

**Horse Canyon Extension  
Lila Canyon Mine**

**Chapter 5  
Engineering**

**Volume 4 of 7**

## Table of Contents

500.	ENGINEERING .....	Page -1-
510.	Introduction .....	Page -1-
511.	General Requirements. ....	Page -1-
512.	Certification .....	Page -3-
513.	Compliance With MSHA Regulations and MSHA Approvals. ....	Page -4-
514.	Inspections. ....	Page -4-
515.	Reporting and Emergency Procedures. ....	Page -6-
516.	Prevention of Slides: .....	Page -8-
520.	Operation Plan. ....	Page -8-
521.	General: .....	Page -19-
522.	Coal Recovery. ....	Page -25-
523.	Mining Methods: .....	Page -26-
524.	Blasting and Explosives: .....	Page -28-
525.	Subsidence: .....	Page -34-
526.	Mine Facilities. ....	Page -46-
527.	Transportation Facilities. ....	Page -50-
528.	Handling and Disposal .....	Page -51-
529.	Management of Mine Openings: .....	Page -54-
530.	Operational Design Criteria and Plans. ....	Page -55-
531.	General. ....	Page -55-
532.	Sediment Control: .....	Page -55-
533.	Impoundments. ....	Page -55-
534.	Roads. ....	Page -57-
535.	Spoil: .....	Page -58-
536.	Coal Mine Waste. ....	Page -58-
537.	Regraded Slopes. ....	Page -60-
540.	Reclamation Plan. ....	Page -60-
541.	General. ....	Page -60-
542.	Narratives, Maps and Plans. ....	Page -61-
550.	Reclamation Design Criteria and Plans. ....	Page -63-
551.	Casing and Sealing of Underground Openings. ....	Page -63-
552.	Permanent Features. ....	Page -63-
560.	Performance Standards. ....	Page -66-

## **List of Appendixes**

Appendix 5-1 Inspection Form for Excess Spoil  
Appendix 5-2 Inspection Form for Impoundments  
Appendix 5-3 Coal Mine Waste Fire Extinguishing Plan  
Appendix 5-4 New Facility Designs  
Appendix 5-5 Slope Stability Analysis  
Appendix 5-6 Mine Openings (Closures)  
Appendix 5-7 Rock Slope Material (Refuse Pile)  
Appendix 5-8 Reclamation Plan

## **List of Plates**

Plate 5-1	Previously Mined Areas
Plate 5-