncontrolled ground water discharges from these entries to the surface water system. All openings at the PMC are located on the east side of the Bear Canyon Graben, on the updip side of mine workings in accordance with UMC 817.50. Since on the east side of the Bear Canyon Graben as discussed in response to UMC 783.15, the regional aquifer is located in the Star Point Sandstone below the coal seams being mined, the portal areas of the PMC should never experience natural discharge through them. If discharge were to ever occur, water quality analyses indicate that due to the high bicarbonate concentrations of ground water and low acidity, acid mine drainage would not be (and characteristically has not been in Utah) a problem and drainage would meet NPDES limitations. Upon closure of the mine, underground mine entries and accesses will be sealed as detailed in respone to UMC 784.14(d).

Topsoil will be redistributed upon termination of the mining activities to re-establish a vegetative cover on disturbed areas of the mine that have been reclaimed. Runoff control facilities which control and treat disturbed area runoff will be maintained through reclamation.

Water pollution has been and is being controlled and minimized within the permit and adjacent area by stabilizing disturbed areas through revegetation, by diverting runoff away from disturbed areas, and by retaining sediment within disturbed areas by diverting runoff from disturbed areas through runoff conveyance and treatment facilities. PMC is implementing a revegetation plan centered on reclaiming disturbed areas (where practical during mining operations) along fill slopes associated with mine pads or roadways and in disturbed surface areas of the mine that are no longer needed in conjunction with surface operations facilities.

In conjunction with the revegetation effort, PMC has constructed and maintains runoff control and treatment facilities. The surface runoff and conveyance system was designed to control disturbed area runoff while minimizing impacts to the surface hydrologic system. Some reduction in total runoff will occur due to increased pond evaporation during runoff periods and increased ground water infiltration while water is retained within each sediment pond. Some slight increase in flow is also realized in Mud Water Canyon as a result of mine water discharges. The overall impacts of the above mentioned streamflow modifications are small when compared to yearly runoff volumes and therefore the mining operation has little impact on the local surface water hydrologic system.

Continued construction and upgrading of surface facilities utilized in conjunction with PMC (yard areas, roads, conveyor lines, etc.) will result in temporary increases in the suspended sediment concentration in Sage Brush Canyon. However, prior to discharge of surface runoff from these disturbed areas, runoff will be passed through sedimentation ponds and treatment facilities.

All surface drainage from disturbed areas of the mine, including disturbed areas that have been graded, seeded, or replanted as part of the reclamation effort are passed through a sedimentation pond or treatment facility before leaving the permit area. Seven sedimentation ponds and one treatment facility have been constructed and maintained to control and treat runoff from disturbed areas of the mine. Conveyance channels have been designed to minimize erosion by regulating velocity or by lining channels when velocities could not be maintained below acceptable levels. Design details of the sedimentation ponds are presented in response to UMC 784.16. These sedimentation ponds and conveyance facilities will be maintained until disturbed areas have been restored and the vegetation requirements of UMC 817.111 through 817.117 are met.

Discharge of water from underground workings to surface waters from other treatment facilities such as the sedimentation ponds (including runoff from the coal refuse pile which is conveyed through Sediment Pond No. 5) is conducted in accordance with effluent limitations of the NPDES permit. Further detail regarding these permits and accompanying effluent limitations are contained in response to UMC 784.16.

MEASURES FOR PROTECTION OF SURFACE AND GROUND WATER QUANTITY AND WATER RIGHTS

Surface operations facilities are located in Sage Brush Canyon, an ephemeral watershed. There are no surface water rights within or adjacent to the mine plan area that could be impacted by operation of surface treatment facilities. In addition, runoff conveyance systems and treatment facilities have been designed to minimize the area that is tributary to the sedimentation ponds. Undisturbed area bypass channels have been designed and constructed which convey runoff around the sedimentation ponds from the undisturbed mountain slopes above the operations facilities. Therefore, the impact due to the quantity of water temporarily detained in the sedimentation ponds is minimized.

As discussed in more detail in Section 784.14(c), with the exception of Section 18, T15S, R8E, no mining is proposed beneath stream channels of perennial watersheds and the minimum cover in most areas of mining is in excess of 800 feet. As a result, impacts from subsidence to surface stream courses and to springs of the Price River North Horn perched aquifer system will be minimized. In addition, the longwall mining method has been selected as the preferred mining method because it creates uniform subsidence, thus causing less potential disturbance to the perched aquifer systems.

In Section 18 mining will occur beneath the North Fork of the Right Fork of Miller Creek in its headwater region where the stream becomes perennial. Mining will be conducted in two coal seams beneath the stream with overburden ranging from 130 feet to over 1000 feet. Land subsidence caused by underground coal mining usually is accompanied by vertical fracturing and bed separation in overlying rocks. The Division is concerned about the various impacts that subsidence caused by underground mining could have on groundwater and surface-water systems above mines in Utah. Specific impacts on stream flow, groundwater levels, and the quality of surface and groundwater are not known. Thus, the Division must consider where mining companies can recover all the coal in a seam and where they must leave pillars of coal to prevent subsidence.

There is little data available on the actual impacts from underground coal mining on subsurface strata, groundwater quantity and quality, and surface water quantity and quality which has been obtained during scientific investigation. The Division currently makes judgements on permit applications to undermine streams based on the best available information, which sometimes includes geotechnical evaluations of the site and past experience.

CPMC proposes to mine beneath the stream using longwall methods in conjunction with a U.S. Geological Survey study to determine the following: (1) To determine the effects of longwall mining and resulting subsidence on overlying groundwater and surface-water environments in an area where the thickness of the overburden is less than 1000 feet; and (2) To develop methods of determining the hydrologic effects of mining-related land subsidence. The relation between the hydrologic effects of subsidence and certain geologic parameters will be included in the study. These parameters include

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by [signature] date 1-11-89

the variable thickness, strength, stratigraphy, and lithologic character of the rocks overlying the mined areas; the orientation and density of pre-existing joints; and the proximity and principal strike direction of faults. Documenting the impact on certain hydrologic properties, such as water levels in perched aquifers, water-level gradient in regional aquifers, chemical quality of groundwater in these aquifers, stream flow quantity and quality, and spring discharge quantity and quality, will be included in the evaluation. A complete project proposal for the USGS study is shown as Exhibit 53, Hydrologic Response to Land Subsidence Caused by Underground Coal Mining, Miller Creek Drainage, Carbon County, Utah.

Mining by CPMC and other Utah companies will be conducted beneath streams of much greater importance than the stream involved in this application. Valuable data will be gathered during this study that can be obtained in no other way except under actual mining conditions.

It is important to note that this study will provide information that will have some degree of transferability to other coal-resource areas in the Wasatch Plateau and Book Cliffs. Determination of the relations between hydrologic effects of subsidence and geologic parameters will be particularly applicable to other coal fields in Utah because of the lithologic similarities.

The study area allows a unique opportunity to gather valuable data; some of the benefits of the study area include:

1 - Overburden varies from less than 200 feet to over 1000 feet.

2 - A stream traverses the surface above two mineable coal seams.

3 - The stream is of marginal value:
   A - Not a fishery;
   B - Very small (5 GPM to 25 GPM);

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by

C - Not used for culinary purposes;

D - Riparian zone is very small, averaging one foot either side of the wetted stream channel;

E - Water rights owned by U.S. Fuel Company;

F - Agreement between CPMC and U.S. Fuel Company on mining beneath the stream.

4 - Surface land owned by U.S. Fuel Company.

5 - Public access to the area is prohibited.

6 - Terrain is extremely rugged, reducing likelihood of human or livestock use.

7 - Water can be returned to the stream channel in the event subsidence causes stream flow to enter the mine workings.

8 - Surface cracks in the stream channel may be able to be sealed to restrict inflow or the flow can be bridged over cracks with culvert.

9 - The coal reserves are owned by CPMC.

We recognize that subsidence will occur at the stream channel location due to mining the previously restricted stream protection barrier. Because of the factors listed above, environmental degradation will not occur. The stream is of very little value and any impacts can be mitigated.

To further avoid potential impacts to the groundwater system from the shallow surface cracks referenced above, CPMC will inspect the stream channel of the North Fork of the Right Fork of Miller Creek during the season when access is possible (June and October). Water monitoring at Station ST-1 and at Station M-8 below the potential subsidence zone will give an indication of water loss due to subsidence if it occurs. Station ST-1 is included in our water monitoring plan and will be monitored monthly from June through October. As part of the USGS study, a continuous recording gauge will be installed at Station M-8 to give an accurate flow rate. If monitoring reveals surface cracks which divert stream flow, CPMC will seal the cracks in the stream channel with bentonite or other environmentally safe materials to effectively prevent water loss.

If it becomes necessary to seal surface cracks in the stream channel, access to the area will be by foot or by helicopter for both men and materials.

The cracks will be sealed with bentonite pellets which will be hand placed. The pellets can be placed in the cracks even under water, and when they expand they will seal the crack from water penetration. If the cracks are too large to effectively seal, rags or some other material will be placed in them at a depth of approximately two feet to provide a stop point for bentonite pellets. Pellets will then be placed in the crack to provide a seal.

Other materials which may be used to seal the cracks include concrete or epoxy mixtures. These materials can be transported to a location near the cracks by helicopter and hand mixed on site.

Surface stabilization in the stream channel, if necessary, will be accomplished by hand with shovels, picks, and other hand tools.

If diversion of the stream flow is necessary during grouting, aluminum culverts, flexible fabric tubing, or plastic liners will be used.

If further movement renders grouting ineffective, the same process will be conducted until ground movement stabilizes.

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Visual and stream monitoring will document stream flow and stream channel conditions.

CPMC has negotiated a mitigation plan, which has been accepted by U.S. Fuel Company, for potential replacement of water lost due to mining beneath the North Fork of the Right Fork of Miller Creek. This agreement is available as Exhibit 43, Water Rights Mitigation Plan. U.S. Fuel Company holds the only water right in this stream reach.

The mitigation plan includes drilling a lateral borehole to the stream channel from the mine and providing a drainage conduit to discharge water that may be intercepted by subsidence cracks. If the streamflow is reduced by more than 50 percent for more than 30 days, inflow from the NFRF Miller Creek will be returned via the borehole to the stream channel. Drilling will commence within one week after the 30 day limit has elapsed. An application for a discharge point under the NPDES program will be submitted for the borehole discharge.

Upon stabilization of the ground surface and when the area is safe for human activity, the channel restoration work discussed previously will be implemented. Upon successfully sealing the surface cracks, the lateral borehole will be sealed with a cement plug.

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by ________ date 1-11-89

Revised 1/5/89

In order to clarify the position of the regional water table beneath Gentry Ridge, a deep monitoring well has been completed in drill hole 86-26-6 toward the southern end of Gentry Ridge during the 1986 drilling season. This deep well was completed and perforated in the lower coal bearing interval of the Blackhawk Formation and on downward into the Star Point Sandstone, and was sealed above these zones to prevent seepage down the outside of the casing from the overlying perched aquifer system. As mining extends into the northern end of Gentry Ridge, additional in-mine monitoring wells may be installed from the Wattis Seam downward to provide additional clarification as to the position of the regional water table and the direction of ground water movement beneath Gentry Ridge.

If significant sustained inflows occur at fracture systems encountered during the Graben Crossing, an attempt will be made to seal these fractures and prevent ground water inflow into the mine by use of a pressure grouted seal. If pressure grouting the fracture system is successful, then dewatering of the aquifer system associated with the fracture (whether perched or regional) will be limited to the partial dewatering that will occur between the time when the fracture is first encountered and when the grout seal is made.

The pressure grouting of water inflows has been successfully used by PMC in the past. The program consists of drilling boreholes into the rock in the tunnels, after which a fast setting grout material is forced into the boreholes and rock fractures under pressure. Holes are drilled and pressure grouted until the inflow of water has effectively been stopped.

Since some perched water inflow is expected in the graben crossing which may decrease over a short time period, PMC proposes to initiate grouting procedures when flows of greater than 50 gpm are experienced that last for longer than three months.

Pressure grouting will be conducted until the flow has been decreased to 10 percent of the sustained flow level. If after grouting has been conducted flows increase, additional holes will be drilled in the problem areas and additional grouting will be conducted to achieve the 10 percent flow rate.

If large inflows, i.e., sustained flows of greater than 50 gpm are encountered in the graben crossing tunnels, PMC will construct water seals at each end of the graben crossing tunnels when the mine is abandoned.

As the major boundary faults of the graben system are approached beneath Gentry Ridge (this consists primarily of the western boundary fault of the Bear Canyon Graben since the eastern boundary fault of the Pleasant Valley Graben appears to lie outside of the mine plan area) an exploratory borehole will be drilled horizontally to intercept the breccia or fracture zone associated with the fault. If significant water inflows are encountered through this exploratory drill hole, then the hole will be sealed and mining will not be advanced any closer to the boundary fault.

PMC uses an active exploration program to make detailed mine plans as mining is advanced. Structural and hydrologic data collected during this program will be used in preparing detailed mine plans to minimize changes to the hydrologic balance, compatible with maximizing coal recovery. Utilizing this active exploration program, an attempt will be made to maintain a coal barrier adjacent to the major faults. Maintaining a barrier of appropriate width between major faults and mine entries serves two purposes. First, entries placed too close to faults with minimal barrier widths create unstable and therefore unsafe working conditions due to high stresses on the pillars which result in floor heave and unstable roof conditions; secondly it is of benefit to PMC to minimize inflow into the mine by investigating faults ahead of mining as described above, and thereby not intercept a major water yielding fault related fracture that would create extra work by having to deal with the large inflows. Therefore, in order to maintain entries that will be open and provide long-term access within the mine and in order to minimize adverse impacts to the ground water system from dewatering major fault related fracture systems of major faults a minimum barrier width of 50 feet will be maintained between the entries and major faults.

In order to avoid impacts due to interbasin transfer of water created by removing water from the Tie Fork Drainage Basin and transferring that water to the Price River Drainage Basin via Mud Water Canyon, alternative mine water discharge point will be investigated such that ground water intercepted within the mine beneath Gentry Ridge can be discharged back into the Tie Fork Drainage Basin. Due to the depth of the coal seam, alternatives for the alternate discharge points are limited. A possible alternative consists of developing an artificial ground water recharge well or zone by developing a fractured area within the mine to allow injection of the mine water into the fracture system. A possible location for an artificial recharge injection well in which ground water would be assured to remain in the Tie Fork Drainage Basin may be within the proposed rock tunnels of the graben crossing within the fracture system into which drillhole CVR-5A is located. The water level in this zone appears to be below the proposed rock tunnels, and there appears to be a sufficient outlet to this zone such that attempts to fill the hole with water for logging purposes were unsuccessful.

Before driving the graben crossing tunnels through the western boundary fault, PMC will drill a horizontal borehole through the fault zone to probe for water. If water is encountered, PMC will have adequate lead time before tunnel advance to prepare grouting equipment and materials to seal off incoming water. This grouting program is discussed in detail later in this Part.

The intent of the grouting program is to seal off water that flows into the graben crossing tunnels to prevent groundwater loss and contamination. This is especially important considering the three Huntington City wells down-dip from the graben crossing.

Grouting equipment is available within one day to grout the interior and boundary fault zones if the need arises.

(b) THE DESCRIPTION SHALL INCLUDE-

(1) A PLAN FOR THE CONTROL, IN ACCORDANCE WITH UMC 817, OF SURFACE AND GROUND WATER DRAINAGE INTO, THROUGH, AND OUT OF THE PROPOSED MINE PLAN AREA;

(2) A PLAN FOR THE TREATMENT, WHERE REQUIRED UNDER SUBCHAPTER K OF THIS CHAPTER AND THE REGULATORY PROGRAM, AND SURFACE AND GROUND WATER DRAINAGE FROM THE AREA TO BE AFFECTED BY THE PROPOSED ACTIVITIES, AND PROPOSED QUANTITATIVE LIMITS ON POLLUTANTS IN DISCHARGES SUBJECT TO UMC 817.42, ACCORDING TO THE MORE STRINGENT OF THE FOLLOWING:

(i) SUBCHAPTER K OF THIS CHAPTER AND THE REGULATORY PROGRAM; OR

(ii) OTHER APPLICABLE STATE AND FEDERAL LAWS.

(3) A PLAN FOR THE COLLECTION, RECORDING, AND REPORTING OF GROUND AND SURFACE WATER QUALITY AND QUANTITY DATA, ACCORDING TO UMC 817.52.

RESPONSE:

RUNOFF CONVEYANCE FACILITIES

The design of runoff and conveyance control facilities were completed in accordance with hydrologic methodologies presented in accordance with UMC 817.43 and 817.46 and to meet NPDES water quality limitations. CPMC's NPDES permit is presented as Exhibit 37, NPDES Permit.

A runoff conveyance plan has been implemented for the Cyprus Plateau Mining operation which includes a complete layout of temporary surface facilities including control diversions, ditches and ponds so that surface water quality and quantity can be effectively controlled. This control comes through the diversion of undisturbed area surface waters around disturbed areas, and the control and containment of disturbed area waters by routing them through sedimentation facilities. Additional purposes of the diversion and conveyance system are to minimize erosion and to reduce the volume of water to be treated. Throughout the majority of the mine permit area these diversions and ditches have been designed to safely pass the 10-year, 24-hour runoff event minimizing the potential for additional contributions of suspended solids. The only exception from using the 10-year, 24-hour precipitation event as the design criteria for runoff conveyance channels is for Class III roads and associated drainages where the State requirement is that the diversion/ditch facility be required to safely pass the 1-year, 6-hour runoff event. For these areas a 2-year, 6-hour runoff event was used as the conservative design criteria. Areas subject to the Class III design (thereby using the 1-year 6-hour precipitation event as the design criteria) are located south of the current mining operations along old mine access roads. These roads are those which connect the current mining operation located at the Lion Deck with the Star Point Mine. These roadways are used by the general public for access to remote back country adjacent to the Cyprus Plateau Mine.

No diversion is located so as to increase the potential for land slides nor were any placed on existing slide areas. When no longer needed, each temporary diversion will be removed and the affected land will be regraded, topsoiled, and revegetated in accordance with Section 817.24, 817.25, 817.101 - 817.106 and 817.111 - 817.117. During construction, any excess excavated material was disposed of in accordance with UMC 817.71 - 817.74 and topsoil removed was handled in accordance to UMC 817.21 - 817.25. In order to properly design the diversion and conveyance facilities, calculations were made of the projected runoff from various precipitation events as specified in the above regulation. The first part of this section describes the methodology used in the runoff prediction process and the design methods used for ditch and channel design, after which the runoff control plan is presented.

DESIGN METHODOLOGY

Flow Hydrographs and Peak Discharge

Peak discharges were calculated for the Cyprus Plateau Mine area utilizing two methodologies. Prior to 1982, peak discharge estimates were made based on the dimensionless hydrograph method presented in chapter 16 of the SCS National Engineering Handbook - Section 4 - Hydrology (NEH-4) prepared by the U.S. Soil Conservation Service, (1977). After 1982, a computer program developed by Vaughn Hansen Associates entitled "HYDRO" was used which implements the SCS Unit Hydrograph method as presented in Chapter 10 of NEH-4. For completeness, both methodologies are presented below.

Estimates of peak discharge to be expected from various precipitation events prior to 1982 were made using the dimensionless hydrograph method. The basic methodology developed in chapter 16 of NEH-4 uses the triangular approximation to a curvilinear unit hydrograph as shown in Figure 21, "Dimensionless Curvilinear Unit Hydrograph and Equivalent Triangular Hydrograph." According to this figure, D is the duration of excess rainfall, T_c the time of concentration, T_p the time to peak, T_r the time of recession, T_b the time of base (all time units in hours); and q_p is the peak discharge in cubic feet per second. Five separate hydrograph families have been developed by the U.S. Soil Conservation Service (1972) to better approximate local hydrologic and climatic conditions. Selection of the proper curve is made based on the curve number and rainfall depth as shown on Figure 22, "Unit Hydrograph Family Curves."

The discharge constant q_p used in the dimensionless hydrograph method is determined according to the equations:

$$q_p = \frac{484\ A\ Q}{T_p} \qquad (784.14\text{-}1)$$

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (784.14\text{-}2)$$

$$CN = \frac{1000}{10 + S} \qquad (784.14\text{-}3)$$

where:

q_p	=	peak discharge constant, in cfs;
A	=	drainage area, in square miles;
Q	=	direct runoff depth, inches;
T_p	=	time elapsed from the beginning of runoff to the hydrograph peak, in hours;
484	=	a conversion factor;
P	=	storm rainfall depth, inches;
S	=	maximum infiltration depth (defined as the maximum possible difference between P and Q), in inches; and
CN	=	curve number, dimensionless.

T_p is assumed to be a function of watershed lag (L), which is determined according to the equation:

$$L = \frac{(h_l{}^{0.8})(S + 1)^{0.7}}{1900\ Y^{0.5}} \qquad (784.14\text{-}4)$$

where:

L	=	watershed lag, in hours;
h_l	=	hydraulic length, or the length of the mainstream to the farthest divide, in feet;
S	=	is as previously defined; and
Y	=	average watershed slope, in percent.

Values of Y were obtained from methods outlined by Craig and Rankl (1977). The hydraulic length was taken from an appropriate topographic map, and S was determined from Equation 784.14-3 once the runoff curve number was estimated.

According to the U.S. Soil Conservation Service (1972), the watershed lag is equal to 0.6 T_c and the time of concentration (T_c) is equal to 1.5 T_p. By combining these two expressions, one can see that T_p = 1.11L where both variables are as previously defined.

The two time constants used in the dimensionless hydrograph method are T_p equal to 1.11L and T_o or D, the duration of excess rainfall. This latter value was determined from the theoretical Type II storm distribution shown in Figure 23, "Twenty-Four Hour Rainfall Distributions." According to the curve number method, sufficient precipitation must fall to satisfy the initial watershed abstraction before runoff will begin. This depth of rainfall is taken as 0.2S (U.S. Soil Conservation Service, 1972), where S is as previously defined. Dividing 0.2S by the total storm depth results in a ratio which can be found on the ordinate of the above referenced figure. The corresponding time on the abscissa of the appropriate type curve is the theoretical time from the beginning of runoff. Subtracting this value from the storm duration results in T_o. Thus, if the runoff curve number for a particular watershed near the Cyprus Plateau Mine is 75, then S = 3.33 and 0.2S = 0.67. The duration of excess rainfall for the 10-yr, 24-hr storm (with a rainfall depth of 2.1 inches) is found by dividing 0.67 by 2.1, entering the figure with the resulting ratio (0.32), and reading the corresponding storm duration during which no runoff occurs from the Type II storm curve (11.6 hrs). Subtracting this value from the storm duration (24 hours) results in an excess rainfall duration (T_o) of 12.4 hrs.

With the time constants properly defined, they are multiplied by increments of discharge and time from the dimensionless hydrograph thereby obtaining the plotting points of the synthetic hydrograph.

The Unit Hydrograph methodology used after 1982 utilizes the runoff depth equations presented earlier (784.14-2 and 784.14-3) as well as the relationships previously shown on Figure 21, "Dimensionless

Curvilinear Unit Hydrograph and Equivalent Triangular Hydrograph." The complete methodology follows.

A hydrograph of a single block of rainfall excess with duration D is shown in the upper portion of the above mentioned figure. The lower portion of the figure contains the resultant runoff hydrograph. For runoff from excess rainfall, the area under the hydrograph curve and the area enclosed by the rainfall hydrograph represent the same volume of water(Q). The peak flow rate for the hydrograph is represented by Q_p, while t_p represents the time to peak, which is defined as the flow from the start of the hydrograph to Q_p. The base time (t_b) is the duration of the hydrograph. The time from the center of mass of rainfall excess to the peak of the runoff hydrograph is the lag time (t_L). The time of concentration (t_c) is defined as the time required for flow from the hydraulically most remote point in a basin to reach the basin outlet.

The time to peak, t_p, was previously found to be equal to 1.11L where L is the watershed lag, in hours, and L is defined as equation 784.14-4. The peak discharge constant used was previously presented as equation 784.14-1 and the 24 hour rainfall distribution used was the NOAA type II storm as shown in Figure 23, "Twenty-Four Hour Rainfall Distributions."

Dimensionless unit hydrographs are developed by simulating many natural unit hydrographs using the time to peak and the peak discharge constant. Haan (1970) proposed a dimensionless unit hydrograph based on the gamma function:

$$\frac{q(t)}{q_p} = (\frac{t\ e}{t_p}\ (1-t/t_p)\S C3t_p \qquad (784.14\text{-}5)$$

where:

q(t) = hydrograph ordinate at time t, cubic feet per second; and the parameters q_p and t_p are as previously defined, and C_3 is a parameter defined by:

$$Q = q_p\ t_p\ (e/C_3t_p)^{(C_3t_p)}\ G\ (C_3t_p) \qquad (784.14\text{-}6)$$

where:

Q = runoff volume (one inch for a unit hydrograph),
G = gamma function,

and all other variables are as previously defined.

Figure 24, "Variation in Hydrograph Shape with Variation in C_3t_p," shows how shape of the hydrograph defined by Equation 784.14-5 changes as C_3t_p changes. The higher the value of C_3t_p, the sharper the peak of the hydrograph.

Estimates of the peak discharge to be expected from various precipitation events were made using the dimensionless hydrograph procedure illustrated on Figure 21, "Dimensionless Curvilinear Unit Hydrograph and Equivalent Triangular Hydrograph." The dimensionless unit hydrograph method involves the development of a runoff hydrograph from a complex rainstorm. The storm is divided into blocks of uniform intensity of duration D and distributed in accordance with the 24-hour rainfall distribution illustrated on Figure 23, "Twenty-Four Hour Rainfall Distributions." Values of D must be less than or equal to t_p. Practically, the selection of D as a multiple of t_p will ensure that the peak will be encountered.

Rainfall excess is generated from the rainfall depths of duration D, and the rainfall-runoff relationship expressed in Equation 784.14-2. The rainfall excess (runoff) from each time increment of duration D is then multiplied by the unit hydrograph ordinates to produce a component hydrograph. Each of the component hydrographs are then lagged by a time increment D and are consecutively summed to produce the synthetic runoff hydrograph.

Because individual hydrographs were not routed through conveyance structures or ponds, the synthetic peak is considered conservative. Calculated flow rates for each ditch or conveyance structure using the above described methods are shown and discussed later in this section.

Channel Flow Design

Open channel flow capacities were determined with the Manning equation. According to this method,

$$V = \frac{1.486}{n} R^{0.67} S^{0.5} \qquad (784.14\text{-}7)$$

where:

V	=	velocity, in feet per second;
n	=	Manning roughness coefficient;
R	=	hydraulic radius, in feet; and
S	=	hydraulic slope, in feet per foot.

The roughness coefficient was estimated from tabular information presented by the U. S. Department of Transportation (1979). The velocity obtained from Equation 784.14-7 was converted to a flow rate with the continuity equation, which states that

$$q = AV \qquad (784.14\text{-}8)$$

where:

q	=	discharge, in cubic feet per second;
A	=	cross-sectional area of flow, in square feet; and
V	=	velocity, in feet per second.

Utilization of the above mentioned equations allowed for the calculation of flow depth and thereby total required channel depth. When possible, ditches and channels were designed allowing for a minimum freeboard height of at least 0.5 feet.

Channel Lining Design

The maximum permissible flow velocity for unlined channels was assumed to be five feet per second. Sections of diversion channels on slopes with velocities in excess of 5.0 feet per second, were designed with appropriate channel linings. Three basic linings types (rock riprap, CMP pipe and conveyor belt lining) have been used on diversion channels in conjunction with mining operations.

Graded rock riprap was designed according to methodologies presented by the U.S. Department of Transportation (1975) and by Barfield, Warner and Haan in their text entitled "Applied Hydrology and Sedimentology for Disturbed Areas (1985)". The U.S. Department of Transportation (DOT) methodology was used in the design of all ditches throughout the mine plan area (except for Ditches 7G and 80A through 80C). More recent designs including the verification of culvert outlet riprap sizing were made based on calculations presented in Barfield, et.al. The methodology presented in Barfield, et.al., for riprap sizing has been determined to be a more conservative methodology than that proposed by the U.S. Department of Transportation. A discussion of both methods is presented follows.

In accordance with the DOT methodology, the maximum permissible depth of flow for a channel lined with rock riprap is determined by

$$d_{max} = \frac{5\ (D_{50})}{\text{Gamma} \cdot So} \qquad (784.14\text{-}9)$$

where:

d_{max} = maximum permissible depth of flow, in feet;

D_{50} = mean rock diameter (or the particle size gradation for which 50% of the mixture is finer by weight), in feet;

Gamma = unit weight of water, in pounds per cubic foot; and

So = channel slope, in feet per foot.

The mean rock diameter (D_{50}), from which the maximum permissible depth of flow was determined, was assumed in each case. The channel configuration was then determined such that the maximum permissible depth at the design flow would not be exceeded. The above equations prepared by DOT in graphical form are shown in Figure 25, "U.S. Department of Transportation Riprap Design".

The methodology for riprap design as presented by Barfield, et.al, (as used for the calculation of riprap sizes for culvert outflows) is shown through the use of the following equations.

$$SF = \frac{\mathrm{Cos(THETA)\ Tan(PHI)}}{\mathrm{Sin(THETA)} + n\ \mathrm{Tan(PHI)}} \qquad (784.14\text{-}10)$$

$$n = \frac{21\ d\ S}{(SG - 1)\ D_{50}} \qquad (784.14\text{-}11)$$

Where

SF = Factor of Safety against failure;
THETA = Angle of channel bed in degrees;
PHI = Angle of repose for riprap;
d = Depth of flow;
S = Channel slope in feet per feet;
SG = Specific gravity of rock, and
D_{50} = Mean riprap size, in feet.

An analysis of side slope stability was completed by applying equations 784.14-12 through 784.14-14.

$$SF = \frac{\mathrm{Cos(ALPHA)\ Tan(PHI)}}{n'\ \mathrm{Tan(PHI)} + \mathrm{Sin(ALPHA)\ Cos(BETA)}} \qquad (784.14\text{-}12)$$

$$BETA = \mathrm{Tan}^{-1}\left(\frac{\mathrm{Cos(THETA)}}{\frac{2\ \mathrm{Sin(ALPHA)}}{n\ \mathrm{Tan(PHI)}} + \mathrm{Sin(THETA)}}\right) \qquad (784.14\text{-}13)$$

$$n' = \frac{C\ n\ (\ 1 + \text{Sin(THETA + BETA)}\ )}{2} \qquad (784.14\text{-}14)$$

Where

ALPHA = Tan^{-1} (1/sideslope);
C = 0.76 for 2H:1V sideslopes
= 0.86 for 3H:1V sideslopes;

sideslope being the number of feet horizontal per foot vertical of the channel sideslopes, and all other values are as previously defined.

Once mean riprap size is determined, a riprap gradation and thickness must be determined. Table 75, "Recommended Riprap Gradation Limits," shows the recommended gradation for both mild and steep channel conditions. In some cases, grout was used in riprapped sections to increase channel stability and/or reduce riprap size. A second type of channel lining utilized consists of overlapped conveyor belt material. This lining was installed in excavated channels in short pieces so that the upstream belt material overlapped the downstream piece thereby preventing water from washing beneath the downstream liner. Each section of channel lining was secured with wire and rebar anchors. The locations of lined channel sections are shown on Map 42, "Surface Water and Sedimentation Control Facilities Map A."

In other locations such as around Ponds 4 and 6, half round CMP pipe has been placed to provide the required erosion protection. CMP pipe has also been used in steep areas where channel flow is infeasible but yet the water must be conveyed down a hillside. Examples of such areas are noted near the upper mine portals and along the roadway leading to the upper mine offices located on the Lion Deck.

Ditch sections requiring erosion protection are shown on Map 42, "Surface Water and Sedimentation Control Facilities Map A". Areas downstream from culvert installations requiring similar protection are shown on Map 42, "Surface Water and Sedimentation Control Facilities

Map B." Specific mention should be made with regard to the design of erosion protection at some of the locations shown on the maps. Current riprap design methodologies do not allow for the design of erosion protection on extremely steep slopes using such materials as rock riprap. In some locations, however, such as at Culverts 57A through 60A (as well as at other locations within the mine permit area), consideration must be given to the fact that local drainage must be transferred down a steep hillside or stream channel. At such locations, procedures are not available for designing riprap erosion protection and, therefore, calculations under such conditions have not been nor can they be made. An effort has been made by Cyprus Plateau Mining Corporation to reduce or eliminate the potential for serious erosion at these locations by placing culvert exits onto existing or man-made rock rubble piles or onto rock ledges which act as energy dissipation devices and effectively reduce downstream erosion. CPMC will continue to monitor culvert outfalls at these locations and thereby determine the efficiency of the rock rubble piles and what additional action, if any, should or can be taken.

Conditions related to lining of individual ditches are shown on Map 42, "Surface Water and Sedimentation Control Facilities Map A." Conditions related to culvert outfall linings are shown on Map 42, "Surface Water and Sedimentation Control Facilities Map B." Channel and Culvert riprap calculations are presented in Exhibit 45, "Riprap Calculations."

Culvert Design

Following the determination of a given peak watershed discharge, design sizes for culverts were calculated as part of the runoff diversion and conveyance facilities. Flow capacity calculations were made for each pipe culvert located within the mine permit area to determine the total flow capacity of the pipe by comparing the required design flow to the capacity under both inlet and full pipe flow conditions. Pipe inlet capacities were determined using methods derived by the U.S. Bureau of Public Roads as presented by the U.S. Soil Conservation Service (1972) and illustrated in Figure 26, "Headwater Depth for Corrugated Metal Pipe Culverts with Inlet Control." Full pipe flow capacities were determined using Manning's equation assuming: 1) a full flowing pipe, 2) a headwater to diameter ratio of 1.0, and 3) tailwater depths no greater than the height of the pipe. For conditions encountered at CPMC, these assumptions are reasonable in light of the relatively steep slope conditions encountered throughout the mine plan area.

In the event that pipe flow capacity was marginal as predicted by Manning's equation (as was the case with Culvert 10C), the upstream headwater depth was taken into account to verify that the additional head would produce enough energy to overcome pipe frictional losses thereby forcing flow through the pipe. The method used which takes headwater and tailwater into account is shown in nomograph form for Culvert 10C in Exhibit 46, "Culvert Capacity Calculations." By taking a more detailed look at the hydraulic characteristics of Culvert 10C by this method, it was found that the culvert was adequate to pass the required design flow rate. It was found that all culverts presently installed at CPMC at the time of this submittal will pass the design flows calculated and discussed within this submittal.

Calculations comparing design flows against inlet and pipe flow capacities are shown in Exhibit 46, "Culvert Capacity Calculations." Culvert design data summary tables have been prepared as a quick reference for each of the culverts identified on the CPMC permit area. Table 76B, "Culvert Peak Flow Design Data" gives a summary of the watershed runoff characteristics for each culvert and Table 77B, "Culvert Design Criteria" gives a summary of the physical characteristics and capacities of each culvert. Culvert location and design criteria are also shown on Map 42, "Surface Water and Sedimentation Control Facilities Map B." Also included on the above referenced table and map are the specifications for riprap at all culvert outlets requiring its installation including size and placement.

During the field investigation and design phases of the culvert inventory, it was determined that additional culvert inlet protection beyond that already provided through channel design was not needed due to the fact that: 1) where upstream channels are not already lined, the design velocity is less than 5.0 feet per second and, therefore, riprap lining is not needed, 2) where the velocity is greater than 5.0 feet per second, riprap lining is already provided and, therefore, the culvert inlet has adequate protection, 3) culvert inlet protection is generally only designed and used under highly critical flow conditions such as one would encounter in a large conveyance channel with the potential for extremely high flows and damage, or at extreme and abrupt channel bends, and 4) no locations were found where erosion appeared to be occurring at any of the sites visited in preparation for this submittal.

Culvert outlet erosion protection was determined according to the methods presented earlier in the discussion regarding riprap design. The Barfield, et.al., method was used in the design of appropriate riprap at culvert outlets having exit velocities in excess of 5.0 feet per second as long as the average riprap size was larger than 0.5 feet and the slope was not limiting. At those locations where design procedures predicted riprap sizes less than 0.5 feet, no erosion protection is proposed with the understanding that the outlets will be monitored and riprap installed should severe erosion occur.

Under these guidelines it is expected that some minor erosion will occur downstream from the culverts (which have a velocity in excess of 5.0 feet per second but which required a riprap size of less than 0.5 feet) as exiting waters adjust to the new downstream channel configuration. In normal design it is common to accept this small amount of erosion as part of the design as long as erosion does not produce headcutting thereby threatening the structure. Headcutting is not considered a problem with CPMC conveyance facilities because downstream channel sections have been designed to be stable. Erosion, should it occur, will generally be limited to a very short section immediately downstream of the culvert. It is felt that this solution is acceptable since all such culverts are located in existing diversion channels whereby the small amount of erosion that may occur is diverted into and contained within existing sedimentation facilities. In addition, the majority of culverts located throughout the mine plan area have been in place for sufficient time for this anticipated erosion to have already occurred, therefore, there would be no additional gain should riprap be installed. As stated above, should serious erosion occur, riprap will be installed.

RUNOFF CONVEYANCE AND CONTROL PLAN

Numerous diversion ditches have been constructed to divert runoff from disturbed areas into sedimentation ponds or to divert runoff from undisturbed areas past sedimentation ponds (See Map 42, "Surface Water and Sedimentation Control Facilities Map A"). All diversion ditches or culverts diverting runoff into sedimentation ponds have been designed to safely pass runoff from the 10-year, 24-hour storm (2.1 inches), except the ditches associated with the refuse pile. These ditches and culverts will safely pass a 100-year, 6-hour storm event. The diversion ditches have also been designed as temporary ditches and will be removed and the area reclaimed upon termination of the mining activities.

No surface waters (either disturbed or undisturbed) are being diverted into underground mine workings. An attempt has been made to divert all undisturbed water around disturbed areas through a system of diversion channels, whereafter the water is discharged back into natural downstream channels after bypassing disturbed areas. All disturbed area water is diverted into sedimentation or treatment facility ponds. All diversion ditches or culverts diverting runoff into sedimentation ponds have been designed to safely pass runoff from the 10-year, 24-hour storm (2.1 inches). The diversion ditches have also been designed as temporary ditches and will be removed and the area reclaimed upon termination of mining activities.

In addition to above mentioned sediment control measures, several small sediment traps have been placed at various locations such as at fan portal pads to improve water quality by containing local sediments. Silt fences have also been employed along roadsides and in some small drainage channels to help reduce downstream sediment loadings. Sedimentation pond design was completed without considering the effect of small sediment traps and silt fences which may lie within the sediment pond drainage boundary thereby resulting in a conservative design. A typical design of a silt fence sediment trap can be seen as Figure 44. A typical design of a sediment trap can be seen as Figure 42.

The diversion ditches have been designed with the trapezoidal cross-section illustrated on Figure 27, "Typical Trapezoidal Diversion Cross-Section." A maximum permissible velocity of 5.0 feet per second was assumed in all cases for diversion ditches without a lining. Freeboard is generally maintained at a minimum of 0.5 feet for all surface conveyance channels and ditches unless otherwise noted. A Manning's roughness coefficient (n) of 0.03 was assumed to represent natural conditions in the area of the surface mine facilities. Under some instances, Manning's n has been increased when deemed necessary to better reflect local and/or riprapped conditions. Changes in Manning's n along with other information relating to peak flows and peak flow design for the diversion ditches are noted in Table 76A, "Diversion Ditch Peak Flow Design Data."

Although Hawkins (1973) has indicated that runoff curve numbers tend to vary inversely with precipitation depth in forested mountain watersheds, the exact relationship between runoff curve numbers and precipitation depth in the vicinity of the CPMC mine plan area is undetermined. Curve numbers (CN) as determined for design purposes are based upon three basic surface conditions, which are: undisturbed, disturbed, and coal refuse and stock pile areas. From material presented in Exhibit 19, Soils Information, it is found that the soils are heavily dominated by sands, silts, and clays with the majority of material identified in the general area being inorganic silts and clays. From the National Engineering Handbook - Section 4 (NEH-4) (SCS, 1972) a soil consisting of mostly inorganic silts and clays is classified as a type "C" soil.

Local vegetative types include sagebrush, Douglas fir, pinion and grassland. As defined by NEH-4, a juniper-grass complex consists of juniper or pinion with an understory of grass and a sage-grass complex consists of sage with an understory of grass. The juniper-grass complex was chosen as the more local representative vegetative type (juniper-grass is also more conservative than the sage-grass complex) with an area-wide ground cover density of approximately 40 percent. From Figure 9.6 of NEH-4, a curve number of 75 was chosen to represent undisturbed areas based on a type C soil, a juniper-grass vegetative type, and a ground cover density of 40 percent; and a CN of 90 was chosen from the same curve to represent disturbed areas (assuming no ground cover).

Coal refuse and stock pile areas are classified differently due to the material composition of the stock and refuse piles. From a survey completed on the coal refuse pile, it was found that 73.4 percent of the composition was made up of material the size of sands and gravels. Fifty percent of the material is sand size. From the U.S. Department of Agriculture triangular soil classification, the material is classified as a sandy loam. Such a material is generally well drained, porous, and transmits water well for which the "A" or "B" soil complexes are most applicable. From NEH-4 figures 9.5 and 9.6, representative curve numbers for both "A" and "B" type soils with zero ground cover would range from 60 to 75 respectively. From this data and early discussions during the initial phase of design with DOGM personnel an overall CN for coal refuse and stock pile areas of 70 was accepted to represent the area.

Weighted curve numbers for each ditch drainage or pond drainage area were derived based on a distinction between undisturbed, disturbed, and coal refuse and stock pile areas.

Design criteria and calculation results for the sizing of the various diversion ditches and culverts are presented in Table 76A, "Diversion Ditch Peak Flow Design Data," Table 76B, "Culvert Peak Flow Design Data," Table 77A, "Diversion Ditch Design Criteria," and Table 77B, "Culvert Design Criteria." Culverts previously identified as "Downspouts" have been included in the "Culvert" classification and are shown throughout this submittal as part of the culvert conveyance system. These tables represent the latest available information regarding the design and construction of runoff conveyance facilities and the data contained therein should supersede all other data heretofore presented. It is important to refer to these tables over all others because of the continual change noted in the runoff conveyance system as a result of modifications made to surface facilities and to ongoing channel reclamation efforts. Also contained in Table 77A, "Diversion Ditch Design Criteria," are the requirements for lining the channels if needed. Sections of channel requiring lining are illustrated on the appropriate maps presented above.

In order to determine the total design flow for Ditch No. 14, the hydrograph for the 25-year, 24-hour event was routed through Pond No. 5 and then summed to the corresponding hydrograph computed for the remainder of the area contributing to Ditch No. 14. No other pond routing was required for the mine plan conveyance facilities.

Flood routing through Pond No. 5 was accomplished using the basic equation:

$$S = Q_i d_t - Q_o d_t \qquad (784.14\text{-}15)$$

where:

S = storage accumulated during dt;
Q_i = average rate of inflow during dt;
Q_o = average rate of outflow during dt; and
d_t = small increment of time.

In the flood routing analysis it was assumed that the pond was full to the decant level (i.e. available storage was the difference between the elevation of the decant and the elevation of the spillway).

The inflow hydrographs and routing calculations for Pond No. 5 are contained in Exhibit 26, "Inflow Hydrographs and Routing Calculations for Pond No. 5." Hydrographs are presented as a function of time since the storm began. The peak flow of approximately 62 cfs from the remainder of the contributing area to Ditch No. 14 occurs approximately 15 hours after the beginning of storm and therefore has no influence on the peak flow to Ditch No. 14.

Flow velocities exiting the 54-inch half round CMP lining of Ditch No. 14 are on the order of 22 fps. In order to reduce these velocities to acceptable velocities that would naturally occur in the downstream channel, energy dissipation is required. By constructing a small basin with zero slope at the exit from the 54-inch half round pipe, a hydraulic jump is forced to occur, thus dissipating excess energy. Channel slopes upstream and downstream of the small basin are super critical and the alternate depth for the hydraulic jump within the basin is greater than critical depth. Therefore, in order for the flow depth to reach normal depth in the downstream channel having super critical slope, the flow will pass through critical depth at the outlet to the basin which serves as control.

In order to determine the location of the hydraulic jump and therefore establish the required basin dimensions, longitudinal water surface profiles were computed from the control at the basin outlet and from normal depth upstream in the 54-inch half round pipe. Water surface profiles moving downstream from normal depth within the 54-inch half round pipe and moving upstream from the basin outlet are presented in Exhibit 27, "Water Surface Profiles for Ditch No. 14 Energy Dissipation Basin." In order to locate the position of the hydraulic jump a trial and error procedure is followed in which the alternate depth for a given position on one of the profiles is calculated and then compared with the depth at the corresponding location of the opposite profile. The hydraulic jump will occur approximately ten feet downstream from the change in slope from 26 percent to five percent where alternate depths equal 0.71 feet and 2.32 feet. Grouted riprap is required throughout the entire basin to protect against severe erosion created by the dissipation of energy. Design details including plan, profile, and cross-section are presented on Map 52, "Channel Transition and Energy Dissipator from Ditch No. 14 into Existing Natural Channel." Design information for the upstream 54-inch CMP and downstream riprapped channel are given in Table 79, "Hydraulic Calculations for Channel Sections Upstream and Downstream from the Energy Dissipation Basin Outlet to Ditch No. 14."

The design and construction of Sediment Pond 9 has modified local runoff flow paths and thereby reduced the total flow through Pond 5 and through Ditch 14. Design calculations for both Pond 5 and Ditch 14 have not been modified and are considered conservatively overdesigned since their design does not take into account the reduction in flow resulting from the construction of Pond 9.

All diversions have been constructed as part of the surface water conveyance system to either divert water into or around sedimentation basins and are not used for the purpose of diverting water into underground coal mine facilities.

<u>Runoff Control Variance Requests</u>

A variance is being requested from providing ditch design and ditch erosion protection at some locations due to special conditions encountered at the site with respect to the design and installation of appropriate channels and/or linings. General problems encountered include: 1) the inability to properly size riprap in steep slope areas due to a lack of general design methodologies; 2) the lack of adequate space to install a riprapped channel; 3) the evidence that minimal erosion has occurred historically; and 4) excessive maintenance and disposal problems which occur annually due to debris and rock fall from the adjacent hillside. Specifically, a variance is requested for Ditches 51, 57, and 58. Each is discussed below separately.

Ditch 51 is the conveyance channel between Culvert 5B and Sedimentation Pond No. 3. This ditch is located on a steep hillside having slopes ranging between 16 and 29 percent. Efforts to minimize erosion in the channel (especially at downstream locations as the channel enters Pond No. 3) have included the placement of large diameter rock. During a site visit in the Summer of 1987, it was noted that the entire channel length had eroded to bedrock regardless of whether or not large diameter rock had been placed as erosion protection. In fact, at some locations where large rock still exists, the channel erosion was noted to be more severe because of the turbulence created by the rock as flowing water impacted against it.

The erosion noted in Ditch No. 51 (although severe) appears to have reached a state of equilibrium as the channel bottom has: 1) eroded to bedrock throughout much of its length; and 2) formed a series of natural drop/pool structures. The formation of the drop/pool structures is the result of the channel dissipating the required energy to reach its state of equilibrium. Because the channel has eroded around the large diameter rock placed to dissipate excess stream energy and appears to have reached a state of natural equilibrium, a variance from requiring additional erosion protection on Ditch No. 51 is requested with the understanding that reclamation will be undertaken on the ditch upon completion of mining activities and the removal of Pond No. 3.

A variance from providing erosion protection on Ditches 57 and 58 is also requested. Design of an adequate riprap channel section indicates that a total channel top width of approximately eight feet would be required to pass the design flow rate. Existing space along the roadway is generally inadequate to provide the width required for such a channel section. If lining were required, additional road cuts must be made in order to obtain adequate channel widths.

Additional problems have also been noted with the existing channel section should riprap be required. Each year roadside channels along the upper mine pad access road are graded to clean out debris which has fallen from the adjacent hillside over the winter period. This grading is completed in order to provide for the required roadside channel flow capacity and involves the removal of tremendous volumes of soil and rock debris. Annual cleaning efforts involving roadside grading would completely destroy any riprap channel should one be constructed. Requiring erosion protection along this section of the mine access road would similarly require that the roadside riprapped channel be reconstructed annually.

In addition, inspections made during the Summer of 1987 indicated that very little erosion was noted in the runoff conveyance channels along the side of the upper mine pad access road. It is certain that some erosion is naturally occurring, but no specific areas of severe erosion were noted along the entire channel reach.

A recommended solution to the sediment control concerns for Ditches 57 and 58 is to install a series of sediment traps throughout the length of each ditch to control the transport of local sediments. It is proposed that there be two evenly spaced sediment traps installed on Ditch 57 and three on Ditch 58. One of the sediment traps will be located on each ditch immediately upstream of the culvert that carries runoff waters across the roadway. The remaining sediment traps are proposed to be evenly spaced throughout the length of the ditch section. The sediment trap solution appears to be the most feasible solution due to the relative ease at which they can be reinstalled after ditch debris removal.

It is therefore requested that Ditches 57 and 58 be granted a variance from requiring channel lining due to: 1) channel width limitations, 2) debris removal limitations and associated costs of riprapped channel reconstruction, and 3) the overall lack of severe erosion noted throughout individual channel sections, with the understanding that the above mentioned sediment traps will be installed in lieu thereof.

WATER TREATMENT

Present water treatment needs at CPMC consist of reducing suspended sediment concentrations from disturbed area runoff, and containing depth in the downstream channel having super critical slope, the flow will pass through critical depth at the outlet to the basin which serves as control.

In order to determine the location of the hydraulic jump and therefore establish the required basin dimensions, longitudinal water surface profiles were computed from the control at the basin outlet and from normal depth upstream in the 54-inch half round pipe. Water surface profiles moving downstream from normal depth within the 54-inch half round pipe and moving upstream from the basin outlet are presented in Exhibit 27, Water Surface Profiles for Ditch No. 14 Energy Dissipation Basin. In order to locate the position of the hydraulic jump a trial and error procedure is followed in which the alternate depth for a given position on one of the profiles is calculated and then compared with the depth at the corresponding location of the opposite profile. The hydraulic jump will occur approximately ten feet downstream from the change in slope from 26 percent to five percent where alternate depths equal 0.71 feet and 2.32 feet. Grouted riprap is required throughout the entire basin to protect against severe erosion created by the dissipation of energy. Design details including plan, profile, and cross-section are presented on Map 52, Channel Transition and Energy Dissipator from Ditch No. 14 into Existing Natural Channel. Design information for the upstream 54-inch CMP and downstream riprapped channel are given in Table 79, Hydraulic Calculations for Channel Sections Upstream and Downstream from the Energy Dissipation Basin Outlet to Ditch No. 14.

All diversions have been constructed to aid in the surface water conveyance system to either divert water into or around sedimentation basins and are not used for the purpose of diverting water into underground coal mine facilities.

WATER TREATMENT

Present water treatment needs at PMC consist of reducing suspended sediment concentrations from disturbed area runoff, and containing underflow from a thickener tank associated with coal washing facilities. A series of sedimentation ponds have been constructed within the mine plan area to capture and reduce the suspended sediment concentrations from disturbed areas. Underflow from the thickener tank is contained by routing it into ponds located immediately northwest of the present coal waste refuse pile. Water discharged into the Thickener Underflow Treatment Ponds is recycled for use back into the coal washing facilities, and is not discharged into the surface water system.

All sedimentation ponds except 4 and 5 have been designed to retain a three-year accumulated sediment volume with a time between the centroids of the inflowing and outflowing hydrographs of 24 hours. Ponds 4 and 5 have a two and a half and a two year accumulated sediment volume capacity, respectively, due to the limited overall capacity of the pond site. Sediment removal from these ponds will be completed on a regular basis when 60% of capacity is reached. Additional disturbed area sediment pond details are discussed further in response to UMC 784.16. Details concerning the Thickener Underflow Settling Ponds are found in Exhibit 28, Thickener Underflow Design Details. Details regarding effluent limitations related to NPDES discharges are found in response to UMC 784.16.

Sedimentation pond and mine discharges have been and will continue to be monitored as specified in UMC 817.42 in accordance with NPDES permits which outlines State and Federal discharge limitations. At present, the only mine discharge is located in Mud Water Canyon (the location of which is shown on Map 31, Ground and Surface Water Monitoring Stations. No gravity mine discharges are possible at the PMC mine thereby complying with UMC 817.50 since all surface entries have been constructed updip from undergroundmine workings. The effect of mining operations on the surface water system will continue to be analyzed through the surface water monitoring plan described later in this section.

DISCHARGE WATER QUALITY

Of the potential discharge locations (Treatment Facility No. 1, Ponds 2 through 8 and Mud Water Canyon discharge), only five have available water quality data. These include discharges from ponds 4, 5, 6, and 8, and from the Mud Water Canyon discharge. Water quality data summary sheets for each site mentioned above are shown in Exhibit 29, NPDES Discharge Water Quality Data Summaries. Treatment Facility No. 1 discharged for the first time in the spring of 1986 and quality data were not available at the time of this writing. Pond No. 2 was completed in the spring of 1986 and has not yet discharged and ponds 3 and 7 have never discharged. The Mud Water Canyon mine discharge is not diverted into a sedimentation pond to control sediment or water quality because, discharges are allowed from underground workings provided that the water meets the requirements of this section.

According to analyses completed at discharge locations, all NPDES discharges have been made in compliance with the discharge permit except for high TDS concentrations recorded at Sedimentation Pond No. 8 and at the Mud Water Canyon Discharge. In a letter dated April 30, 1986, PMC indicated that TDS concentrations at Pond No. 8 had generally increased between February and March of 1986 with high effluent concentrations of 3,913.0 mg/l being recorded on the 10th of March. An undisturbed area sample taken on the same day near the Pond 8 discharge recorded a concentration of 6,024.0 mg/l which is over three times the NPDES discharge limitations. In an effort to isolate and quantify natural background TDS concentrations, PMC monitored inflows to Pond No. 8 and made a request to EPA for a change in the limitation.

In a letter from PMC dated June 28, 1985 a request was made to increase the Mud Water TDS concentration limit from 650 to 1,450 mg/l. This request was made after an in-mine sampling program was made which indicated that mine inflows were high in dissolved solids. It is believed that the noted increases in dissolved solids is due to the fact that mining is now occurring under greater overburden and that the water may be picking up more dissolved solids as it travels downward to greater depths.

On January 22, 1988, EPA renewed PMC's NPDES Discharge Permit with a 1300 mg/l TDS for Mud Water Canyon mine water discharge and a 2,000 pounds per day discharge limit for all sediment ponds combined. A copy of the renewed permit can be found as Exhibit 37, NPDES Permit.

WATER MONITORING PLAN

An ongoing operational hydrologic monitoring plan has been carried out over the past five-year permit term and will be continued for each ground and surface water monitoring station shown on Map 31, Ground and Surface Water Monitoring Stations. In addition to springs, ground water monitoring stations will include the three in-mine water quality monitoring sites referred to as 1st West No. 6, 1st West No. 4, and 9th Left No. 12 on the above referenced map and the three in-mine wells (P-86-01-TD, P-86-02-HD, and P-86-03-WD) which have been drilled downward from the coal seams into the Star Point Sandstone. As the mine is expanded, particularly as it is expanded beneath Gentry Ridge, additional in-mine wells may be constructed and added to the monitoring plan. Data to be obtained from these in-mine wells may include piezometric surface data and aquifer test data (primarily transmissivity). In addition to these in-mine monitoring wells, two deep ground water monitoring wells were drilled during the 1986 drilling season and one during the 1987 season, which will be added to the monitoring plan. Due to the anticipated water surface depth being in excess of 1,000 feet below the ground surface and the fact that only a 2-inch diameter casing could practically be installed in these three deep wells, only piezometric surface data will be obtained from these wells. The three deep wells are completed or perforated in the Lower Blackhawk-Upper Star Point Formations to define the piezometric surface of the regional aquifer system. They were sealed above the Wattis Seam to avoid influence of the piezometric surface from water

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seeping down the hold from overlying perched aquifer systems. The shallow monitoring well, 86-26-4, has been completed in the uppermost perched aquifer system identified on Gentry Ridge, as illustrated by the uppermost sandstone shale interface on Map 25, Inventoried Seeps and Springs and Surface Geology.

Historically, ground water samples have generally been confined to areas east of the Bear Canyon Graben coincident with mined areas. However, within this next five-year permit term mining is proposed to extend to the west, within the Gentry Ridge Horst on the west side of the Bear Canyon Graben. Therefore, the additional monitoring stations (illustrated on Map 31, Ground and Surface Water Monitoring Stations) on the west side of the Bear Canyon Graben will be added to the monitoring schedule in accordance with the scheduled sequence of mining to the west. Although mains will be extended beneath Gentry Ridge starting in 1990, longwall mining of the first panel will not begin until 1991 and therefore impact to springs of the perched aquifer system or to surface water sources due to subsidence along Gentry Ridge could not occur until after the year 1991.

This monitoring plan was selected using the criteria outlined in the Division's Guidelines for Establishment of Surface and Ground Water Monitoring Programs for Coal Mining and Reclamation Operations dated January 1986.

The selection of spring locations for inclusion in the ongoing monitoring program is the result of careful consideration of location, flow, lithology, potential for subsidence and current spring development. In general, an attempt was made to select developed springs with higher yields which were representative of the differing lithologic and aquifer characteristics of the area. A summary of these items for each spring selected as a proposed monitoring site is shown in Table 90, Spring Characteristic Summary.

The selection of springs was governed by the desire to provide a broad data base. Proposed monitoring locations include some springs above old, new and future mine workings such as Springs S18-2, 229, 500, 429, 238, 494, and 753, some adjacent to potentially impacted areas such as S11-1, S14-9, 748, 751, 749, 444, and 978, and some well outside the mine permit boundary such as Spring 530 and wells 85-35-1, 86-35-2 and

86-35-3. The diversity of spring locations will allow for monitoring of both pristine areas as well as areas potentially impacted by subsidence. Higher yield characteristics of those springs chosen will also allow for continuity of sampling and provide a stronger assurance that continued sampling will be possible during drought years or during low flow fall periods. The proposed locations for some of the spring sampling as shown on the table and in the map previously referenced were revised by DOGM prior to preparation of the PAP.

Spring S18-2 which has been monitored for years will be directly above mining in Section 18, T15S, R8E, and will provide data on possible impacts from longwall mining. Springs 299, 494, 238, and 500 were selected because they too are above future mining in Section 18, T15S, R8E. If subsidence causes hazardous conditions which make it unsafe to monitor any spring, PMC will notify the Division immediately and discontinue monitoring.

The monitoring stations were selected as discussed previously. Additional considerations were given in selecting a monitoring schedule and parameters list for some stations. The following details specific considerations for individual stations. Stations not discussed here are shown on Table 80, Ground and Surface Water Monitoring Stations With Proposed Schedule When Baseline and Operational Monitoring Will Be Implemented, Table 90, Spring Characteristic Summary and on Map 31, Ground and Surface Water Monitoring Stations, and will be monitored as shown:

530 - Baseline water quality has been obtained. This spring is outside the current mining area in the Blackhawk Formation and may give a good comparison for the two springs in the Blackhawk above mining areas.

S11-1 - Baseline water quality and flow have been obtained. This spring is outside the current mining area but is a developed spring.

749 - Baseline water quality and flow have been obtained. This spring is on the west side of the Graben where mining will be conducted after the current permit term. Field measurements will be obtained during this permit term to document trends, and a baseline quality sample will be taken at low flow in 1991, the year prior to permit renewal. As mining approaches this area, regular operational monitoring will be conducted (approximately 1994).

429 - Baseline monitoring will be conducted during 1988, after which field parameters will be measured during high and low flows. In 1991, a baseline quality sample will be taken at low flow. This spring is on the west side of the Graben where mining will be conducted after the current permit term. Field measurements will be obtained during this permit term to document trends. As mining approaches this area, regular operational monitoring will be conducted (approximately 1994).

444 - Baseline monitoring will be conducted during 1988, after which field parameters will be measured during high and low flows. In 1991, a baseline quality sample will be taken at low flow. This spring is on the west side of the Graben where mining will be conducted after the current permit term. Field measurements will be obtained during this permit term to document trends. As mining approaches this area, regular operational monitoring will be conducted (approximately 1994).

S14-9 - Baseline water quality and flow have been obtained. Field parameters will be measured during high and low flows during this permit term. In 1991 a baseline quality sample will be taken at low flow. This spring is on the west side of the Graben where mining will be conducted after the current permit term. As mining approaches this area, regular operational monitoring will be conducted (approximately 1994).

85-26-1 - Baseline water quality and flow have been obtained. Field parameters will be measured during high and low flows during this permit term. In 1991 a baseline quality sample will be taken at low flow. This spring is on the west side of the Graben where mining will be conducted after the current permit term. As mining approaches this area, regular operational monitoring will be conducted (approximately 1992).

Some sampling locations lack some quarterly data mainly due to inaccessibility of the sampling locations during the winter season. Mud and snow are the main problems encountered in reaching surface sampling stations during early and late year sampling runs. Surface management agencies (BLM and USFS) restrict travel on access roads to the monitoring sites when these roads are wet and muddy.

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As indicated above, baseline and operational monitoring will be conducted at the monitoring stations identified on Map 31, Ground and Surface Water Monitoring Stations with Water Quality Data in accordance with the time schedule indicated in Table 80, Ground and Surface Water Monitoring Stations with Proposed Schedule when Baseline and Operational Monitoring will be Implemented.

SURFACE WATERS

<u>Baseline</u>

Monitoring will be conducted as follows:

1. Field Measurements - as shown on Table 82, Baseline Low Flow Water Quality Analytical Schedule, during May or June, July, August and September.
2. Quality Samples - during high flow in May or June, and at low flow in September using the parameters list shown on Table 82, Baseline Low Flow Water Quality Analytical Schedule.

<u>Operational</u>

Monitoring will be conducted as follows:

1. Field Measurements - as shown on Table 81, Operational And Post-Mining Water Quality Analytical Schedule, during high flow in May or June and low flow in September.
2. Quality Samples - during high flow in May or June, and during low flow in September using the parameters list shown on Table 81, Operational And Post-Mining Water Quality Analytical Schedule.

GROUND WATERS

<u>Springs and Wells Used for Culinary Sources</u>

<u>Baseline</u>

Monitoring will be conducted as follows:

1. Field Measurements - as shown on Table 82, Baseline Low Flow Water Quality Analytical Schedule, during May or June, July, August and September.

2. Quality Samples - during high flow in May or June, and during low flow in September, using the parameters list shown on Table 82, Baseline Low Flow Water Quality Analytical Schedule.

After the baseline quality samples are taken, an analysis will be made of the metals and nutrient levels in new ground water sources to compare with other sources. If the levels are significantly different, an additional year's data will be collected to give more understanding of the differences. If after the first year, the levels of metals and nutrients are similar to other waters in the area, the operational monitoring schedule will be conducted on these new sources.

Operational

Monitoring will be conducted as follows:

1. Field Measurements - as shown on Table 81, Operational and Post-Mining Water Quality Analytical Schedule, during May or June, July, August, and September.
2. Quality Samples - during high flow in May or June, and during low flow in September using the parameters list shown on Table 81, Operational and Post-Mining Water Quality Analytical Schedule.

Mine Flows

Baseline

Monitoring will be conducted as follows:

1. Field Measurements - as shown on Table 82, Baseline Low Flow Water Quality Analytical Schedule during January, April, July and October.
2. Quality Samples - during January, April, July and October, using the parameters list shown on Table 82, Baseline Low Flow Water Quality Analytical Schedule.

Operational

Monitoring will be conducted as follows:

1. Field Measurements - as shown on Table 81, Operational and Post-Mining Water Quality Analytical Schedule, during January, April, July and October.
2. Quality Samples - during January, April, July and October, using the parameters list shown on Table 81, Operational and Post-Mining Water Quality Analytical Schedule.

Ground Water Wells

Water levels will be monitored during January, April, July and October for in-mine wells. The water level of other wells on the surface will be monitored during May or June, July, August and September. No quality samples will be taken.

During year five of the mining permit (the year preceding permit renewal) the monitoring program will be expanded by sampling according to a baseline water quality analytical schedule during the low flow period of the year. For surface water sites and in-mine monitoring sites, this schedule will consist of the collection and analysis of water quality data during three quarters of the year according to Table 81, "Operational Water Quality Analytical Schedule." Fourth quarter samples will be taken during the fall of the year when flows are at a minimum and will be analyzed according to the schedule shown on Table 80, "Baseline Low Flow Water Quality Analytical Schedule." For springs, this schedule will consist of obtaining a single water quality sample during the low flow period of the year which will be analyzed in accordance with the parameter list for baseline monitoring. It should also be noted that historic water quality data are generally in the "total" form and that dissolved concentrations have not been measured. As a general rule, grab sample total concentrations have been well below current dissolved quality limitations (for additional details see response to UMC 783.16). Since total concentrations have been characteristically below the dissolved water quality limitations, it is felt that the water quality analysis schedules presented above (to be analyzed primarily for total concentrations only) are adequate to meet the requirements of UMC 817.52.

A stream survey of the NFRF of Miller Creek will be conducted in June and September of each year mining is conducted in Section 18 with a potential for subsidence. This survey will consist of flow measurements, pH, conductivity, water temperature, and air temperature at the stations shown on Map 29, "Stream Survey - North Fork Right Fork Miller Creek." The surveys will be conducted until mining ceases in Section 18 or until subsidence stabilizes.

Complete water quality sets of data collected to date under the current monitoring plan are not submitted with this report because the data as available on computer are voluminous and not practically manageable in a report of this type, however, water quality summaries were presented in response to UMC 783.15 and 783.16. Samples will continue to be analyzed according to the testing methodologies presented in Exhibit 6, "Laboratory Methods Used for Sample Analysis."

Surface and ground water monitoring will continue for the life of the operation on a quarterly basis, when accessible, and during post-mining operations until the reclamation effort is approved by DOGM. Post-mining samples will be analyzed according to the plan described above unless an abbreviated 3rd quarter schedule is approved. Post-mining samples will be analyzed in accordance with regulatory agency guidelines in effect during post-mining monitoring.

Monitoring of all mine related discharges will be conducted in accordance with the currently held National Pollutant Discharge Elimination System (NPDES) permits. Notices of non-compliance with NPDES permits, from either mine water discharge or discharge from sedimentation ponds, will be filed with the appropriate agencies following any exceedence to the water quality limitations. Accompanying the written "Notice of Non-Compliance" will be the analytical results. As discussed previously, requests have been made and a response is pending from the Environmental Protection Agency to increase the TDS effluent limitation for the Mud Water mine discharge and for Sedimentation Pond No. 8. These requests have been made to replace the present TDS limitation in the NPDES permit with a value that is more compatible with TDS concentrations of natural waters into which water from these two discharge points is released.

As required, water monitoring data collected from water monitoring stations will be submitted to DOGM. Such reports will normally be submitted within 90 days of the end of each quarter, depending on the speed of the laboratory analyses. An annual summary of data will be submitted at the end of each calendar year.

In compliance with UMC 784, four water quality monitoring stations have been proposed for installation at the Cyprus Plateau Mine. The stations as proposed are located below existing Sediment Pond No. 4 at a point which is downgradient from final channel reclamation for reclaimed channel 25C, and below Sediment Ponds No. 6, No. 7, and No. 8. The locations of these stations are shown on Map 50 (Sheet 2 of 7), "Post Mining Channel Reclamation." These locations appear to be ideal for monitoring post mining water quality from upgradient mining areas due to their location and ease of access.

(c) THE DESCRIPTION SHALL INCLUDE A DETERMINATION OF THE PROBABLE HYDROLOGIC CONSEQUENCES OF THE PROPOSED UNDERGROUND COAL MINING ACTIVITIES, ON THE PROPOSED MINE PLAN AREA AND ADJACENT AREA, WITH RESPECT TO THE HYDROLOGIC REGIME AND THE QUANTITY AND QUALITY OF WATER IN SURFACE AND GROUND WATER SYSTEMS UNDER ALL SEASONAL CONDITIONS, INCLUDING THE CONTENTS OF DISSOLVED AND TOTAL SUSPENDED SOLIDS, TOTAL IRON, PH, TOTAL MANGANESE, AND SUCH OTHER PARAMETERS AS MAY BE REQUIRED BY THE DIVISION ON A CASE-BY-CASE BASIS.

RESPONSE:

A description of probable hydrologic consequences related to the hydrologic regime and the quantity and quality of water under all seasonal conditions is presented below for ground water followed by surface water.

PREDICTION OF MINING IMPACTS ON GROUND WATER HYDROLOGY

Potential impacts to the ground water hydrologic system as a result of mining within and adjacent to the mine plan area can be categorized under four primary headings:

- Impacts to the perched aquifer systems as a result of subsidence.

- Impacts to the regional aquifer system due to mining either above or within the regional system.

- Impacts to the hydrologic regime within the Bear Canyon Graben due to the graben crossing.

- Impacts caused by the interbasin transfer of water from the San Rafael River Basin to the Price River Basin.

IMPACTS TO THE PERCHED AQUIFER SYSTEMS

Impacts to the most significant perched aquifer system within or adjacent to the mine plan area (the perched aquifer system of the Price River - North Horn Formations) may occur as a result of subsidence caused by removal of coal seams beneath the mine plan area. Understanding of the impacts from subsidence to the ground water system of the perched aquifer of the Price River and North Horn Formations and therefore the overlying springs associated with this system is still in its infant stage. Data have not been collected for a sufficient period of time in subsided areas from mining along the Wasatch Plateau to document what impacts will occur from subsidence to the perched aquifer system of overlying formations.

Flow hydrographs for springs S7-1, S11-1, S17-2, S18-2, 748, 751, and 753 (which are springs monitored over the past five years as part of the operational monitoring plan) are presented on Figure 13, Flow Hydrographs -Springs. As illustrated by comparing the locations of these springs on Map 26, Ground and Surface Water Quality Sampling Stations with Water Quality Data, with the mine workings presented on Map 28, In-Mine Flow Monitoring Sites and Tributary Areas, springs S7-1, S17-2, S18-2, and 753 either directly overlie mine workings or lie within the angle of draw. Of these springs, only Spring 753 (which overlies the longwall area in the Wattis Seam) lies above a fully extracted section of the mine. Examination of the flow hydrographs for the above referenced springs, particularly Spring 753, does not indicate that any impact has occurred to these springs from past mining activities. In fact, Spring 753 shows a significant increase in flow between 1981 and 1985, which reflects the wetter climatic weather conditions experienced since 1982.

According to J.F.T. Agapito and Associates, Inc. Exhibit 30, Prediction of Subsidence Due to Two-Seam Longwall Mining in Section 18, who has prepared a prediction of subsidence to an area to potentially be added to the mine plan area in the future, three different zones develop above the mined area as a result of subsidence. Zone I is the immediate roof which is highly stressed and free to collapse. Roof rocks within this zone collapse in small pieces until the void due to coal extractions is filled, creating a highly permeable zone. In Zone II which lies above Zone I, the roof beams deform and fracture, but maintain their continuity because of lateral confinement. Fracturing of the roof beams is associated with lateral expansion which is limited by the sidewalls of the excavation. Such confinement tends to keep the fractures closed; however, this fracturing can increase the permeability of the strata in Zone II. Zone III lies above Zone II and extends from the top of Zone II to the ground surface. Zone III consists of gradual downward movement of the strata with no fractures, except possibly shallow (less than 35 feet deep) surface cracks in tensile zones adjacent to the edge of excavation.

As indicated in the above referenced report, the fissured zones (Zones I and II) where fracturing of the overlying strata occurs, is limited to less than 400 feet above the extracted coal seams. The perched aquifer system of the Price River - North Horn Formation (with the base of the Price River Formation lying some 1,100 feet above the Wattis Coal Seam, the uppermost coal seam to be mined), is located well into Zone III where only deformation of the strata is predicted, with no fracturing of the strata in this zone, except minor surface cracking near the fringes of the mined out areas. Therefore, fracturing of the upper shale layers which support the perched aquifer system is not anticipated and as such dewatering of the perched system through fractures associated with subsidence is likewise not anticipated. However, the impact from deformation of the formation due to subsidence is more difficult to springs, particularly Spring 753, does not indicate that any impact has occurred to these springs from past mining activities. In fact, Spring 753 shows a significant increase in flow between 1981 and 1985, which reflects the wetter climatic weather conditions experienced since 1982.

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<u>As discussed on Page 784-89, understanding of the impacts from subsidence to the groundwater system of the perched aquifer of the Price River and North Horn Formations is in its infant stages. Understanding of subsidence impacts on groundwater in general is not well understood. The USGS study in association with mining under the Right Fork of the North Fork of Miller Creek will provide a unique opportunity to gather data in a scientific study to answer many of the questions plaguing the regulatory agencies, such as:</u>

- <u>How high above the mined coal seam does the strata break up?</u>

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
date 1-11-89
by [signature]

Revised 12-7-88

- What are the zones of subsidence effects above mining -- broken, fractured, and deformed?
- What is the effect of mining under shallow cover, i.e., under 500 feet?
- What is the timing of subsidence?
- What is the angle of draw at various cover depths?
- What is the effect of subsidence on perched aquifers?
- What is the effect of subsidence on springs overlying mining?
- How deep do cracks penetrate the ground?
- Will surface water flow into subsidence cracks and for how long?
- Will mudstone, siltstone, or shales seal off and prevent the downward movement of inflows?
- What water quality changes result from subsidence?

The more significant impact that could result to the perched aquifer system of the Price River - North Horn Formation from subsidence, could occur to fault related springs. Subsidence which intersects faults could result in a step-wise movement of the fault thereby affecting the conduit system which feeds the fault related springs. This stepwise movement may not impair the seal at the shale aquitard interface of the fault (which is apparently sealed at most locations along the fault thereby creating a fault related spring in the perched system); the seal may simply move downward causing the spring to issue at a different location; or the slippage along the fault plane may damage the shale aquitard seal at the fault allowing seepage down the fault to a lower aquifer system, thereby diminishing or eliminating the flow from the spring. Impacts of this nature cannot be quantified, except by monitoring.

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by ________ date 1-11-89

 Revised 12-7-88

Impacts to the springs issuing from the perched aquifer system in the Castlegate Sandstone, which lies some 700 to 800 feet above the Wattis Coal Seam are expected to be similar to those identified above for the perched system of the Price River - North Horn Formations. The Castlegate Sandstone is likewise located in the subsidence Zone III where only deformation of the strata is predicted. According to J.F.T. Agapito and Associates (1986) who calculated surface strains at perched springs of the Castlegate Sandstone and lower Price River Formation, from longwall mining beneath Section 18, surface strains indicated little potential damage to these springs from longwall mining in the Wattis Seam. However, there is a potential for the development of minor cracks at the base of the springs which are located at the northern edge of Longwall Panels No. 5 and No. 6 in the Wattis Seam (located in the northern portion of Section 18) during mining of Panels No. 7 and No. 8 in the Third Seam directly below. Although some shallow surface cracking (less than 35 feet) may occur in tensile zones adjacent to the edges of mining excavation which could result in cracking of the sandstone formations, the shale or mudstone aquitard beneath the sandstone should prevent loss of water down the crack to deeper aquifer systems, although the location of the spring may be altered. J.F.T. Agapito and Associates also concluded that the potential for shallow cracking at the surface exists for mining under up to 800 feet of cover. Therefore, this phenomenon should be restricted to the Castlegate Sandstone and underlying formation, and not result in major impacts to the perched system of the Price River-North Horn formations.

Springs in Section 18 as shown on Map 72, Spring Mining Correlation, that may be affected by subsidence include: 227, 228, 229, 238, 493, 496, 497, 498, 499, 500, 240, and S18-2. Of these, Spring 228 had a flow during the 1986 inventory of 9 GPM; Spring 229, 12 GPM; Spring 238, 4 GPM; Spring 500, 3 GPM; Spring 240, 2 GPM; and Spring S18-2, 9 GPM. All of the rest had flows less than 1 GPM each. Springs 229, S18-2, and 500 will be monitored for mining impacts. If subsidence causes hazardous conditions which make it unsafe to monitor any spring, PMC will notify the Division immediately and discontinue monitoring.

Revised 4/10/87

Regarding springs found issuing from the Blackhawk Formation, as indicated in response to UMC 783.14, of the total number of springs found within or adjacent to the permit area, only five percent (10 springs) were found which issue from the Blackhawk Formation. None of the Blackhawk related springs are high yielding springs which is indicative of the poor aquifer characteristics of the Blackhawk Formation as well as low recharge potential. Of the ten springs found issuing from the Blackhawk Formation, only two of the springs (in Seeley and Mud Water Canyon) are located in areas directly affected by subsidence. No springs were found issuing from the Blackhawk Formation in Section 18 (one of the parcels added to the permit area). The other eight springs are located outside of the mine plan area. Flow from the two springs described above could be diminished due to subsidence or totally eliminated. There are no ground water rights tied directly to these springs that could be affected should the flow from either of these springs be diminished.

Water made within the mine has been derived from perched aquifer systems of channel sandstones intercepted along the roof and floors of the mine. The regional water table east of the Bear Canyon Graben, where all mining to date has occurred, has been identified to occur in the Star Point Sandstone Formation which lies beneath the coal seams being mined. As presented in response to UMC 783.15, the total water made within the mine from these perched channel sandstones from April 1985 to March 1986 that was discharged at the surface was 134 gpm (216 acre-feet).

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Much of this 134 gpm discharged from the mine is derived from water stored in the channel sandstones above and below the coal seams being mined and, therefore, does not indicate that the flow in surface streams (which provide the ultimate outlet for ground water in the mine plan and adjacent areas) will be reduced by 134 gpm. Inflow to the mine from a channel sandstone may be significant when first encountered, but as the mine advances, inflow from channel sandstones previously encountered drop off rapidly often to zero indicating that recharge to these perched systems in the Blackhawk Formation is limited. Limited recharge is a result of shale or mudstone layers in the Blackhawk and overlying formations which form barriers to the vertical movement of ground water.

As an indication of the volume of water potentially derived from storage in the channel sandstones of the Blackhawk Formation, the contributing area of aquifer can be derived that is required to produce an annual yield of 134 gpm, assuming a specific yield of 0.1 for the sandstone units. With an annual yield of 134 gpm, the total volume of water released from storage is only 216 acre-feet. Assuming a sandstone unit that is only 10 feet thick with a specific yield of 0.1, the required area to produce from storage 216 acre-feet of water is only 216 acres. Assuming a sandstone unit that is 20 feet thick, the required contributing area is only 108 acres. The longwall area itself of the Wattis Coal Seam (See Map 28, In-Mine Flow Monitoring Sites and Tributary Areas,) covers some 130 acres. Total area within the mine, included within the tributary areas to the in-mine monitoring sites, includes approximately 1,400 acres. Therefore, recognizing that recharge to the Blackhawk - Star Point aquifer system is limited and based on the calculations presented above, probably over 95 percent of water made within the mine is derived from storage of the channel sandstones in the Blackhawk Formation, and actual total impact to surface receiving streams is probably less than five gpm.

Some additional impact can be expected to ground water inflow to the North Fork of the Right Fork of Miller Creek from mining beneath

Section 18, particularly as mining is advanced beneath the stream channel itself. This impact will occur through that reach of stream channel where fracturing of subsidence Zones I and II intercept the perched water in channel sandstones of the Blackhawk Formation. Direct dewatering into the mine of water from these perched sandstone channels within the first 300 to 400 feet of Blackhawk Formation above the coal seams to be mined will result in some loss of ground water seepage or base flow to the North Fork of the Right Fork of Miller Creek.

The extent to which subsidence will impact the base flow of the North Fork of the Right Fork of Miller Creek as derived from flow from perched sandstone channels above the coal seams to be mined in the Blackhawk Formation is difficult to predict. As indicated by J.F.T. Agapito and Associates (1986), mudstones present within the Blackhawk and overlying formations are an average of nine feet thick, and are located at an average spacing of 40 feet. The existence of these impermeable units among the more permeable sandstone units is useful and essential for minimizing the ground water intercepted within the mine from dewatering the overlying perched systems within subsidence Zones I and II as well as preventing direct hydraulic connection between surface waters and underground workings, particularly at shallow overburden depths.

The maximum potential impact to the base flow of the North Fork of the Right Fork of Miller Creek by intercepting ground water from the perched channel sandstones within the lower Blackhawk Formation can be made by assuming that all baseflow derived from the Blackhawk Formation (within the 400 feet immediately above the Wattis Coal Seam) is intercepted by the mine and lost from the North Fork of the Right Fork of Miller Creek. From a stream survey of the North Fork of the Right Fork of Miller Creek (discussed in detail in Section 783.15) conducted on July 2, 1986, total ground water contribution to the streamflow of Miller Creek through the Blackhawk Formation was determined to be on the order of nine gpm. Of this nine gpm, approximately three gpm was derived from the upper Blackhawk Formation above subsidence Zones I and II and is therefore not anticipated to be intercepted by direct dewatering down into the mine. However, flow from this reach could be diminished due to deformation of the formation resulting from subsidence. Some of this nine gpm likewise occurs below the Third Seam, the lowest coal seam to be mined in Section 18. Therefore as of July 2, 1986, the maximum potential loss to the base flow of the North Fork of the Right Fork of Miller Creek by ground water intercepted within the mine by dewatering the perched aquifer systems of the overlying channel sandstones in the Blackhawk Formation is less than nine gpm. Actually, since this survey was conducted in the early summer period when base flows are expected to be somewhat higher, the average annual impact to baseflow contributions from the Blackhawk Formation are expected to be on the order of five gpm or less.

Aquifer characteristics in the subsidence Zones I and II will change due to the fracturing of the formations in these zones above the coal extraction areas. This fracturing will increase the secondary permeability of the lower Blackhawk Formation resulting in the limited recharge to this system flowing more quickly through this portion of the formation. Recharge to this lower zone is not anticipated to increase significantly since the fracturing associated with Zones I and II is anticipated to extend to a height of less than 400 feet above the coal seam. Since the next formation above the Blackhawk lies some 700 to 800 feet above the Wattis Coal Seam, the fracturing will be limited to the Blackhawk Formation which receives minimal recharge.

Likewise, since the ground water will move more quickly through this lower Blackhawk Formation, significant changes in the chemical quality of ground water are not anticipated. If any changes occur, it could result in a decrease in the TDS concentration since ground water in the lower Blackhawk by virtue of increased secondary permeability will be in contact with minerals in the rock for a shorter time.

IMPACTS TO THE REGIONAL AQUIFER SYSTEM

As discussed in respone to UMC 783.15, east of the Bear Canyon Graben the regional aquifer system has been identified to exist within the mine plan and adjacent areas in the Star Point Sandstone below the Blackhawk (coal bearing) Formation. There has undoubtedly been some impact to the regional aquifer system due to mining east of the graben, as mining has intercepted the limited recharge that may be occurring from the perched system in the channel sandstones of the Blackhawk Formation. As discussed previously, shales and mudstones effectively limit the downward movement of water and recharge directly downward through the Blackhawk Formation is limited. Removal of the 134 gpm annual discharge from the mine probably reflects less than a five gpm impact to surface streams which receive recharge from ground water systems of the mine plan area.

Potential impacts to the ground water system within the Bear Canyon Graben, through which a tunnel will be driven to access coal reserves beneath Gentry Ridge, will be addressed in a subsequent section.

As presented in response to UMC 783.15, on the west side of the Bear Canyon Graben, in the horst of Gentry Ridge, the elevation of the regional water table and its position relative to the Blackhawk - Star Point Formations has not been determined. It is anticipated that mining will penetrate the regional aquifer system (at a minimum) toward the southern (downdip) end of Gentry Ridge and may encounter the regional aquifer system more toward the northern or updip end of the ridge.

Mining beneath the regional water table of Gentry Ridge will require dewatering of the mine as mine inflows are anticipated to be at least equal to and probably greater than those presently experienced east of the Bear Canyon Graben. Dewatering of the mine will result in drawing down the piezometric surface of the regional aquifer. Except where fracture systems (associated with the north-south extensional system) are intercepted, initially most of the mine inflow will be derived from dewatering ground water in storage in the aquifer, and some of the water may be derived from a decrease in natural discharge from the aquifer. The impacts on surface streamflows from dewatering the non-fracture related channel sandstones of the Blackhawk Formation is not expected to be much more significant than that projected for the system east of the Bear Canyon Graben.

The more significant impact to the hydrologic system could occur if significant inflows occur as faults of the north-south extensional system are intercepted in the mine. As identified previously, south of "The Steeps" the direction of ground water movement in the north south fault system is to the south, probably providing recharge to Tie Fork and Huntington Creeks. Therefore, the interception of significant quantities of ground water from faults within the mine beneath Gentry Ridge could reduce recharge to these surface water sources.

Of primary concern is the direct potential impact from the mine to the three Huntington City wells located in Section 34, T. 15 S., R. 7 E. near the junction of Wild Cattle and Gentry Hollows and developed as a culinary water supply for Huntington City. These wells (located approximately 6,500 feet south of the present mining boundary) appear to be related to the eastern boundary fault of the Pleasant Valley Graben. As discussed in response to UMC 783.14, recharge to these wells developed in the Star Point Sandstone, is derived from the perched aquifer system of the Price River - North Horn Formations.

As presently mapped (See Map 25, Inventoried Seeps and Springs and Surface Geology), the Huntington City wells appear to be associated with the eastern boundary fault of the Pleasant Valley Graben and the first finger fault east of the Pleasant Valley Graben. As mapped, the eastern boundary fault of the Pleasant Valley Graben lies some 300 to 400 feet west of the mine permit area and as such, the fault will not be intercepted by the mine. The first finger fault east of the Pleasant Valley Graben fault lies primarily west of the mine plan area, just nicking the southwest edge of the mine plan area. If the primary conduit system of these faults is not intercepted by the mine, then with recharge for these wells occurring from the Price River-North Horn Formations, the mine should not impact these wells unless subsidence were to somehow affect the conduit system at the fault.

The quantity of ground water inflow into the mine beneath Gentry Ridge and therefore, the magnitude of potential impact is difficult to predict. As indicated previously in areas not intercepting the splinter faults which extend in a south-easterly direction from the eastern boundary fault of the Pleasant Valley Graben, inflow would be on the order of magnitude or probably somewhat greater than that experienced in the mine east of the Bear Canyon Graben. However, more significant inflows may be anticipated as the splinter faults are intercepted, particularly as the mine advances to the south where the probability of being within the regional aquifer system is greater. At the Bear Canyon Fault, U. S. Fuel Company has encountered a sustained inflow at their 10th West Section and at other contacts with the fault in the King IV Mine. These larger sustained flows from the fault probably account for much of the mine water presently being discharged from the Mohrland Portal (800 to 900 gpm). Should significant water bearing fracture systems be encountered, higher flows on the order of those experienced by U.S. Fuel may be experienced.

IMPACTS TO THE HYDROLOGIC REGIME FROM THE GRABEN CROSSING

The hydrologic position of the graben crossing will first be discussed followed by a discussion of estimated ground water inflow into the graben crossing, and projected impacts from the graben crossing.

Hydrologic Position of Graben Crossing

As discussed in response to UMC 783.15, entitled Piezometric Surface, the proposed rock tunnel crossing through the Bear Canyon Graben to allow PMC to access Coal Lease U-13097 under Gentry Ridge extends from the eastern boundary fault in the NW 1/4 of Section 13, T. 15 S., R. 7 E., through the graben to the western boundary fault of the graben in Section 14 (See Map 27, Piezometric Surface -Regional Aquifer System). Only one of the two proposed tunnel sets illustrated on the map reference above, will actually be driven, probably the southern most tunnel set. The proposed rock tunnel graben crossing will extend from the Wattis Coal Seam, east of the graben (elevation 8,492 feet) to the Wattis Coal Seam west of the Bear Canyon Graben (elevation 8,450 feet) (See Figure 8, Bear Canyon Graben - A-A' Cross-Section).

In addition to the eastern and western boundary faults of the graben, the proposed rock tunnels will be cut through three to four additional identified faulted or fractured zones (See Figure 8, Bear Canyon Graben -A-A' Cross-Section). These zones have hydrologic significance due to the increased ground water inflow into the mine that may or may not occur as these zones are intercepted. The first zone (progressing from east to west) is identified as a "fracture zone or small fault." This zone was identified from VLF surveys conducted across the area as an anomaly, indicating either the presence of a fault or significant fracture at this location. The other two to three zones have been identified as faults from the logs of exploratory drill holes along the proposed graben crossing.

The most significant faults at the proposed crossing are the boundary faults on the east and west side of the graben. As identified on the above referenced map, these boundary faults are actually fault zones composed of multiple slippage planes. The most significant inflows into the rock tunnels of the graben crossing can be expected at these boundary faults.

The proposed graben crossing is located in the upper Blackhawk Formation from 200 to 325 feet above the Wattis Coal Seam within the graben. Therefore the proposed rock tunnels are expected to traverse through the interbedded mudstones and sandstones of the upper Blackhawk.

The proposed graben crossing appears to be located above the regional water table. Anticipated ground water inflows into the rock tunnel during drivage are expected to be derived from a perched aquifer system of limited extent in the upper Blackhawk Formation, and as such inflows into the mine through the tunnel area are expected to be of short duration.

A horizontal hole was drilled through the gouge zone of the eastern boundary fault of the Bear Canyon Graben at 2nd Left in the mine (See Map 27, Piezometric Surface - Regional Aquifer System). Forty to 60 feet of gouge and fractured rock were penetrated before tapping into a significant ground water conduit, initially flowing at 150 gpm, but dropping to less than 10 gpm after 10 weeks and eventually dropping to zero, indicating the dewatering of a limited perched system associated with fractures on the inside of the graben along the eastern boundary fault. Inflow to the mine at the second contact point with the eastern boundary fault of the Bear Canyon Graben, the proposed entry to the rock tunnels at 2nd West Mains, dropped rapidly from 30 gpm to 10 gpm in only four weeks, and since that time to zero, indicating the dewatering of a perched aquifer system.

If the proposed graben crossing were to be driven at an elevation below the regional water table, the drill holes inside of the Bear Canyon Graben would have identified fluid levels at elevations higher than the proposed tunnels and inflow to the mine at the 2nd West Mains and 2nd Left encounters would have been maintained at a sustained rate, not diminishing so drastically with time.

The opposite is true at the encounter with the eastern boundary fault of the Bear Canyon Graben by U.S. Fuel Company in the 10th West Section of the King IV Mine (See Map 27, Piezometric Surface - Regional Aquifer System). As indicated in the U.S. Fuel Company Hiawatha Mine Permit Application, page VII-3 of Section 7.1, "large water flows have been encountered in the past, mainly due to contact with the Bear Canyon Fault, which is a major water bearing structure. Old mine workings have contacted the fault at several points and this probably accounts for most of the mine water presently being discharged from the Morhland portal" (800 to 900 gpm).

Unlike flows encountered by PMC at the proposed graben crossing, inflows into U.S. Fuel Company's King IV Mine from contact with the eastern boundary fault of the graben have stabilized at fairly high inflow rates when compared with most mines of the area, indicating that the King IV Mine lies below the regional water table. The 10th West Main encountered the Bear Canyon Fault in the NE 1/4 of the SW 1/4 of Section 23, T.15 S, R.7 E at an elevation of about 8,180 feet. Ground water encountered at this location occurred on the east side of the fault, primarily from the floor through an area the size of a bushel basket. According to information contained in November 7, 1983 U.S. Fuel Company, "Response to Determination of Adequacy," on file at the DOGM, inflow into the mine at the 10th West Main intercept with the Bear Canyon Fault, was measured at 100 gpm. Personnel of U.S. Fuel Company have indicated that this inflow rate is fairly constant. The fault was not penetrated; therefore, water encountered in the mine is presumed to be bounded on the west by the gouge zone of the fault system and presumably receives recharge from areas east of the fault. Interception of the regional system at the 2nd West Mains and 2nd Left sections in the Star Point Mine would have resulted in a sustained inflow into the mine as is presently occurring in the 10th West Main of U. S. Fuel's King IV Mine.

The fact that inflow into the Star Point Mine from the in-mine horizontal drill hole (which penetrated through the eastern boundary fault into the Bear Canyon Graben) dropped off rapidly with time eventually dropping to zero, indicates that recharge to the perched system that would be drained by the graben crossing is limited. Limited recharge to this perched system in the Blackhawk Formation is a result of shale layers in the upper Blackhawk and overlying formations,which are essentially impermeable (or of extremely low permeability) and which as described previously apparently also form barriers to the vertical movement of ground water along fault planes. It is anticipated that water drained from the perched system is water accumulated in the fracture system of the fault from years and years of extremely low seepage from the overlying strata through the shales layers of low permeability.

Estimated Ground Water Inflow into the Graben Crossing

Ground water inflow along the proposed graben crossing is expected to be most severe through the fault zones of the eastern and western boundary faults of the Bear Canyon Graben. Since inflow from the underground horizontal drill hole which penetrated the eastern boundary fault at 2nd Left has dropped to zero, the perched aquifer system associated with the fracture zone of the fault has been dewatered down to the elevation of the hole. As indicated by the elevation difference between 2nd Left and the proposed graben crossing at 2nd West Mains previously referenced, 2nd West Mains is located at an elevation 300 feet lower than the drill hole at 2nd Left. Therefore, as the tunnel is driven through the eastern boundary fault at the 2nd West Mains section inflow can be anticipated from the fracture zone of the eastern boundary fault. Assuming inflow to be on the order of that encountered from the drill hole at 2nd Left, peak inflow rates at the eastern boundary fault may be on the order of 150 to 200 gpm, dropping off rapidly to 100 gpm in two weeks, to less than 10 to 20 gpm in a two to three-month period, and eventually to zero. Assuming averages over time of the figures presented above of 136 gpm for the first two weeks, 60 gpm for the next 10 weeks, and 5 gpm for an additional 12 weeks, the total inflow volume at the eastern boundary fault may be on the order of 30 acre-feet. Inflow at the western boundary fault is anticipated to be similar to that encountered at the eastern boundary fault. Therefore, peak inflow rates at the western boundary fault may likewise be on the order of 150 to 200 gpm, dropping off rapidly to less than 100 gpm in two weeks and to less than 10 to 20 gpm in a two to three month period and eventually to zero. Assuming averages over time from the figures presented above, the total volume of inflow at the western boundary fault may be on the order of 30 acre-feet.

Anticipated inflow from the three to four fault or fracture zones identified on the interior of the graben is more difficult to estimate. As indicated in response to UMC 783.15, the formation at exploratory drill hole CVR-5A (located 2,000 feet north of the proposed crossing) was so fractured that fluid could not be maintained in the hole while attempting to log the hole. The fluid level was not intercepted until a depth of some 44 feet below the elevation of the proposed rock tunnels of the graben crossing. Hole CVR-5A is located within 250 feet of the center fault identified on Figure 8, Bear Canyon Graben - A-A' Cross-Section. Therefore, a perched system associated with the interior faults may or may not be encountered on the interior of the graben at the elevation of the proposed tunnel crossing. Should inflow be experienced at these interior fault and fracture zones, the inflow rate is anticipated to be less than that expected or already experienced at the exterior fault zones of the graben. As a conservative assumption assuming inflow rates at all interior fault and fracture zones to be on the order of inflow rates measured at the eastern boundary fault, the total inflow volume of ground water intercepted by the graben crossing would be on the order of 180 acre-feet. Once dewatered, recharge to the fracture zones penetrated by the graben crossing is expected to be minimal. Therefore, the additional volume of water which may flow into the tunnel of the graben crossing on an annual basis is likewise expected to be minimal.

Underground Mine Discharge from the Graben Crossing

Ground water intercepted within the proposed graben crossing and not used in the mine will be discharged from the mine into the surface water system via the portal in Mud Water Canyon. Discharge from an underground mine will be allowed if the discharge (with or without treatment) satisfies effluent limitations and if discharge will result in changes in the prevailing hydrologic balance that are minimal and post-mining land use will not be adversely affected.

Discharge at Mud Water Canyon from water collected at other locations within the Star Point Mines is presently monitored in accordance with a NPDES discharge permit. Prior to 1985, no water quality exceedence to the NPDES permit had occurred from underground mine water discharge at Mud Water Canyon. However, during 1985, a number of samples taken from the discharge at Mud Water Canyon contained TDS concentrations slightly greater than the NPDES limitation of 650 mg/l. Out of 15 samples collected during 1985, the TDS concentration varied from a low of 598 mg/l taken in late May to a high of 772 mg/l taken in late October. The sample mean was 689 mg/l with a standard deviation of 53 mg/l. In a letter dated June 28, 1986 from Ben Grimes (Senior Environmental Engineer of PMC) to the Regional Administrator of EPA, Mr. Grimes indicated that an in-mine survey of water quality revealed that most of the ground water currently inflowing into the mine naturally has a higher TDS concentration than the 650 mg/l NPDES limitation; that this is probably due to the fact that mining is occurring under areas with greater overburden and therefore greater opportunity for percolating ground water to pick up dissolved solids; and that the naturally occurring TDS concentration in the Mud Water Canyon drainage receiving the ground water discharge is greater than the TDS concentration of the mine discharge. As a result, mine discharge into Mud Water Canyon has not adversely affected the receiving stream and PMC has submitted a request to EPA and the Utah State Department of Health that the NPDES TDS limitation be increased from 650 mg/l to 1,450 mg/l (an average of the naturally occurring concentration of the Mud Water Canyon stream). The decision from EPA and the Department of Health pertaining to this request is pending.

Discharge of ground water intercepted in the tunnels of the proposed graben crossing will result in transferring water which would be considered tributary to the San Rafael River Basin to Mud Water Canyon which is tributary to the Price River Basin, thereby affecting the prevailing hydrologic balance. Discharge from the perched aquifer system of the fracture zones with the Blackhawk Formation within the graben to surface streamflow within Tie Fork Canyon or Huntington Creek is probably minimal due to limited recharge to and discharge from the perched system. Therefore, impact to the yield of these surface water courses will be minimal and the primary impact to the hydrologic balance of the system will occur from the discharge into Mud Water Canyon of the projected 180 acre-foot volume which may be intercepted by the proposed graben tunnels as the perched system is dewatered. This quantity may be significantly less. Since recharge to the perched system is small, discharge into Mud Water Canyon of water collected in the graben crossing could be considered almost a one-time event. Therefore, changes to the hydrologic balance are anticipated to be small from the graben crossing.

Summary of Impacts to the Hydrologic System from the Graben Crossing
The primary impact to the ground water system from the proposed graben crossing will be the dewatering of the limited perched aquifer system in the upper Blackhawk Formation which may be restricted primarily to the fracture zones of the principle boundary faults. As indicated by the flow diminishing rapidly to zero from the underground drill hole which penetrated horizontally into the graben some 400 feet, recharge is minimal to the perched system to be intercepted by the graben. The rapidly diminishing flow is also an indication that since recharge is minimal, outflow to a surface of subsurface drain is also minimal and that water to be intercepted by the graben crossing has been accumulated in storage from many years of seepage through the shales of extremely low permeability. Therefore, the impact to the yield for surface stream courses will be small.

Impacts to springs of the perched aquifers are not anticipated. As illustrated on Map 25, Inventoried Seeps and Springs and Surface Geology, until the Bear Canyon Graben intercepts Huntington Canyon which is located about nine miles south of the proposed graben crossing, all springs associated with faults of the graben system are located higher in the watersheds, issuing from the perched system of the Price River and North Horn Formations. The perched system of the Price River and North Horn Formations is separated hydraulically from the perched water of the Blackhawk Formation at the graben crossing by underlying shales which form the barrier to vertical ground water movement which results in the formation of the perched system. Impacts due to subsidence from the graben crossing are not anticipated since only a single set of tunnels will be driven through the graben area.

Since outflow is minimal from the intercepted perched system, and there appears to be minimal hydraulic connection between this perched system of the Blackhawk Formation and the perched system from the North Horn and Price River Formations where most of the springs issue, impacts to ground water and surface water rights are anticipated to be minimal. With the exception of springs issuing from the Star Point Sandstone near Huntington Creek, all ground water rights associated with springs within the Bear Canyon Graben appear to be associated with springs of the perched aquifer system of the Price River and North Horn Formations. Since the surface formations over most of Gentry Hollow are the Price River and North Horn Formations, primary recharge to surface streamflow along the Bear Canyon Graben or Gentry Hollow occurs from the perched system of the Price River and North Horn Formations. Therefore, no significant impact to surface water rights is anticipated to occur from the proposed graben crossing.

INTERBASIN TRANSFER OF WATER

Ground water intercepted by the mine which is tributary to the San Rafael River Basin and discharged in Mud Water Canyon results in an interbasin transfer of water from the San Rafael River Basin to the Price River Basin. This will occur as PMC extends into Lease U-13097 beneath Gentry Ridge, if water made from this area of the mine is discharged at the Mud Water portal. Ground water of the Gentry Ridge area is tributary to the Tie Fork -Huntington Creek drainage basins which are tributary to the San Rafael River. Mud Water Canyon is tributary to the Price River.

Some interbasin transfer of water is already occurring, but the transfer is from one sub-basin (Miller Creek) within the Price River system to another sub-basin (Corner Canyon via Mud Water Canyon) within that same river system. The present extent of mining which is limited to the area east of the Bear Canyon Graben, the actual impact to surface streams, and therefore, impact due to exchanging water from one sub-basin to another within the Price River Basin is probably less than five gpm. Mining beneath Section 18 and intercepting ground water within the Blackhawk Formation which provides the base flow to the North Fork of the Right Fork of Miller Creek as described in a preceding section could result in an additional transfer of five gpm or less. Therefore, the total impact east of the Bear Canyon Graben due to exchanging water from one sub-basin to another in the Price River Basin is probably less than 10 gpm.

The quantity of ground water inflow into the mine beneath Gentry Ridge and therefore the magnitude of impact associated with interbasin transfer is difficult to predict. In areas not intercepting the splinter faults which extend in a south-southeasterly direction off of the eastern boundary fault of the Pleasant Valley Graben, inflow into the mine would be on the order of magnitude per area of the flow presently made from longwall areas within the mine beneath Hoag Ridge. More significant inflows into the mine may be anticipated as splinter faults are intercepted as the mine is advanced to the south where the probability of intercepting the regional aquifer system is greater. Flowrates on the order of those intercepted by U. S. Fuel Company at the Bear Canyon Fault could occur as these faults are intercepted. U. S. Fuel Company presently discharges 800 to 900 gpm at their Old Morhland Portal; therefore, if flowrates of this magnitude are intercepted in the mine the magnitude of the interbasin transfer of water could be significant without mitigation.

Measures to mitigate impacts from the potential for creating an inter-basin transfer of water are presented in response to UMC 784.14 (a).

PREDICTION OF MINING IMPACTS ON SURFACE WATER

SURFACE WATER HYDROLOGY

Local surface water hydrology consists of mountain springs, seeps and streams originating as watershed runoff and ground water inflow. The majority of runoff occurs in the spring of the year during the months of April, May, and June as higher elevation snowpacks are reduced.

The primary surface disturbances resulting from the PMC surface facilities are on the eastward draining watersheds which contribute to flows in Sage Brush Canyon. Within this subdrainage are located the majority of surface facilities including mine portals, conveyor systems, stock piles, coal refuse piles, loadout facilities, equipment storage areas, roadways, offices, and all other systems associated with mine operation. The only other surface facilities located in the mine permit area are two mine ventilation fans. One fan is located in the South Fork of Corner Canyon and the other in Mud Water Canyon.

Both fan facilities are located on small pads with straw and earthen berms placed along the perimeter to retain the small amount of runoff water which could potentially leave the area. The fan portal in Corner Canyon has a small sediment basin, the design of which was previously approved by DOGM. The fan portal in Mud Water Canyon does have mine water discharge which enters the canyon drainage system. This water is derived underground and is excess water which is removed from the mine. The average Mud Water Canyon discharge over the period from April 1985 through March 1986 was 129 gpm (0.29 cfs). The maximum discharge rate observed at the discharge point was on the order of 220 gpm (0.5 cfs). This discharge rate is the highest rate noted for the discharge location and is not indicative of the average yearly discharge rate of 129 gpm mentioned previously. Water is intermittently pumped from the PMC mine workings to the Mud Water discharge location.

Mud Water Canyon is an ephemeral stream and only intermittently experiences natural channel runoff. During non precipitation periods, water within Mud Water Canyon will probably be the result of mine discharge. Channel runoff resulting from storm events within the drainage will typically far exceed the flow being added by the mine discharge.

According to available water quality records, no water quality exceedence to the NPDES permit had occurred from underground mine water discharge at Mud Water Canyon prior to 1985. However, during 1985, a number of samples taken from the discharge at Mud Water Canyon contained TDS concentrations slightly greater than the NPDES limitation of 650 mg/l. Out of 15 samples collected during 1985, the TDS concentration varied from a low of 598 mg/l taken in late May to a high of 772 mg/l taken in late October. The sample mean was 689 mg/l with a standard deviation of 53 mg/l. In a letter dated June 28, 1985 from Ben Grimes (Senior Environmental Engineer of PMC) to the Regional Administrator of EPA, Mr. Grimes indicated that an in-mine survey of water quality revealed that most of the ground water currently inflowing into the mine naturally has a higher TDS concentration than the 650 mg/l limitation; that this is probably due to the fact that mining is occurring under areas with greater overburden and therefore greater opportunity for percolating ground water to pick up dissolved solids; and that the naturally occurring TDS concentration in the Mud Water Canyon drainage receiving the ground water discharge is greater than the TDS concentration of the mine discharge. As a result, mine discharge into Mud Water Canyon has not adversely affected the receiving stream and PMC has submitted request to EPA and the Utah State Department of Health that the NPDES TDS limitation be increased from 650 mg/l to 1450 mg/l (an average of the naturally occurring concentration of the Mud Water Canyon stream). The decision from EPA and the Department of Health pertaining to this request is pending.

Since all discharge quality parameters (except TDS which itself is lower than the naturally occurring TDS in Mud Water Canyon) meet NPDES quality criteria, since the discharge rate is considerably less than is naturally experienced in Mud Water Canyon during a precipitation event, and since surface runoff water is retained on the pad, no hydrologic consequences are anticipated to the surface water system. The hydrologic consequences resulting from the fan facilities appear to be confined to some slight increase in Mud Water Canyon flows resulting from mine discharge. The average annual increase in flow is approximately 129 gpm.

In accordance with State and Federal regulations, a runoff conveyance and sedimentation control plan has been developed for PMC which mitigates the impacts of mining operations from surface facilities. Surface runoff originating upon or traveling across disturbed areas is diverted into sedimentation ponds which improve water quality, and decrease peak runoff flows. Through the ponding process, some additional water loss is anticipated in the form of increased surface evaporation and soil infiltration. Because local storm runoff is infrequent, the increased losses will be small. Some water loss does occur as the pond sediment storage area is filled with water since UMC 817.46 requires that dewatering devices be placed above the sediment storage level. As a result there exists a small dead pool volume for each pond which retains incoming sediment and water. As sediments accumulate, this volume will decrease.

Dead pool water at each sedimentation pond will gradually exit the pond through one of two methods. The most obvious loss will be to evaporation as the water remains in storage. The second route of loss is to ground infiltration. Infiltrated water will either penetrate into deep subsurface aquifers and become part of ground water storage, or it will be redirected by shallow bedrock or aquitard systems back into downstream channels. Assuming that all water entering dead pool storage is lost and unavailable to the hydrologic system, the maximum potential losses for all ponds located in conjunction with the PMC operation would be approximately 8 acre-feet.

Throughout the years various changes in surface water runoff patterns and characteristics have been made in Sage Brush Canyon as a result of continued mine operation. These changes to surface runoff facilities have been designed based on modeled hydrologic runoff events as given by a computer model of the SCS Curve Number technique. The continued construction of conveyance channels used to divert undisturbed drainage around surface disturbed area treatment facilities has modified drainage patterns as well as resulted in changes to channel and pond infiltration, retention, and evaporation.

Although some surface waters are temporarily diverted out of their original channels, they shortly thereafter re-enter the main channel and continue their course downstream having experienced little overall modification. Disturbed waters exiting any one of the seven existing sedimentation ponds or treatment facility re-enter the natural downstream drainage system. Overall hydrologic consequences to surface flows in Sage Brush Canyon are directly related to the runoff conveyance plan and appear to be small. Long term impacts after reclamation should be minimal.

With the exception of mining in Section 18 beneath the North Fork of the Right Fork of Miller Creek, no mining is proposed beneath stream channels of perennial watersheds and the minimum cover in most areas is in excess of 800 feet. Throughout the remainder of the mine plan area impacts due to subsidence to surface stream courses will be minimal.

Longwall mining is proposel as the method of mining within Section 18. As presently proposed, longwall panels will be developed within the Wattis Seam through most of the mine plan area in Section 18, which will include mining beneath the North Fork of the Right Fork of Miller Creek in its headwater region where the stream becomes perennial. Longwall panels will also be developed within the Third Coal Seam in the northern section of Section 18.

A prediction of subsidence from longwall mining in Section 18 with associated impacts was prepared by J.F.T. Agapito and Associates and is presented in Exhibit 30, Prediction of Subsidence Due to Two-Seam Longwall Mining in Section 18. As discussed previously, impacts to base flow conditions in the North Fork of the Right Fork of Miller Creek due to the interception of ground water within the mine are estimated to be five gpm or less.

In addition to the above indicated potential impact to the base flow of the North Fork of the Right Fork of Miller Creek from subsidence, additional impact to the surface flows in the North Fork of the Right Fork of Miller Creek could occur if fracturing associated with subsidence Zones I and II were to intercept the shallow surface cracking (determined to be less than 35-50 feet deep) which may occur in tensile zones adjacent to the edge of excavation where cover is less than 800 feet. If the fissured (or fractured) zones (Zones I and II) were to intercept the shallow surface cracks described above, then direct hydraulic connection between the underground mine workings and the stream could occur, resulting in inflow into the mine from the stream. Should this occur, the rate of inflow would be dependent upon the hydraulic capacity of the fracture system as well as the surface supply. According to J.F.T. Agapito's report, as long as a minimum cover depth of 400 feet is maintained in areas of single seam mining and 480 feet is maintained in areas of two-seam mining, the caved/fissured zones (Zone I and II) will not extend to a point of intercepting shallow surface cracks that could potentially develop near the edges of excavation.

The above referenced report indicates that there are two potential locations in the stream channel of the North Fork of the Right Fork of Miller Creek where shallow surface cracks could develop. The first (Point A) is located in the channel near the eastern edge of proposed excavation for a central longwall panel in the Wattis Seam, at elevation 8,900 feet MSL. The second (Point B) is located in the channel near the southern edge of longwall mining in the Third Coal Seam (see Figure 1 of the above referenced report for locations). Since the preparation of Exhibit 30, Prediction of Subsidence Due to Two-Seam Mining in Section 18, the mine plan has been revised as shown on Map 5, Mine Plan -Third Seam, and Map 6, Mine Plan - Wattis Seam. Prediction of subsidence has been revised as shown on Figure 28, Subsidence Prediction - Mining Wattis Seam, and Figure 39, Subsidence Prediction - Mining Wattis Seam and Middle Seam. Points A and B are shown on Figure 39 in the same relative position as shown on Figure 1 in Exhibit 30. Should these fractures intercept existing open fracture systems within the formation, some surface water could be lost to the ground water system. However, since as discussed in response to Section 783.15, the North Fork of the Right Fork of Miller Creek through this reach is a gaining reach of stream, it is anticipated that these shallow surface cracks would merely fill with water without acting as a conduit to remove water from the system; or since drainage systems are often formed at weak/

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Approved, Division of Oil, Gas & Mining

by [signature] date 1-11-89

jointed surface locations, it is likely that surface water lost to existing fractures would travel down the fractures and issue back into the drainage system downstream, particularly if mudstones are present at the base of such cracks.

Mitigation to potential impacts from these shallow surface cracks (should they occur across Miller Creek) is presented in response to UMC 784.14(a), under Measures for Protection of Surface and Ground Water Quantity and Water Rights.

SURFACE WATER QUALITY

Increased mining activities may impact local water quality due to increased erosion potential and increased suspended sediment concentrations of runoff from disturbed areas.

Movement of particulate matter usually occurs as the direct result of either surface runoff erosion or as wind blown erosion. Volumes and quantities expected would be greater during heavy construction phases than during non-construction periods. To combat the potential for decreased water quality resulting from increased sediment loads, a treatment facility and seven sedimentation ponds have been constructed. These ponds have been designed to remove and store stream sediments originating from disturbed areas. Estimates of the volume of sediment anticipated from local area watersheds was accomplished using the Universal Soil Loss Equation.

According to the NPDES discharge permit, total suspended and dissolved solids must be less than 70.0 and 2000.0 mg/l, respectively. The limit for total iron concentration is 2.0 mg/l and for oil and grease, the limit is 10.0 mg/l. The hydrogen ion (pH) must be between the limits of 6.5 to 9.0, and settleable solids must be no higher than 0.5 mg/l.

Treatment Facility No. 1 and Sedimentation Ponds 2 through 7 have all operated in compliance with NPDES discharge limitations. TDS exceedences have occurred in Sediment Pond No. 8 and at the Mud Water

Canyon discharge. Programs have been implemented to isolate the origin of the poor quality water and requests for modifications to the limits have been proposed. These request have been made due to preliminary findings which indicate that natural inflows into both the mine and into Sediment Pond No. 8 have increased.

Data presented in response to UMC 783.16 indicate that some naturally occurring seasonal variations exist with some water quality criteria, but that no long term water quality trends are evident. No evidence has been found from available water quality data that indicate future operations will result in similar water quality.

Recent major construction related to the Unit Train Loadout Facility will temporarily increase local TSS concentrations, but they should stabilize after construction is completed. Even though local sediment increases are likely as a result of continued construction, sediment ponds have been designed to remove the increased sediment loadings. Silt fences have been installed at various locations throughout the mine permit area. These fences located at roadsides, or within drainageways, will aid in the stabilization and protection of local stream channels. After mine reclamation, water quality will approach those of pre-mining conditions.

(d) EACH PLAN SHALL CONTAIN A DETAILED DESCRIPTION, WITH APPROPRIATE DRAWINGS, OF PERMANENT ENTRY SEALS AND DOWN-SLOPE BARRIERS DESIGNED TO ENSURE STABILITY UNDER ANTICIPATED HYDRAULIC HEADS DEVELOPED WHILE PROMOTING MINE INUNDATION AFTER MINE CLOSURE FOR THE PROPOSED MINE PLAN AREA.

RESPONSE:

Hydraulic heads that will develop within the mine following closure are anticipated to be small and should not reach existing mine entry ways or associated portal seals for the following reasons. First, mine workings are above the regional groundwater table, second, local geology is highly fractured and capable of moving large quantities of water underground through faults, fractures and joints as stated in the mine permit application, and third, mine entry ways and portals are located on the updip end of all mine workings. Before water could flow out of the mine at one of the existing surface entries, an elevation head increase of over 100 feet would have to be reached. Such large heads are not believed possible above the regional water table with the existing fractured geology identified throughout the area.

Although it is believed that the concrete block seal drains as recommended by the agency to prevent portal seal "blow out" are not necessary for the above mentioned reasons, a drain will be installed at the portal at the lowest elevation. The design details of the portal seal with the drain included are shown on Figure 20, Typical Permanent Entry Seal Design. All permanent entry seals consist of keyed block barriers, installed within each portal entry as shown in the referenced figure with the exception that only the portal at the lowest elevation requires the drain as shown. After seal construction, the portals will be back filled with a non-combustible material.

UMC 784.15 RECLAMATION PLAN: POSTMINING LAND USES

(a) EACH PLAN SHALL CONTAIN A DETAILED DESCRIPTION OF THE PROPOSED USE, FOLLOWING RECLAMATION, OF THE LAND TO BE AFFECTED WITHIN THE PROPOSED PERMIT AREA BY SURFACE OPERATIONS OR FACIITIES, INCLUDING A DISCUSSION OF THE UTILITY AND CAPACITY OF THE RECLAIMED LAND TO SUPPORT A VARIETY OF ALTERNATIVE USES, AND THE RELATIONSHIP OF THE PROPOSED USE TO EXISTING LAND USE POLICIES AND PLANS. THIS DESCRIPTION SHALL EXPLAIN-

RESPONSE:

The post mine land use will be the same as premining use; these uses include livestock grazing, wildlife habitat, recreation and forestry. Table 83, Postmining Land Use, summarizes the disturbed areas and their postmine land uses.

Forestry as a post-mining land use will be achieved by the implementation of the Reclamation Plan as discussed in response to UMC 784.13, UMC 784.14, UMC 784.15, and UMC 784.16. This Plan allows for replanting tree species compatible with native species where appropriate.

Recreation as a post-mining land use will be achieved in the same manner, by implementing the Reclamation Plan. This Plan allows for reclaiming disturbances, replanting species compatible with grazing, wildlife and forestry. Recreationalists will be able to utilize the area as they did prior to mining activity. Public access to the area will be available via County Road 290 and to Gentry Mountain via the Mohrland Canyon Road.

Following the removal of the surface facilities, the affected area will be restored to a condition capable of supporting the predisturbance land use of grazing land and wildlife habitat as described in response to UMC 783.22. This will be achieved by implementing the reclamation plan described in response to UMC 784.13. Specifically, the affected area will be regraded to the approved contour, drainage patterns will be restored, soil material will be reapplied and the seed mixtures will be planted.

All reclaimed areas will be capable of supporting the postmine land uses. Based on interim vegetation, vegetation test plots, ongoing vegetation monitoring and data gathered over the first five year permit term, the soils in the disturbed areas are capable of supporting a variety of vegetation compatible with current and post mine land use.

(1) HOW THE PROPOSED POSTMINING LAND USE IS TO BE ACHEIVED AND THE NECESSARY SUPPORT ACTIVITIES WHICH MAY BE NEEDED TO ACHIEVE THE PROPOSED LAND USE;

RESPONSE:

Postmining land use is to be achieved by effectively reclaiming disturbed areas including the establishment of a diverse vegetative cover compatible with wildlife and livestock grazing.

(2) WHERE A LAND USE DIFFERENT FROM THE PRE-MINING LAND USE IS PROPOSED, ALL MATERIALS NEEDED FOR APPROVAL OF THE ALTERNATIVE USE UNDER UMC 817.133; AND

RESPONSE:

Postmining land uses will be the same as pre-mining land uses.

(3) THE CONSIDERATION GIVEN TO MAKING ALL OF THE PROPOSED UNDERGROUND COAL MINING ACTIVITIES CONSISTENT WITH SURFACE WATER PLANS AND APPLICABLE STATE AND LOCAL LAND USE PLANS AND PROGRAMS.

RESPONSE:

The reclamation plan for disturbed areas is consistent with all state, federal and local land use plans and programs, including surface water plans.

(b) THE DESCRIPTION SHALL BE ACCOMPANIED BY A COPY OF THE COMMENTS, IF ANY, CONCERNING THE PROPOSED USE FROM THE LEGAL OR EQUITABLE OWNER OF RECORD OF THE SURFACE AREAS TO BE AFFECTED BY SURFACE OPERATIONS OR FACILITIES WITHIN THE PROPOSED PERMIT AREA AND THE STATE AND LOCAL GOVERNMENT AGENCIES WHICH

WOULD HAVE TO INITIATE, IMPLEMENT, APPROVE, OR AUTHORIZE THE PROPOSED USE OF THE LAND FOLLOWING RECLAMATION.

RESPONSE:

The surface owners of record agree with the post mining land uses. No other comments have been received.

UMC 784.16 RECLAMATION PLAN: PONDS, IMPOUNDMENTS, BANKS, DAMS AND EMBANKMENTS

(a) GENERAL. EACH APPLICATION SHALL INCLUDE A GENERAL PLAN FOR EACH PROPOSED SEDIMENTATION POND, WATER IMPOUNDMENT, AND COAL PROCESSING WASTE BANK, DAM, OR EMBANKMENT WITHIN THE PROPOSED MINE PLAN AREA.

(1) EACH GENERAL PLAN SHALL-

(i) BE PREPARED BY, OR UNDER THE DIRECTION OF, AND CERTIFIED BY, A QUALIFIED REGISTERED PROFESSIONAL ENGINEER OR BY A PROFESSIONAL GEOLOGIST WITH ASSISTANCE FROM EXPERTS IN RELATED FIELDS SUCH AS LAND SURVEYING AND LANDSCAPE ARCHITECTURE;

(ii) CONTAIN A DESCRIPTION, MAP AND CROSS-SECTION OF THE STRUCTURE AND ITS LOCATION;

(iii) CONTAIN PRELIMINARY HYDROLOGIC AND GEOLOGIC INFORMATION REQUIRED TO ACCESS THE HYDROLOGIC IMPACT OF THE STRUCTURE;

(iv) CONTAIN A SURVEY DESCRIBING THE POTENTIAL EFFECT OF THE STRUCTURE FROM SUBSIDENCE OF THE SUBSURFACE STRATA RESULTING FROM PAST UNDERGROUND COAL MINING ACTIVITIES IF UNDERGROUND COAL MINING HAS OCCURRED; AND

(v) CONTAIN A CERTIFICATION STATEMENT WHICH INCLUDES A SCHEDULE SETTING FORTH THE DATES WHEN ANY DETAILED DESIGN PLANS FOR STRUCTURES THAT ARE NOT SUBMITTED WITH THE GENERAL PLAN WILL BE SUBMITTED TO THE DIVISION. THE DIVISION SHALL HAVE APPROVED, IN WRITING, THE DETAILED DESIGN PLAN FOR A STRUCTURE BEFORE CONSTRUCTION OF THE STRUCTURE BEGINS.

(2) EACH DETAILED DESIGN PLAN FOR A STRUCTURE THAT MEETS OR EXCEEDS THE SIZE OR OTHER CRITERIA OF THE MINE SAFETY AND HEALTH ADMINISTRATION, 30 CFR 77.216(A) SHALL-

(i) BE PREPARED BY, OR UNDER THE DIRECTION OF, AND CERTIFIED BY A QUALIFIED REGISTERED PROFESSIONAL ENGINEER WITH ASSISTANCE FROM EXPERTS IN RELATED FIELDS SUCH AS GEOLOGY, LAND SURVEYING, AND LANDSCAPE ARCHITECTURE;

(ii) INCLUDE ANY GEOTECHNICAL INVESTIGATION, DESIGN, AND CONSTRUCTION REQUIREMENTS FOR THE STRUCTURE;

(iii) DESCRIBE THE OPERATION AND MAINTENANCE REQUIREMENTS FOR EACH STRUCTURE; AND

(iv) DESCRIBE THE TIMETABLE AND PLANS TO REMOVE EACH STRUCTURE, IF APPROPRIATE.

(3) EACH DETAILED DESIGN PLAN FOR A STRUCTURE THAT DOES NOT MEET THE SIZE OR OTHER CRITERIA OF 30 CFR 77.216(A) SHALL-

(i) BE PREPARED BY, OR UNDER THE DIRECTION OF, AND CERTIFIED BY A QUALIFIED REGISTERED PROFESSIONAL ENGINEER OR REGISTERED LAND SURVEYOR EXCEPT THAT ALL COAL PROCESSING WASTE DAMS AND EMBANKMENTS COVERED BY UMC 817.91 -817.93 SHALL BE CERTIFIED BY A QUALIFIED REGISTERED PROFESSIONAL ENGINEER;

(ii) INCLUDE ANY DESIGN AND CONSTRUCTION REQUIREMENTS FOR THE STRUCTURE, INCLUDING ANY REQUIRED GEOTECHNICAL INFORMATION;

(iii) DESCRIBE THE OPERATION AND MAINTENANCE REQUIREMENTS FOR EACH STRUCTURE; AND

(iv) DESCRIBE THE TIMETABLE AND PLANS TO REMOVE EACH STRUCTURE, IF APPROPRIATE.

(b) SEDIMENTATION PONDS.

(1) SEDIMENTATION PONDS, WHETHER TEMPORARY OR PERMANENT, SHALL BE DESIGNED IN COMPLIANCE WITH THE REQUIREMENTS OF UMC 817.46. ANY SEDIMENTATION POND OR EARTHEN STRUCTURE WHICH WILL REMAIN ON THE PROPOSED MINE PLAN AREA AS A PERMANENT WATER IMPOUNDMENT SHALL ALSO BE DESIGNED TO COMPLY WITH THE REQUIREMENTS OF UMC 817.49.

(2) EACH PLAN SHALL, AT A MINIMUM, COMPLY WITH THE REQUIREMENTS OF THE MINE SAFETY AND HEALTH ADMINISTRATION, 30 CFR 77.216-1 AND 77.216-2.

(c) PERMANENT AND TEMPORARY IMPOUNDMENTS. PERMANENT AND TEMPORARY IMPOUNDMENTS SHALL BE DESIGNED TO COMPLY WITH THE REQUIREMENTS OF UMC 817.49. EACH PLAN SHALL COMPLY WITH THE REQUIREMENTS OF THE MINE SAFETY AND HEALTH ADMINISTRATION, 30 CFR 77.216-1 AND 77.216-2.

(d) COAL PROCESSING WASTE BANKS. COAL PROCESSING WASTE BANKS SHALL BE DESIGNED TO COMPLY WITH THE REQUIREMENTS OF UMC 817.81 - 817.85.

(e) COAL PROCESSING WASTE DAMS AND EMBANKMENTS. COAL PROCESSING WASTE DAMS AND EMBANKMENTS SHALL BE DESIGNED TO COMPLY WITH THE REQUIREMENTS OF UMC 817.91 - 817.93. EACH PLAN SHALL COMPLY WITH THE REQUIREMENTS OF THE MINE SAFETY AND HEALTH ADMINISTRATION, 30 CFR 77.216-1 AND 77.216-2, AND SHALL CONTAIN THE RESULTS OF A GEOTECHNICAL INVESTIGATION OF THE PROPOSED DAM OR EMBANKMENT FOUNDATION AREA, TO DETERMINE THE STRUCTURAL COMPETANCE OF THE FOUNDATION WHICH WILL SUPPORT THE PROPOSED DAM OR EMBANKMENT STRUCTURE AND THE IMPOUNDED MATERIAL. THE GEOTECHNICAL INVESTIGATION SHALL BE PLANNED AND SUPERVISED BY AN ENGINEER OR ENGINEERING GEOLOGIST, ACCORDING TO THE FOLLOWING:

(1) THE NUMBER, LOCATION AND DEPTH OF BORINGS AND TEST PITS SHALL BE DETERMINED USING CURRENT PRUDENT ENGINEERING PRACTICE FOR THE SIZE OF THE DAM OR EMBANKMENT, QUANTITY OF MATERIAL TO BE IMPOUNDED, AND SUBSURFACE CONDITIONS.

(2) THE CHARACTER OF THE OVERBURDEN AND BEDROCK, THE PROPOSED ABUTMENT SITES, AND ANY ADVERSE GEOTECHNICAL CONDITIONS WHICH MAY AFFECT THE PARTICULAR DAM, EMBANKMENT, OR RESERVOIR SITE SHALL BE CONSIDERED.

(3) ALL SPRINGS, SEEPAGE, AND GROUND WATER FLOW OBSERVED OR ANTICIPATED DURING WET PERIODS IN THE AREA OF THE PROPOSED DAM OR EMBANKMENT SHALL BE IDENTIFIED ON EACH PLAN.

(4) CONSIDERATION SHALL BE GIVEN TO THE POSSIBILITY OF MUDFLOWS, ROCK-DEBRIS FALLS, OR OTHER LANDSLIDES INTO THE DAM, EMBANKMENT, OR IMPOUNDED MATERIAL.

(f) IF THE STRUCTURE IS 20 FEET OR HIGHER OR IMPOUNDS MORE THAN 20 ACRE-FEET, EACH PLAN UNDER PARAGRAPHS (B), (C), AND (E) OF THIS SECTION SHALL INCLUDE STABILITY ANALYSIS OF EACH STRUCTURE. THE STABILITY ANALYSIS SHALL INCLUDE, BUT NOT BE LIMITED TO, STRENGTH PARAMETERS, PORE PRESSURES, AND LONG-TERM SEEPAGE CONDITIONS. THE PLAN SHALL ALSO CONTAIN A DESCRIPTION OF EACH ENGINEERING DESIGN ASSUMPTION AND CALCULATION WITH A DISCUSSION OF EACH ALTERNATIVE CONSIDERED IN SELECTING THE SPECIFIC DESIGN PARAMETERS AND CONSTRUCTION METHODS.

RESPONSE:

As required, this application contains a general plan for each sedimentation pond, water impoundment and coal processing waste bank in the mine plan area. All water impounding structures are less than 20-feet high and have storage volumes less than 20 acre-feet and therefore do not meet the size criteria of 30 CFR 772.216(a).

SEDIMENT POND DESIGN

The seven small sedimentation ponds, a treatment facility and associated runoff control facilities have been designed, constructed, inspected and certified (with the exceptions noted below) as required by UMC 817.46 under the direction of a registered professional engineer to provide runoff storage, sediment control and improve overall water quality in compliance with NPDES discharge limitations from disturbed surface drainage and to be relatively maintenance free. The seven ponds and one treatment facility were selected as opposed to one large pond, located below all disturbed areas, for two reasons. Small ponds can be located close to disturbed areas, reducing the area of undisturbed land contributing runoff to the pond, and one large pond would have required an embankment height in excess of 20 feet and a storage volume greater than 20 acre-feet, which would have required other additional government regulations for small dams be met in the embankment construction. This

(4) CONSIDERATION SHALL BE GIVEN TO THE POSSIBILITY OF MUDFLOWS, ROCK-DEBRIS FALLS, OR OTHER LANDSLIDES INTO THE DAM, EMBANKMENT, OR IMPOUNDED MATERIAL.

(f) IF THE STRUCTURE IS 20 FEET OR HIGHER OR IMPOUNDS MORE THAN 20 ACRE-FEET, EACH PLAN UNDER PARAGRAPHS (B), (C), AND (E) OF THIS SECTION SHALL INCLUDE STABILITY ANALYSIS OF EACH STRUCTURE. THE STABILITY ANALYSIS SHALL INCLUDE, BUT NOT BE LIMITED TO, STRENGTH PARAMETERS, PORE PRESSURES, AND LONG-TERM SEEPAGE CONDITIONS. THE PLAN SHALL ALSO CONTAIN A DESCRIPTION OF EACH ENGINEERING DESIGN ASSUMPTION AND CALCULATION WITH A DISCUSSION OF EACH ALTERNATIVE CONSIDERED IN SELECTING THE SPECIFIC DESIGN PARAMETERS AND CONSTRUCTION METHODS.

RESPONSE:

As required, this application contains a general plan for each sedimentation pond, water impoundment and coal processing waste bank in the mine plan area. All water impounding structures are less than 20-feet high and have storage volumes less than 20 acre-feet and therefore do not meet the size criteria of 30 CFR 772.216(a).

SEDIMENT POND DESIGN

Eight small sedimentation ponds and the treatment facility have been designed, constructed, inspected and certified (with the exceptions noted below) as required by UMC 817.46 under the direction of a registered professional engineer in such a manner so as to provide runoff storage, sediment control and improve overall water quality in compliance with NPDES discharge limitations from disturbed surface drainage and to be relatively maintenance free. The eight ponds and one treatment facility were selected as opposed to one large pond, located below all disturbed areas, for two reasons. First, small ponds can be located close to disturbed areas, thereby reducing the area of undisturbed land contributing runoff to the pond, and second, one large pond would have required an embankment height in excess of 20 feet and a storage volume greater than 20 acre-feet, which would have required that State and other additional government regulations for small dams be met in the embankment construction. This requirement would have increased the cost considerably. The eight sedimentation ponds are referred to herein as Sedimentation Ponds 2 through 9 and the treatment facility is referred to as Treatment Facility No. 1.

After several meetings and discussions held with the Office of Surface Mining and the Division of Oil, Gas, and Mining concerning the stability of sedimentation pond embankments for Ponds No. 1, No. 3, and No. 5, Plateau proposed that an exemption be granted for Pond No. 1 from design criteria under UMC 817.42(a)(3) and that the pond be redesignated as a treatment facility instead of a sedimentation pond. In a letter dated August 16, 1983 from DOGM (See Exhibit 31, "Sedimentation Pond Approval, Documentation, and Certification"), the Division accepted the request for exemption of Pond No. 1 from design criteria of UMC 871.42(a)(3) and therefore, Pond No. 1 is referred to herein as Treatment Facility No. 1.

Certifications of construction of Ponds No. 2, No. 4, No. 6, No. 7 and No. 8 by a registered professional engineer are presented in Exhibit 31, "Sedimentation Pond Approval, Documentation, and Certification." A variance to the requirement that Treatment Facility No. 1 and Sedimentation Ponds No. 3 and No. 5 be inspected and certified by a registered professional engineer was requested in a letter to DOGM from Plateau dated April 4, 1984 (See the above referenced Exhibit). In a letter dated July 19, 1984 (also contained in the above referenced Exhibit), DOGM indicated the following pursuant to Treatment Facility No. 1:

> "After researching the files and the history of the permitting events leading up to the Division's August 16, 1983 approval to redesignate this pond as a treatment facility, it is our opinion that the subject pond does not need to demonstrate strict compliance with all of the requirements of UMC 817.46. The structure has met, and is in compliance with the performance standards for treatment facilities.
>
> Consequently, PMC will not be required to obtain an engineering certification for Pond No. 1, and a variance to the same (UMC 817.46(r)) is hereby granted."

In the above referenced letter, DOGM requested that additional as-built information be submitted prior to granting the variance requested for Sediment Ponds No. 3 and No. 5. Upon receipt of as-built survey information, documenting that hydrologic storage requirement had been met, and upon receipt of the stability analysis for Ponds No. 3 and No. 5, DOGM indicated in a letter dated December 7, 1984 (see the above referenced Exhibit) that a variance was granted from "PE Certification requirements for Sediment Ponds No. 3 and No. 5."

The overall sediment control plan including pond location, drainage area characteristics associated with each pond, and other required runoff facilities, are illustrated in Map 42, "Surface Water and Sedimentation Control Facilities Maps A and B." Since their initial construction, modifications have been made to Ponds 3, 4, 5, and 6 to enhance their effectiveness and ability to better comply with State and Federal regulations. These modifications have been incorporated into the discussion which follows. Future structure and conveyance facility modifications associated with the runoff control plan will utilize the existing conveyance and sedimentation facilities to the extent feasible.

Design details for the treatment facility are shown on Map 53, "Design Details for Treatment Facility No. 1." Sediment pond details are illustrated on Maps 54 through 60, "Design Details for Sediment Ponds 2 through 8," and on Map 79, "Design Details for Sedimentation Pond 9." A stage-capacity curve for Treatment Facility 1 is shown of Figure 28, "Stage Capacity Curve for Treatment Facility No. 1." The stage capacity curves for the as-built sedimentation ponds are presented on Figures 29 through 35, "Stage Capacity Curve for Sediment Ponds 2 through 8," and Figure 41, "Stage Capacity Curve for Sediment Pond 9." Illustrated on these figures are the available sediment storage and runoff volume capacities of the existing facilities. A comparison of available storage versus required storage for each treatment or sedimentation facility is made in Table 84, "Available Versus Required Sediment Pond Storage Requirements." The following discussion outlines in more detail the design parameters used for the layout and construction of each structure.

SEDIMENT VOLUME

Sediment control measures at the Plateau mine have been designed according to local needs and conditions and standard engineering practice. According to Mundorff, 1972, sediment yield from the upper portions of the two major basins within the mine plan area is probably negligible. The U.S. Soil Conservation Service (1975) states that erosion rates in the Price and San Rafael river basins vary from 0.1 to 3.0 acre-ft/mi^2/yr. In a USGS Water Supply Paper dated 1981, (U.S. Geological Survey, 1981) differentiation was made between areas above the Castlegate Formation and areas below which consist of Mancos Shales. Erosion rates within and above the Castlegate Formation in the predominantly limestone and dolomite formations appear to be on the order of 0.1 to 0.2 acre-ft/mi^2/yr. Erosion rates at lower elevations in the Mancos Shale are reported between 0.5 and 1.0 acre-ft/mi^2/yr. Some lower valley locations had erosion rates up to 3.0 acre-ft/mi^2/yr. These more recent erosion estimates made by the Geological Survey are believed to be representative for each formation discussed above. Reported erosion rates confirm that the bulk of the sediment yielded each year at the mouths of the major rivers comes from limited areas covered with highly erodible shales (Mundorff, 1972).

The sediment ponds and treatment facility were designed (where possible) to contain the accumulated sediment volume from a three-year period and to prevent short circuiting. The amount of sediment to be yielded to the sedimentation ponds was determined from the Universal Soil Loss Equation (Clyde et al., 1978, and U.S. Soil Conservation Service, 1977). In accordance with this equation, soil erosion caused by water is determined from

$$A = R \cdot K \cdot LS \cdot C \cdot P \qquad (817.46\text{-}3)$$

where:

A	=	computed amount of soil loss, in tons/acre/year;
R	=	rainfall factor, in foot-tons/acre/hour;
K	=	soil erodibility factor, in tons/acre/year/unit of R;
LS	=	topographic factor (length and steepness of slope), dimensionless;
C	=	cover or cropping management factor, dimensionless; and
P	=	erosion control practice factor, dimensionless.

Values for R and K were determined from Clyde et al. (1978). The topographic factor (LS) was determined from

$$LS = \frac{(650 + 450S + 65S^2)\ (L/72.6)^m}{10{,}000 + S2} \qquad (817.46\text{-}4)$$

where:

L	=	average overland flow length, in feet;
S	=	average steepness of slope, in percent; and
m	=	an exponent dependent upon the steepness of slope (0.3 for slopes less than 0.5%, 0.5 for slopes 0.51% to 10%, and 0.6 for slopes greater than 10%).

The average overland flow length (L) was determined from Williams and Berndt (1972) as defined by the equation

$$L = \frac{0.5\ DA}{LCH} \qquad (817.46\text{-}5)$$

where:

DA	=	drainage area, in square feet; and
LCH	=	total length of channels in the watershed, in feet.

Values for C and P were determined from the U.S. Soil Conservation Service (1977).

A sediment density of 75 lb/ft^3 was used in conjunction with the USLE to determine the volume of reservoir sediment storage required. This value was obtained based upon on-site soil surveys (included as Exhibit 19 in the mine permit) which shows that local soils consist mostly of a mixture of silty clayey sands. Sands commonly have unit weights in the order of 85-100 pcf based upon ASCE findings (see Sedimentation Engineering - ASCE M & R No. 54) with values more commonly used in the order of 95 pcf. Other references confirm this and indicate that silts and clays usually have lower unit weights, but at times do range from 27 to 100 pcf. Because local soil complexes do contain substantial quantities of silts and clays, a more conservative sediment density of 75 pcf was chosen as the appropriate value to use for calculation of sediment volume.

The ponds have been designed so the sediment will be removed when the sediment volume reaches 60 percent of the accumulated sediment storage volume. All sediments will be disposed of in the washed coal refuse pile. Sediment yield parameters and the accumulated sediment volume for each pond (including Treatment Facility No. 1) are contained in Table 85, "Sediment Design Parameters for Sediment Ponds 1 through 9."

All ponds have adequate sediment storage volume to provide for the three-year accumulated sediment yield except Treatment Facility No. 1 and Pond No. 4 which have sufficient storage to contain an accumulated sediment volume from a 1.3 year period and a 2.3 year period respectively. Treatment Facility No. 1 and Pond No. 4 are limited in size due to site limitations, however, sediment will be removed at the respective 60% cleanout level for these ponds as with all other ponds associated with the mine plan.

Because of the difficulty in removing sediment with a post located within the pond (marked at the 60 percent clean-out level), Plateau Mining Company will identify the need for clean-out through pond surveys. The sediment traps are not designed structures but are intended to enhance operation of the sediment ponds. By placing them in ditches leading to sediment ponds, sediment is removed from water flowing to the ponds, thus making the ponds more effective. The traps can easily and quickly be cleaned of sediment. They vary in size but are generally less than 3,000 square feet and have an average depth of four feet. They are equipped with an overflow culvert or a spillway channel. When they become silted in, they are cleaned out with loaders or a backhoe to make them functional again.

During quarterly pond inspections, the sediment level will be surveyed to determine whether pond cleaning is required. Records of pond inspections are maintained at the Mine Office. Sediment levels at which clean-out will occur are shown on Figures 28-35, "Stage Capacity Curves for Sediment Ponds."

In addition to sedimentation ponds, small sediment trap basins are located throughout the property. Where these sediment traps have been installed within the drainage boundry of a sedimentation pond, the sedimentation ponds have been designed to contain runoff from the entire disturbed area without regard to the influence of these small sediment traps. In such instances the sediment traps will tend to enhance the sediment control plan. These small sediment traps are generally less than 3,000 square feet in size and have an average depth of 4 feet. As shown in Figure 42, "Typical Sediment Trap Detail." The outlets from the traps consist of either overflow channels or pipe culverts which discharge waters into downstream ditch sections. Each sediment trap will be visually surveyed and cleanout operations performed when 60 percent of the available volume has been reached.

Two small disturbed areas lying outside the major Sage Brush Canyon drainage area consist of fan and mine breakouts which have been installed in Mud Water and Corner Canyons to establish ventilation within the mine. Plateau Mining Company initiated sediment control of these small disturbed areas in 1980 by 1) constructing a small sediment trap on the Corner Canyon pad capable of collecting and retaining the small amount of disturbed area runoff, and 2) by constructing small straw and earthen berms along the perimeter of both pads. In accordance with this plan:

"Straw berms have been placed along the outside edge of the deck and at intervals on the deck itself roughly perpendicular to the outside edge. Straw, of course, is not of a permanent nature; therefore, the berms will be covered with soil (See Figure 36, "Berm Construction Detail"). These berms will prevent surface runoff from eroding the fill slope, and they will confine runoff to small pockets on the deck surface, thereby eliminating the necessity of constructing a sedimentation pond on the deck."

Mine discharges from Mud Water Canyon are governed by a NPDES discharge permit and in accordance with that plan are not discharged into a sedimentation facility (therefore additional sedimentation pond storage is not required). Additional details regarding mine discharge and effluent water quality from Mud Water Canyon are presented in Section UMC 784.14.

RUNOFF VOLUME

Each sedimentation pond and treatment facility was designed to contain the 10-year 24-hour runoff event without resulting in discharge over the crest of either the primary or emergency spillways. The technique used to calculate the required volume is described below.

The runoff depth resulting from a given rainfall depth was determined using the runoff curve number technique, as defined by the USDA Soil Conservation Service (1972). According to the curve number methodology, the relationship between storm rainfall, soil moisture storage, and runoff can be expressed by the equations:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (784.16\text{-}1)$$

$$CN = \frac{1000}{10 + S} \qquad (784.16\text{-}2)$$

where:

Q = direct runoff depth, inches;
P = storm rainfall depth, inches;
S = maximum infiltration depth (defined as the maximum possible difference between P and Q), inches; and
CN = curve number, dimensionless.

Use of Equations 784.16-1 and 784.16-2 requires the selection of a curve number, which is a function of vegetative cover and the hydrologic soil groups. Curve numbers for the study area were selected from information provided by the USDA Soil Conservation Service (1972), by Hawkins (1973), and from personal hydrologic judgement following field observation. Weighted curve numbers were used for heterogeneous areas.

Values of P were selected for the design return periods from Miller et. al. (1973) based on a 24-hour storm. A rainfall return period of 10 years was used for design.

Equation 784.16-1 is based on the assumption that Ia = 0.2S, where Ia is the initial abstraction from storm rainfall, defined as the rainfall which must fall before runoff begins (i.e., to satisfy interception, evaporation, and soil-water storage). Therefore, determination of runoff from Equation 784.16-1 is valid only when P _ 0.2S. Below this point, no runoff can occur. Once Q was determined from the above equation, runoff volume was calculated by multiplying the runoff depth by the drainage area.

POND DETENTION

Runoff detention calculations were made for the sediment ponds by calculating the time difference between inflowing and outflowing hydrographs. Treatment Facility No. 1 and Sediment Ponds 3 and 7 have manual dewatering devices and do not automatically discharge water through dewatering orifices. Therefore, the detention time between centroids of the inflowing and outflowing hydrographs is not calculated. When manually operated, the 10-year 24-hour volume of water stored within these ponds are discharged such that outflowing water quality meets NPDES permit limitations.

Ponds 2, 4, 5, 6, 8 and 9 all have dewatering orifices located at the sediment storage elevation which allows a gradual release of stored water. Detention times for each of these ponds have been modeled to ensure that the 24-hour required detention between inflowing and outflowing hydrographs is maintained. Detention time calculations and modeled effluent calculations for each of the above mentioned sediment ponds except Pond 9 are contained within Exhibit 32, "Pond Detention Calculations." Detention calculations for Pond 9 are included in Exhibit 48, "Pond 9 Calculations."

POND SPILLWAY CAPACITY

Spillway capacity requirements for the ponds were based on runoff from the 25-year, 24-hour storm (2.6 in). Table 86, "Sedimentation Pond Storage and Spillway Capacity Requirements," contains the volume and spillway capacity requirements for Treatment Facility No. 1 and for ponds 2 through 4 and 6 through 9 based on existing drainage basin configurations. Spillway capacity requirements for Pond 5 are ased upon the drainage basin configuration which existed prior to the installation of Pond 9. Since a large portion of the area which used to drain toward Pond 5 now drains toward Pond 9 (thereby making Pond 5 calculations conservative) the areas and runoffs have not been refined. Spillway capacity requirements were determined according to the peak discharge methodologies presented earlier in this section. Pond runoff storage volume requirements were determined according to the methodologies presented earlier in this section.

The stage-discharge relationship of the corrugated metal risers and conduits used in the pond spillway design was determined from methods outlined by Mynear and Haan (1977), who state that the discharge of the spillway is calculated as the smallest of the possible flows due to weir flow, orifice flow, or pipe flow at any stage. The coefficients suggested by Mynear and Haan (1977) were used in the appropriate equations.

Weir flow is determined by the equation

$$q = CLH^{3/2} \quad (784.16\text{-}3)$$

where:

- q = flow rate in cfs;
- C = coefficient determined by entrance conditions;
- L = length of the weir crest, in feet, or the circumference of the riser; in feet; and
- H = head of water above the riser inlet, in feet.

The entrance coefficient (C) is determined by

$$C = 3.27 + 0.4\ H/W \quad (784.16\text{-}4)$$

where C and H are previously defined and W is the height of the weir crest above the channel bottom, in feet.

Orifice flow occurs when the flow is restricted by the opening. It can be determined as

$$q = CA\ (2gH)^{1/2} \quad (784.16\text{-}5)$$

where:

- q = as previously defined;
- C = coefficient dependent upon the orifice geometry (0.6 in this case);
- A = cross-sectional area of the opening, in square feet;
- g = gravitational constant (32.2 ft/s^2); and
- H = head above the orifice inlet, in feet.

The orifices considered are the riser inlet and the inlet of the conduit leading from the riser through the pond embankment.

Pipe flow occurs when the friction of the pipe controls the flow. According to Mynear and Haan (1977), this flow type can be described by

$$q = \frac{A\ (2gH)^{1/2}}{(1 + K_e + K_b + K_c\ L)^{1/2}} \qquad (784.16\text{-}6)$$

where q, A, g, and H are as previously defined and:

K_e = entrance loss coefficient (0.5 in this case);
K_b = correction factor for energy loss in bends (0.0 in this case);
K_c = friction factor; and
L = pipe length, in feet.

K_c can be determined by the equation

$$K_c = \frac{5087\ n^2}{d^{4/3}} \qquad (784.16\text{-}7)$$

where:

n = Manning's roughness coefficient; and
d = inside diameter of the pipe, in inches.

The principal and emergency spillway systems (the configuration of which depends upon the age of the pond and concurrent regulations in force at the time of construction) consist of corrugated metal risers and conduits, with an anti-vortex device, trash rack, and anti-seep collars and have been designed to safely discharge the 25-year, 24-hour precipitation runoff event. With the exception of Ponds 2, 8 and 9, all sediment ponds and storage facility contain a single spillway designed to pass the 25-year, 24-hour event.

Equations 784.16-3 through 784.16-7 were used to determine the discharge capacities of riser-conduit combinations with diameters of 15, 24, 30 and 36 in. Combinations of these risers were found adequate in passing through the respective ponds the peak inflow resulting from the 25-year, 24-hour storm (see Figure 37, "Stage-Discharge Curves"). Ponds 2, 8 and 9 were recently designed and constructed with both a principal and an emergency spillway the combined capacity of which will pass the 25-year, 24-hour event. In Ponds 2, 8, and 9, the crest of the emergency spillway is located 1.0 foot above elevation of the principal spillway.

EMBANKMENT HEIGHT AND WIDTH

The total embankment height for Treatment Facility No. 1 and for Sediment Ponds 2, 4, 5, 6, 7 and 8 were obtained by adding the stage at full storage capacity, the head of water over the spillway under design flow conditions, the required freeboard height (1.0 feet), and a 5 percent settlement allowance. Sediment Pond No. 3 is an excavated pond and Pond No. 9 is primarily an excavated pond with very little embankment that was built above the natural ground surface. Total embankment heights for these two ponds do not include the 5 percent settlement allowance. The embankment top width was determined from the regulatory criteria that the top width not be less than (H + 35)/5, where H is the height of the embankment in feet, as measured from the upstream toe of the embankment. Table 87, "Sediment Pond Design Values," summarizes the design specifications for Treatment Facility No. 1 and Sediment Ponds 2 through 9.

SIDE SLOPES

Where possible embankment slopes have been designed according to UMC 817.46(m), with combined upstream and downstream slopes of the settled embankment not less than 1V:5H with neither slope being greater than 1V:2H, however, due to site limitations some embankment designs necessitated embankment slopes which approximate 1.5H:1V.

Both Treatment Facility No. 1 and Sedimentation Pond No. 3 are excavated structures located on fill pads at the locations shown on Map 42, "Surface Water and Sedimentation Control Facilities - Map A." The pads have taken the natural angle of repose in the area of approximately 1.5H:1.0V. Sedimentation Ponds 2 and 5 have been constructed near the edge of natural embankments with slopes of approximately 1.5H:1.0V. To obtain the necessary pond storage capacity, the inside slope of pond number 5 was designed at 2.0H:1.0V.

Discussions and on-site meetings with DOGM have resulted in approvals being granted for sedimentation Ponds No. 2, 4, 6, 7, and 8; in variances to the above stated slope requirements being granted for Ponds No. 3 and No. 5; and a variance being granted for Treatment Facility No. 1 (wherein Sediment Pond No. 1 was reclassified as Treatment Facility No. 1). Additional details related to these approvals and variances were presented earlier in this section. Final approval of Sedimentation Pond No. 9 will be forthcoming following completion of construction and final inspection.

ANTI-SEEP COLLARS

Anti-seep collars were designed based on methods outlined by the U.S. Environmental Protection Agency (1976). Table 88, "Anti-Seep Collar Dimensions," outlines the dimensions required for the anti-seep collars for each facility. Spacing requirements between collars (when more than one are required) for Treatment Facility No. 1 are shown on Map 53, "Design Details for Treatment Facility No. 1," and for Ponds 2 through 8 on Maps 54 through 60, "Design Details for Sediment Ponds 2 through 8," and on Map 79, "Design Details for Sedimentation Pond 9."

RIPRAP PROTECTION

Loose or grouted riprap has been placed in pond and treatment facility inlet channels, around spillway risers, and at spillway outlets as shown on the previously mentioned design detail maps and as will be discussed later in this section. Riprap around all spillway risers (except Pond 9) has been placed so as to surround the risers to a width of five feet. Rock added to the pond design around spillway risers will generally minimize erosion caused by currents and eddies created by the concentration of flows around the outlet risers. Rock was not placed around the outlet riser for Sediment Pond 9 because it was felt that the riser was of sufficient height to prevent embankment erosion.

Consideration was also given to the erosion potential at each pond outlet. It was found that some pond outlets were located on slopes that are too steep for the design of conventional riprap erosion protection. An example of such a section is at Treatment Facility No. 1 where the discharge slope approximates 70 percent. In such locations each outlet has been placed onto a man-made or natural rock or riprap splash pile. For the ponds that have been so constructed, discharge waters appear to be controlled by the existence of the rubble piles and the solution appears to be working well. For ponds using natural rock or riprap splash piles, no calculations are provided since calculation techniques are not currently available for their design on such steep slopes as encountered at the Plateau Mine.

Design details of a riprap energy dissipation structure at the outlet pipes from Sediment Pond No. 2 are shown in Exhibit 42, "Sediment Pond 2 Energy Dissipation Structure."

Some pond outlet designs have considered not only riprap basins, but also concrete energy dissipation boxes. To date, riprap solutions appear to be more feasible than concrete energy dissipation boxes with the understanding that routine maintenance may be required. A description of the inlet and outlet conditions for each pond follows.

<u>Treatment Facility No. 1</u>

Inlets to this facility are from Culverts 54A, 55A and 56A which drain the upper mine pad area. These culverts will discharge onto extremely steep slopes wherein the design of riprap erosion protection is not possible. The outlets to these culverts have therefore been placed on rock rubble piles, which appear to be effectively dissipating the erosive energy originating from the respective culverts as discussed above.

The outlet culvert from the treatment facility is likewise located on a steep slope section approximating 70 percent. As with the inlet culverts, the outlet culvert for this facility has been placed over a rock rubble pile to dissipate excess energy in the discharging water before being allowed to enter the downstream channel section.

Pond 2

Water entering Pond 2 comes from two sources. The main inlet source consists of a grouted riprap channel (Ditch 20) which collects waters from upstream disturbed areas. Design criteria for flows in Ditch 20 can be found in the diversion ditch design data tables. A much smaller inlet source consists of Culvert 68A which diverts water from 0.34 acres of disturbed area adjacent to the asphalted roadway leading to the upper mine pad. The total calculated flow developed from Culvert 68A is on the order of 0.4 cfs which exits directly into the north side of the pond. Culvert outlet calculations (included in Exhibit 46, "Culvert Capacity Calculations") indicate that the exit velocities generated from this culvert are not sufficiently high to require outlet protection. At the time of an inspection made in 1987, it was observed that erosion did not appear to be occurring at the outlet from the culvert thereby confirming outlet calculations.

The pond outlet consists of two CMP culverts which discharge onto a riprap energy dissipation apron. Riprap design calculations are presented in Exhibit 47, "Pond Inlet and Outlet Design Calculations." Since the outlet is located in the channel bottom, large diameter rock has been placed on the upstream side of the outlet culverts to protect both the culverts and placed riprap from waters flowing down the natural channel. The outlet will be monitored periodically to verify that additional erosion is not occurring. Should a problem develop with the outlet as designed, modifications will be made to the outlet basin consisting of the replacement of existing loose riprap with grouted rock riprap.

Pond 3

Drainage Ditch No. 51 conveys the majority of inflowing water into this pond. The inlet channel is located on a steep slope which has eroded throughout the majority of its length to bedrock as stated earlier in this document. Since the channel has already eroded to bedrock, and since proven methods are not currently available to design stable channels with flexible linings on such steep slopes, a variance is being requested from requiring that additional erosion protection measures be made.

The pond outlet consists of a CMP culvert which discharges into a natural channel. Since the receiving slope is too steep for conventional design, a rock rubble pile has been placed at the outlet from the culvert to minimize erosion. No erosion was noted to have occurred at the outlet from this pond at the time of inspection prior to this submittal.

Pond 4

Inlets to Pond 4 consist of CMP pipes which drain into a large diameter riprap channel before entering the pond. According to design calculations included in Exhibit 47, "Pond Inlet and Outlet Design Calculations," a trapezoidal riprap channel with a bottom width on the order of 3 feet and a mean riprap size in the order of 1.0 foot will safely pass the required flow into the pond.

The outlet from Pond 4 is through a culvert system which empties into a riprapped channel section at the start of Ditch 24. Design criteria applicable to Ditch 24 is presented on Table 77A, "Diversion Ditch Design Criteria." No downstream erosion was reported to exist at the time of this submittal at the outlet from this pond under its present design.

Pond 5

With the installation of Pond 9, only one culvert (7E) will be required to divert disturbed area water into Pond 5. Culvert 7E has been constructed to minimize erosion through the installation of a conveyor belt liner attached to its outlet.

The pond outlet consists of a CMP downspout that carries discharge waters down a steep slope and into a natural drainage channel to the south. The CMP outlet from the pond has been placed directly over a rock rubble pile to dissipate excess energy before continuing downstream. The presence of the rubble pile at the pond outlet appears to be effectively controlling erosion downstream of the pond outlet.

Pond 6

Inflows into Pond 6 are derived mainly from an upstream unlined natural channel. Since the immediate upstream channel has not been disturbed through mining activities, plans have not been made to install any sort of erosion protection at the inlet to Pond 6. The intent is to leave the channel in as natural a condition as possible while still maintaining compliance with mining regulations.

Discharge waters from Pond 6 exit into a channel section containing rock and vegetative stands. According to calculations presented in Exhibit 47, "Pond Inlet and Outlet Design Calculations," the flow velocity from the pond outlet culvert is less than five feet per second and therefore does not require erosion protection. A site inspection made during the Summer of 1987 confirmed that no erosion is occurring at the outlet from this pond.

Pond 7

As with Pond 6, the drainage channel flowing into Pond 7 has not been altered through mining activities. The natural configuration and shape of the channel has been conserved in a pre-mining state. In order to continue to preserve the integrity of inlet conditions, a rock pile has been placed across the entrance to the pond to reduce the potential for disturbance of the upstream channel during sediment removal operations. As an added benefit, the large diameter rock placed across the inlet channel appears to be reducing the potential for erosion within the natural upstream channel by forming a small energy dissipation pool at the inlet to the pond.

The outlet culvert for this pond empties onto a small riprap energy dissipation pad. Calculations and dimensions for the pad, along with the required size of riprap used, are shown in Exhibit 47, "Pond Inlet and Outlet Design Calculations." The total design outflow from the pond is approximately 1.7 cfs and the designed riprap median size is conservatively sized to 0.5 feet.

Pond 8

The inlets to Pond 8 consist mostly of flows from small local draws and Culverts 34A, 35A, and 37A. The outlet from Culvert 34A is located on a steep slope and has been constructed with a small rock rubble pile at its outlet to dissipate energy before entering Pond 8. A conveyor belt liner has been installed on the outlet from Culvert 35A and a riprap energy dissipation pad has been placed at the outlet from Culvert 37A to help prevent erosional degradation. Calculations related to Culvert 37A flow capacity and outlet protection are presented in Exhibit 46, "Culvert Capacity Calculations."

Two outlet (dual) spillways have been constructed to Pond 8. The original spillway outlet from Pond 8 (referred to as Spillway

No. 1) exits onto a newly constructed riprap energy dissipation pad. The design for the second spillway constructed (Spillway No. 2) includes a rock lined energy dissipation basin. Calculations (and design sketches) related to both spillway outlet dissipation structures, including dimensions and riprap sizes, are shown in Exhibit 47, "Pond Inlet and Outlet Design Calculations."

Pond 9

Inflows into Pond 9 are carried through Ditch 80C. The ditch entering Pond 9 (just recently constructed) is lined with riprap having a D_{50} equal to 1.5 feet. Design details are shown on Map 79, "Design Details for Sedimentation Pond No. 9."

The outlet from the pond consists of two 36 inch CMP risers connected to a single outfall pipeline. The outfall pipeline crosses the main access road and ties into Culvert 9A at a point just upstream of the connection between Culvert 9A and Ditch 9B.

CONNECTIONS AND COMPACTION

All connections (joints, seals, etc.) were designed to be watertight to prevent structural failure and soil piping. The embankment fill material was placed in 6 to 8-inch thick continuous layers over the entire length of the fill and machine compacted. Material immediately around the conduits leading through the embankment was hand compacted to prevent damage by machinery and to provide proper compaction around the conduits.

VEGETATIVE COVER

All sedimentation pond embankments (except Pond No. 9 which is located bordering the coal refuse pile) have been revegetated to prevent surface erosion. Sediment Pond No. 2 was seeded recently but the seed did not take and re-seeding efforts will be conducted.

STABILITY ANALYSES

Embankment stability analysis were completed for Sediment Ponds 3 and 5 in 1981, 1982 and again in 1985 after pond modifications were made. According to the findings of the studies the ponds were finally accepted by DOGM with factors of safety of 1.333 and 1.47 to 1.48 respectively. After pond enlargement modifications were made in 1984 the analyses indicate that the dry pond factors of safety are respectively 1.5 and 1.8. A letter prepared by R&M Consultants dated November 21, 1984 attesting to the latest factors of safety is reproduced in Exhibit 31, "Sedimentation Pond Approval, Documentation and Certification." A stability analysis of Sediment Pond 9 was completed prior to construction by Chen and Associates, which indicated that the 3H:1V embankment slopes will result in a factor of safety greater than 1.5.

HYDROLOGIC IMPACTS

Hydrologic impacts resulting from the construction of the sedimentation ponds are confined to some small increased losses resulting from increased surface evaporation and pond infiltration. Additional details regarding hydrologic impacts are given in Section 784.14.

Since the time that the Mining and Reclamation Plan was last prepared in 1982, a few changes have been made relating to operation, monitoring, hydrology and sedimentation. In 1985 a report was prepared which updated some of the more operational aspects of the 1982 waste pile plan (see Exhibit 33, "Star Point Mine's Refuse Pile Expansion - Operation and Monitoring Plan). Modifications made to runoff conveyance facilities have been incorporated into this report as well as up-to-date design and as-built information for each existing sedimentation pond or treatment facility.

No past, present, or future mining activities have or will be conducted beneath any existing sedimentation pond, treatment facility or waste pile embankment, therefore there will be no effect upon such structures due to subsidence of the subsurface strata. Any new structures which may be needed in the future will be properly designed and the plans submitted before construction begins.

UMC 784.17 PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES

FOR ANY PUBLIC PARKS, OR HISTORIC PLACES THAT MAY BE ADVERSELY AFFECTED BY THE PROPOSED OPERATION, EACH PLAN SHALL DESCRIBE THE MEASURES TO BE USED TO MINIMIZE OR PREVENT THESE IMPACTS AND TO OBTAIN APPROVAL OF THE DIVISION AND OTHER AGENCIES AS REQUIRED IN UMC 761.12(F).

RESPONSE:

There are no public parks or historic places in or near the permit area.

UMC 784.18 RELOCATION OR USE OF PUBLIC ROADS

EACH APPLICATION SHALL DESCRIBE, WITH APPROPRIATE MAPS AND CROSS SECTIONS, THE MEASURES TO BE USED TO ENSURE THAT THE INTERESTS OF THE PUBLIC AND LANDOWNERS AFFECTED ARE PROTECTED IF, UNDER UMC 761.12(D), THE APPLICANT SEEKS TO HAVE THE DIVISION APPROVE-

(a) CONDUCTING THE PROPOSED UNDERGROUND COAL MINING ACTIVITIES WITHIN 100 FEET OF THE RIGHT-OF-WAY LINE OF ANY PUBLIC ROAD, EXCEPT WHERE MINE ACCESS OR HAUL ROADS JOIN THAT RIGHT-OF-WAY; OR

RESPONSE:

Map 44, Surface Facilities (4 sheets), shows the county road joining PMC Permit Area. PMC has been an operating coal mine since 1917, and as such is well established as one of only two parcels of private property at the end of the county road. Through traffic to public land beyond PMC's fee land is allowed at the discretion of PMC. There is no adverse impact to the public because of PMC operations near the public road.

(b) RELOCATING A PUBLIC ROAD.

RESPONSE:

PMC does not anticipate relocating a public road.

UMC 784.19 UNDERGROUND DEVELOPMENT WASTE

EACH PLAN SHALL CONTAIN DESCRIPTIONS, INCLUDING APPROPRIATE MAPS AND CROSS-SECTION DRAWINGS OF THE PROPOSED DISPOSAL METHODS AND SITES FOR PLACING UNDERGROUND DEVELOPMENT WASTE AND EXCESS SPOIL GENERATED AT SURFACE AREAS AFFECTED BY SURFACE OPERATIONS AND FACILITIES, ACCORDING TO UMC 817.71 - 817.74. EACH PLAN SHALL DESCRIBE THE GEOTECHNICAL INVESTIGATION, DESIGN,

CONSTRUCTION, OPERATION, MAINTENANCE AND REMOVAL, IF APPROPRIATE, OF THE STRUCTURES AND BE PREPARED ACCORDING TO THE FOLLOWING:

(a) EACH APPLICATION SHALL CONTAIN DESCRIPTIONS, INCLUDING APPROPRIATE MAPS AND CROSS-SECTION DRAWINGS, OF THE PROPOSED DISPOSAL SITE AND DESIGN OF THE DISPOSAL STRUCTURES ACCORDING TO UMC 817.71 - 817.74. THESE PLANS SHALL DESCRIBE THE GEOTECHNICAL INVESTIGATION, DESIGN, CONSTRUCTION, OPERATION, MAINTENANCE, AND REMOVAL, IF APPROPRIATE, OF THE SITE AND STRUCTURES.

RESPONSE:

The waste pile at PMC has been previously permitted through DOGM. Continued operation of the pile will be under the same requirements and procedures as previously approved. The waste pile is located south and east of the preparation plant. Currently, the waste pile is in Phase II as described in Exhibit 33, Star Point Mines Refuse Pile Expansion - Operation and Monitoring Plan. This plan includes descriptions of geotechnical investigations, design, construction and operation of the waste pile. Pile stability investigations are periodically conducted and detailed reports are maintained on file at the mine offices.

(b) EACH APPLICATION SHALL CONTAIN THE RESULTS OF A GEOTECHNICAL INVESTIGATION OF THE PROPOSED DISPOSAL SITE, INCLUDING THE FOLLOWING:

(1) THE CHARACTER OF BEDROCK AND ANY ADVERSE GEOLOGICAL CONDITIONS IN THE DISPOSAL AREA,

(2) A SURVEY IDENTIFYING ALL SPRINGS, SEEPAGE, AND GROUND WATER FLOW OBSERVED OR ANTICIPATED DURING WET PERIODS IN THE AREA OF THE DISPOSAL SITE;

(3) A SURVEY OF THE POTENTIAL EFFECTS OF SUBSIDENCE OF THE SUBSURFACE STRATA DUE TO PAST AND FUTURE MINING OPERATIONS;

(4) A TECHNICAL DESCRIPTION OF THE ROCK MATERIALS TO BE UTILIZED IN THE CONSTRUCTION OF THOSE DISPOSAL STRUCTURES CONTAINING ROCK CHIMNEY CORES OR UNDERLAIN BY A ROCK DRAINAGE BLANKET; AND

(5) A STABILITY ANALYSIS INCLUDING, BUT NOT LIMITED TO, STRENGTH PARAMETERS, PORE PRESSURES AND LONG-TERM SEEPAGE CONDITIONS. THESE DATA SHALL BE ACCOMPANIED BY A DESCRIPTION OF ALL ENGINEERING DESIGN ASSUMPTIONS AND CALCULATIONS AND THE ALTERNATIVES CONSIDERED IN SELECTING THE SPECIFIC DESIGN SPECIFICATIONS AND METHODS.

RESPONSE:

Responses to these requirements can be found in Exhibit 22, Coal Processing Waste Pile Extenson Plan and Feasibility Study, and in Exhibit 33, Star Point Mines Refuse Pile Expansion - Operation and Monitoring Plan.

GRABEN CROSSING DEVELOPMENT WASTE

Waste from the tunnels will be conveyed to the surface by means of regular coal conveyors. Rock may be mixed with regular coal mined underground and conveyed to the preparation plant where it will be removed in conjunction with coal washing. The waste rock would then be mixed with regular coal refuse and deposited on the refuse pile.

Another alternative being considered is to convey the waste via conveyor belts on off-shifts to the surface where it would be disposed of on the refuse pile.

Another alternative would be the creation of "gob" rooms underground for disposal of waste rock.

Development waste will consist of approximately 45,000 cubic yards of sandstone, mudstone and siltstone. This material is very similar to the rock that is mined incidentally with the coal. The roof and floor of the coal seams are comprised of the same three rock types.

The active portion of the refuse pile at the time of the Graben Crossing will consist of thirteen surface acres. If the waste rock were to be deposited in one lift, it would be 2.15 feet deep; however given the 12 to 18 month length of time the project will take, the waste will be mixed with coal refuse.

The thirteen acre active disposal area comprises 28% of the final refuse pile. The addition of the development waste will be insignificant when compared to the overall refuse pile volume. If the development waste was spread over the entire refuse pile in one lift it would be 0.6 feet deep, this on a pile that will be as much as 150 feet deep.

No changes in size or location of the existing refuse waste pile will be required by the addition of the minor amount of waste from the Graben Crossing.

(c) IF, UNDER UMC 817.71(i), ROCKTOE BUTTRESSES OR KEY-WAY CUTS ARE REQUIRED, THE APPLICATION SHALL INCLUDE THE FOLLOWING:

(1) THE NUMBER, LOCATION, AND DEPTH OF BORINGS OR TEST PITS WHICH SHALL BE DETERMINED WITH RESPECT TO THE SIZE OF THE SPOIL DISPOSAL STRUCTURE AND SUBSURFACE CONDITIONS; AND

(2) ENGINEERING SPECIFICATIONS UTILIZED TO DESIGN THE ROCKTOE BUTTRESSES AND KEY-WAY CUTS WHICH SHALL BE DETERMINED IN ACCORDANCE WITH PARAGRAPH (B)(5) OF THIS SECTION.

<u>RESPONSE</u>:
Rock tow buttresses or key-way cuts are not anticipated.

UMC 784.20 SUBSIDENCE CONTROL PLAN

THE APPLICATION SHALL INCLUDE A SURVEY WHICH SHALL SHOW WHETHER STRUCTURES OR RENEWABLE RESOURCE LANDS EXIST WITHIN THE PROPOSED PERMIT AND ADJACENT AREA AND WHETHER SUBSIDENCE IF IT OCCURRED COULD CAUSE MATERIAL DAMAGE OR DIMINUTION OF REASONABLY FORESEEABLE USE OF SUCH STRUCTURES OR RENEWABLE RESOURCE LANDS. IF THE SURVEY SHOWS THAT NO SUCH STRUCTURES OR

RENEWABLE RESOURCE LANDS EXIST, OR NO SUCH MATERIAL DAMAGE OR DIMINUTION COULD BE CAUSED IN THE EVENT OF MINE SUBSIDENCE, AND IF THE DIVISION AGREES WITH SUCH CONCLUSION, NO FURTHER INFORMATION NEED BE PROVIDED IN THE APPLICATION UNDER THIS SECTION. IN THE EVENT THE SURVEY SHOWS SUCH STRUCTURES OR RENEWABLE RESOURCE LANDS EXIST, AND THAT SUBSIDENCE COULD CAUSE MATERIAL DAMAGE OR DIMINUTION OF VALUE OR FORESEEABLE USE OF THE LAND, OR IF THE DIVISION DETERMINES THAT SUCH DAMAGE OR DIMINUTION COULD OCCUR, THE APPLICATION SHALL INCLUDE A SUBSIDENCE CONTROL PLAN WHICH SHALL CONTAIN THE FOLLOWING INFORMATION-

(a) A DETAILED DESCRIPTION OF THE MINING METHOD AND OTHER MEASURES TO BE TAKEN WHICH MAY AFFECT SUBSIDENCE, INCLUDING:

(1) THE TECHNIQUE OF COAL REMOVAL, SUCH AS LONGWALL MINING, ROOM AND PILLAR WITH PILLAR REMOVAL, HYDRAULIC MINING OR OTHER METHODS; AND

(2) THE EXTENT, IF ANY, TO WHICH PLANNED AND CONTROLLED SUBSIDENCE IS INTENDED.

RESPONSE:

The surface of the area to be mined that might be impacted by subsidence is used primarily for cattle grazing. Timber production is minimal. Presubsidence surveys indicate features which might be affected by subsidence would be: localized perched aquifers that possibly serve as a water supply for cattle and wildlife; the upper reaches of the North Fork of the Right Fork of Miller Creek; and, two golden eagle nest sites. The only man made structures on the surface are a TV translator station, a small one-room cabin, a PMC owned power line from the main portal across the mountain to a ventilation fan, drift fences for cattle, and unimproved forest service roads. In general, no known major aquifers exist above the immediate coal zone. Two known water wells (both on the far eastern edge of the permit area near the surface facilities below the coal seams) exist within the permit area. Buildings, conveyors, etc. for the mining operation are all located east of and below the coal field. In general, the area is rugged and not readily accessible to the public.

On the eastern portion of the mine plan area only a few springs exist. On the western portion of the mine plan area many springs have been located as explained in response to UMC 783.15.

Subsidence effects are not anticipated to cause material damage or diminuation of the renewable resources or the few structures above the coal seams.

PMC will use longwall and room and pillar methods to extract the coal resource contained in the three economic coal seams on the property. All three seams are not present over the entire permit area.

Longwall panels have been designed with yielding chain pillars to insure a uniform subsidence profile. This smooth subsidence profile is classified as trough subsidence, in that normally a gradual flexure of the surface is observed. It is anticipated that maximum subsidence will be 70% of extraction height with an angle of draw of 22½ degrees. Multiple seam mining effects are assumed to be additive. Idealized full extraction with room and pillar methods will create similar subsidence profiles to that of longwall extraction. In room and pillar areas, full extraction will be stressed because of the decrease in subsidence effects and improved resource recovery.

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by [signature] date 1-11-89

Revised 12/7/88

Noticeable cracks have occurred in the Blackhawk Formation in the eastern part of the mine plan area where pillars have been pulled in areas with a shallow overburden and on narrow promontories and ridges with steep side slopes (Maps 61 and 62, Subsidence Monitoring Plan). Numerous faults exist in this part of the mine plan area. The conclusion is that where the overburden is weakened and fractured, stresses

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occurring from areas of caving within the mine are not distributed laterally but extend vertically to the surface, producing a surface crack.

In the western part of the mine plan area, the overburden is at least 1,000 ft thick, and the coal-bearing Blackhawk Formation is covered by the Castlegate Sandstone and by the Price River Formation as well as the North Horn Formation. The additional thickness of strong sandstone-bearing formations should resist the formation of surface cracks. This western area of the mine plan also appears to be less fractured by faults.

(b) A DETAILED DESCRIPTION OF THE MEASURES TO BE TAKEN TO PREVENT SUBSIDENCE FROM CAUSING MATERIAL DAMAGE OR LESSENING THE VALUE OR REASONABLY FORESEEABLE USE OF THE SURFACE, INCLUDING-

(1) THE ANTICIPATED EFFECTS OF PLANNED SUBSIDENCE, IF ANY;

(2) MEASURES, IF ANY, TO BE TAKEN IN THE MINE TO REDUCE THE LIKELIHOOD OF SUBSIDENCE, INCLUDING SUCH MEASURES AS-

(i) BACKSTOWING OR BACKFILLING OF VOIDS;

(ii) LEAVING SUPPORT PILLARS OF COAL; AND

(iii) AREAS IN WHICH NO COAL REMOVAL IS PLANNED, INCLUDING A DESCRIPTION OF THE OVERLYING AREA TO BE PROTECTED BY LEAVING COAL IN PLACE.

(3) MEASURES TO BE TAKEN ON THE SURFACE TO PREVENT MATERIAL DAMAGE OR LESSENING OF THE VALUE OR REASONABLY FORESEEABLE USE OF THE SURFACE INCLUDING SUCH MEASURES AS-

(i) REINFORCEMENT OF SENSITIVE STRUCTURES OR FEATURES;

(ii) INSTALLATION OF FOOTERS DESIGNED TO REDUCE DAMAGE CAUSED BY MOVEMENT;

(iii) CHANGE OF LOCATION OF PIPELINES, UTILITY LINES OR OTHER FEATURES;

(iv) RELOCATION OF MOVABLE IMPROVEMENTS TO SITES OUTSIDE THE ANGLE-OF-DRAW; AND

(v) MONITORING, IF ANY, TO DETERMINE THE COMMENCEMENT AND DEGREE OF SUBSIDENCE SO THAT MEASURES CONSISTENT WITH KNOWN TECHNOLOGY MAY BE ADOPTED IN ORDER TO PREVENT SUBSIDENCE FROM CAUSING MATERIAL DAMAGE TO THE EXTENT TECHNOLOGICALLY AND ECONOMICALLY FEASIBLE, MAXIMIZE MINE STABILITY, AND IN ORDER TO MAINTAIN THE VALUE AND REASONABLY FORESEEABLE USE OF SUCH SURFACE LANDS, EXCEPT IN THOSE INSTANCES WHERE THE MINING TECHNOLOGY REQUIRES PLANNED SUBSIDENCE IN A PREDICTABLE AND CONTROLLED MANNER: PROVIDED, THAT NOTHING IN THIS SUBSECTION SHALL BE CONSTRUED TO PROHIBIT THE STANDARD METHODS OF MINING. THE MONITORING, IF ANY, WILL CONTINUE UNTIL THE FINAL CESSATION OF MINING AND THE COMPLETION OF RECLAMATION HAS OCCURRED OR UNTIL SUCH SHORTER TIME AS MAY BE APPROVED BY THE DIVISION.

RESPONSE:

Since some subsidence has occurred in the eastern part of the mine plan area because pillars have been pulled by PMC and by prior mine owners, the impact of the observed subsidence is being evaluated and used as a guide in determining the need for control and mitigation of subsidence. The results of a field review of existing subsidence will be discussed subsequently.

Subsidence control and mitigating measures will need to be site specific. The TV tower and power line, the only existing structures that need special consideration, are both near the main portal area, where pillars have already been pulled. No evidence of subsidence damage can be identified. There are no dams, reservoirs, buildings, major highways, or proposed highways in the area to be undermined.

Because all surface structures and facilities are located beyond the coal outcrops, no damage to them can result from subsidence. Reinforcement is, therefore, unnecessary. The Carbon County TV translator

(iii) CHANGE OF LOCATION OF PIPELINES, UTILITY LINES OR OTHER FEATURES;

(iv) RELOCATION OF MOVABLE IMPROVEMENTS TO SITES OUTSIDE THE ANGLE-OF-DRAW; AND

(v) MONITORING, IF ANY, TO DETERMINE THE COMMENCEMENT AND DEGREE OF SUBSIDENCE SO THAT MEASURES CONSISTENT WITH KNOWN TECHNOLOGY MAY BE ADOPTED IN ORDER TO PREVENT SUBSIDENCE FROM CAUSING MATERIAL DAMAGE TO THE EXTENT TECHNOLOGICALLY AND ECONOMICALLY FEASIBLE, MAXIMIZE MINE STABILITY, AND IN ORDER TO MAINTAIN THE VALUE AND REASONABLY FORESEEABLE USE OF SUCH SURFACE LANDS, EXCEPT IN THOSE INSTANCES WHERE THE MINING TECHNOLOGY REQUIRES PLANNED SUBSIDENCE IN A PREDICTABLE AND CONTROLLED MANNER: PROVIDED, THAT NOTHING IN THIS SUBSECTION SHALL BE CONSTRUED TO PROHIBIT THE STANDARD METHODS OF MINING. THE MONITORING, IF ANY, WILL CONTINUE UNTIL THE FINAL CESSATION OF MINING AND THE COMPLETION OF RECLAMATION HAS OCCURRED OR UNTIL SUCH SHORTER TIME AS MAY BE APPROVED BY THE DIVISION.

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RESPONSE:

Since some subsidence has occurred in the eastern part of the mine plan area because pillars have been pulled by PMC and by prior mine owners, the impact of the observed subsidence is being evaluated and used as a guide in determining the need for control and mitigation of subsidence. The results of a field review of existing subsidence will be discussed subsequently.

Subsidence control and mitigating measures will need to be site specific. The TV translator station and power line, the only existing man-made structures that need special consideration, are both near the main portal area, where pillars have already been pulled. No evidence of subsidence damage can be identified. There are no dams, reservoirs, buildings, major highways, or proposed highways in the area to be undermined.

Because all surface structures and facilities are located beyond the coal outcrops, no damage to them can result from subsidence. Reinforcement is, therefore, unnecessary. The Carbon County TV translator station is located over stable mined-out areas of the seams and will require no additional reinforcement. This area has already been subjected to subsidence effects. However, should danger to this structure become apparent, corrective measures will be carried out. It is felt at this time that installation of footers will not be necessary. No change in the location of lines will be necessary, nor will improvements require relocation.

Mitigating measures are limited in this relatively inaccessible area. However, the TV translator station and the power line can be moved or protected against structural failure. Damage to any man-made structures, including fences and roads, can be repaired. Since no other buildings or structures exist in the area to be undermined, there are no plans for restoration, rehabilitation, or insurance as required under Section 784.20(c). Since the sedimentation ponds are small, less than 20 acre-ft in size, and are located east of and below the coal field, no buffer zone is required.

Spring flows which are fault related may be affected by mines subsidence. These fault related springs are fully described in response to Section 783.15. Representative springs will be monitored to determine the extent of subsidence modification to these springs.

Strata bound springs should be minimally affected by subsidence effects. Water flow should continue with little or no diminuation of quality and quantity. Again, representative springs will be monitored as described in the Hydrologic Monitoring Plan.

In order to minimize subsidence effects to nesting sites for golden eagles, sufficient cover exists to mask subsidence effects. Longwall mining methods with yielding chain pillars under these features will allow uniform subsidence with minimum surface fissuring. The nesting sites are in the interior of planned longwall panels which should ensure a gradual uniform dropping of the land surface.

Before longwall mining in Section 18, T15S, R8E, begins, PMC will take photographs of the stream channel in the potential subsidence zone to document pre-subsidence conditions. Photographs will be taken at 100 foot intervals in the stream channel through the barrier zones where subsidence effects would be manifest. Copies of these photographs with location map will be submitted with PMC's subsidence monitoring report for 1987.

Proposed subsidence monitoring points are shown on Maps 61 and 61C, Subsidence Monitoring Plan. Proposed monitoring points in Section 18, T15S, R8E, are shown on Map 61, Proposed Monitoring Plan, and details of cliff subsidence monitoring in conjunction with Golden Eagle nests in Section 18, T15S, R8E, are contained in Exhibit 41, Golden Eagle Cliff Nesting and Subsidence Monitoring and Mitigation Plan.

Subsidence control can be accomplished by several methods as needed, such as not pulling pillars in selected sensitive areas such as outcrops, uniform extraction to minimize impacts, and using longwall methods with yielding chain pillar.

In the permit area, pillars will be left only in those areas in which recovery work would be unsafe or uneconomical. In addition, 100-ft-wide barrier pillars are planned along seam outcrops; 200-ft-wide pillars are planned along both sides of permanent entry systems. Shaft pillars will be large enough to protect the shafts from subsidence.

PMC has three types of subsidence monitoring programs. The primary method is with aerial photography; secondary is surveying established monuments, and tertiary is casual observance of any subsidence evidence by traveling the surface above the mine.

PMC has contracted with the USFS to annually fly the mining areas above the mine working and prepare contour maps. These maps are then compared to the base map prepared previously. Reports and maps from the USFS have not been delivered as promptly as initially agreed. The USFS representatives have indicated this situation will be corrected in 1987.

Staff of the Manti-La Sal National Forest have outlined a subsidence monitoring plan that has been implemented. Primary components of the plan are as follows:

1. Initial baseline photography of the entire permit area above mining.

2. Annual aerial photography to evaluate any subsidence occurring subsequent to the base or first year.

The color aerial photographs taken annually are of a scale and overlap agreed upon by the USFS. This photography is digitized and will be of such accuracy that horizontal and vertical control is expected to be obtained to within 1 ft. The highest practical degree of accuracy will be obtained. The annual photography will cover the previously mined areas and the areas to be mined in the following 18 months.

Monument locations have been selected to serve as control points for the aerial photography and to facilitate subsidence detection. The locations of these points are shown on Maps 61 and 62, Subsidence Monitoring Plan. Monitoring data collected during the past permit term is summarized in Table 89, Subsidence Monitoring Data. Adequate monuments outside of the angle of draw have been established. Control monuments are constructed of durable material such as iron pipes or rods set in concrete with brass, aluminum, or bronze caps. The monuments are designed to minimize "frost-heave". The monument identification number is impressed on the caps.

In addition to the USFS plan, PMC conducts an ongoing monitoring program as follows:

1. A base map has been prepared (Maps 61 and 62, Subsidence Monitoring Plan) showing contours and surface features that might be impacted by subsidence, such as surface structures, streams, and springs. The extent of mining is shown in these maps and the area where pillars have been removed and areas extracted by longwall are indicated. These base maps are updated annually.
2. Photographs have been taken of the principal surface structures to document their present condition (Exhibit 15, Mine Structure Photographs).
3. Principal springs and streams are being monitored for quantity and quality ahead of mining to establish a baseline condition for comparison with postmining conditions.
4. An annual field survey will be made to identify where observable subsidence has occurred. A report of the field survey will be submitted to the appropriate agencies.
5. When subsidence is observed to adversely impact a surface structure or resource, the extent of the impact will be evaluated, and appropriate action taken.
6. Monitoring points have been established above the longwall area. These points are surveyed on the ground to evaluate subsidence.

The secondary method of subsidence monitoring is by surveying monuments established over PMC longwall area. These monuments were constructed and surveyed prior to any longwall activity. This method will continue "on a somewhat irregular basis as a secondary check of the aerial methods". This type of subsidence monitoring will be gradually phased out as the aerial methods are perfected. Periodic surveys are conducted to ascertain horizontal and vertical movements of the established

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monuments. Reports of these surveys are submitted to the appropriate agencies annually as required and are on file at the Mine Office. Results of the survey information have been plotted and subsidence contours drawn on the area of the longwall panels as shown on Map 61 and 62, Subsidence Monitoring Plan.

The third method of casual inspection, that is walking the surface to determine if additional subsidence evidence/damage has occurred, is done on a biannual schedule. This method is used to evaluate the effects and schedule any remedial methods if justified. Again these reports are submitted to the appropriate agencies and are on file at the mine office.

Future monitoring points to be established by the ground surveying method are shown in their approximate locations on Maps 61 and 61A, Subsidence Monitoring Plan. The locations for these future monitoring points may be changed as field conditions dictate. Only mining during this permit term has monitoring points proposed.

Subsidence monitoring will continue until the reclamation bond is released or until such shorter time as may be approved by the DOGM.

No surface subsidence will occur because of the Graben Crossing tunnels. The tunnels will be left open after mining ceases with roof supports remaining in-place. Since the tunnels will be in solid interbedded sandstone, mudstone and siltstone, structural stability is expected to be good with minor areas of instability associated with interior faults.

Because the tunnels are confined horizontally by solid rock and since there will be no additional mining on either side, the lateral extension of caving is restricted. The roofrock material has good bulking characteristics which will reduce the vertical amount of caving, if it occurs, to approximately 15 feet above the tunnel. Overburden thickness above the tunnels is an average of 1300 feet thick with 1200 as a minimum, which will prevent any surface effects.

(c) A DETAILED DESCRIPTION OF THE MEASURES TO BE TAKEN TO MITIGATE THE EFFECTS OF ANY MATERIAL DAMAGE OR DIMINUTION OF VALUE OR FORESEEABLE USE OF LANDS WHICH MAY OCCUR, INCLUDING ONE OR MORE OF THE FOLLOWING AS REQUIRED BY UMC 817.24-

(1) RESTORATION OR REHABILITATION OF STRUCTURES AND FEATURES, INCLUDING APPROXIMATE LAND-SURFACE CONTOURS, TO PREMINING CONDITION.

(2) REPLACEMENT OF STRUCTURES DESTROYED BY SUBSIDENCE.

(3) PURCHASE OF STRUCTURES PRIOR TO MINING AND RESTORATION OF THE LAND AFTER SUBSIDENCE TO CONDITION CAPABLE OF SUPPORTING AND SUITABLE FOR THE STRUCTURES AND FORESEEABLE LAND USES.

(4) PURCHASE OF RENEWABLE INSURANCE POLICIES PAYABLE TO THE SURFACE OWNER IN THE FULL AMOUNT OF THE POSSIBLE MATERIAL DAMAGE OR OTHER COMPARABLE MEASURES.

RESPONSE:

It is not anticipated that material damage will occur because of subsidence effects. No sensitive man-made structures exist over active areas of subsidence, and other renewable resource damage would be mitigated. Should material damage occur to any structure, the structure will be repaired or replaced depending on the situation. PMC does not anticipate purchase of structures prior to mining, nor purchase of special subsidence insurance.

(d) A DETAILED DESCRIPTION OF MEASURES TO BE TAKEN TO DETERMINE THE DEGREE OF MATERIAL DAMAGE OR DIMINUTION OF VALUE OR FORESEEABLE USE OF THE SURFACE, INCLUDING SUCH MEASURES AS-

(1) THE RESULTS OF PRE-SUBSIDENCE SURVEYS OF ALL STRUCTURES AND SURFACE FEATURES WHICH MIGHT BE MATERIALLY DAMAGED BY SUBSIDENCE.

(2) MONITORING, IF ANY, PROPOSED TO MEASURE DEFORMATIONS NEAR SPECIFIED STRUCTURES OR FEATURES OR OTHERWISE AS APPROPRIATE FOR THE OPERATION.

RESPONSE:

Monitoring to determine the degree of material damage (should it occur) will initially begin with the aerial photographs and the presubsidence surveys. Should any structure or surface feature become in jeopardy from subsidence effects, additional monitoring will be implemented.

Revised 12/15/86

(2) REPLACEMENT OF STRUCTURES DESTROYED BY SUBSIDENCE.

(3) PURCHASE OF STRUCTURES PRIOR TO MINING AND RESTORATION OF THE LAND AFTER SUBSIDENCE TO CONDITION CAPABLE OF SUPPORTING AND SUITABLE FOR THE STRUCTURES AND FORESEEABLE LAND USES.

(4) PURCHASE OF RENEWABLE INSURANCE POLICIES PAYABLE TO THE SURFACE OWNER IN THE FULL AMOUNT OF THE POSSIBLE MATERIAL DAMAGE OR OTHER COMPARABLE MEASURES.

RESPONSE:

It is not anticipated that material damage will occur because of subsidence effects. No sensitive structures exist over active areas of subsidence, and other renewable resource damage would be mitigated. Should material damage occur to any structure, the structure will be repaired or replaced depending on the situation. PMC does not anticipate purchase of structures prior to mining, nor purchase of special subsidence insurance.

(d) A DETAILED DESCRIPTION OF MEASURES TO BE TAKEN TO DETERMINE THE DEGREE OF MATERIAL DAMAGE OR DIMINUTION OF VALUE OR FORESEEABLE USE OF THE SURFACE, INCLUDING SUCH MEASURES AS-

(1) THE RESULTS OF PRE-SUBSIDENCE SURVEYS OF ALL STRUCTURES AND SURFACE FEATURES WHICH MIGHT BE MATERIALLY DAMAGED BY SUBSIDENCE.

(2) MONITORING, IF ANY, PROPOSED TO MEASURE DEFORMATIONS NEAR SPECIFIED STRUCTURES OR FEATURES OR OTHERWISE AS APPROPRIATE FOR THE OPERATION.

RESPONSE:

Monitoring to determine the degree of material damage (should it occur) will initially begin with the aerial photographs and the presubsidence surveys. Should any structure or surface feature become in jeopardy from subsidence effects, additional monitoring will be implemented.

Monitoring will be conducted at or near structures commensurate with the importance and value of the structure. Monitoring points which are physically surveyed on the ground are approximately 400 to 500 feet apart located approximately over the center of mining panels and running the lengths of the panels plus the angle of draw distance plus extra distance based upon sight, terrain, and vegetative cover factors.

Since no significant buildings, utilities, gas lines, water bodies, or other structures exist above mining areas, the spacing of the proposed monitoring points is adequate to detect surface movement.

The photogrammetric method of monitoring discussed in response to UMC 784.20(b)(3)(v) on page 784-140 allows the capability of densifying point readings to any spacing. Where this method is used, monitoring at or near any structure can be done on any photography taken in the past. If a structure becomes of interest in the future for example, a historical look can be made of the immediate area to document subsidence progression.

If the photogrammetric method is used, monuments are placed as per the recommendations of the photogrammetrist. Where ground surveys are made, monitoring points are located as discussed previously, and at locations determined using standard surveying procedures.

Subsidence monitoring data will be submitted to the DOGM yearly.

UMC 784.21 FISH AND WILDLIFE PLAN

(a) EACH APPLICATION SHALL CONTAIN A FISH AND WILDLIFE PLAN, CONSISTENT WITH THE PERFORMANCE STANDARDS OF UMC 817.97 AND WHICH PROVIDES:

(1) A STATEMENT OF HOW THE PLAN WILL MINIMIZE DISTURBANCES AND ADVERSE IMPACTS ON FISH AND WILDLIFE AND RELATED ENVIRONMENTAL VALUES DURING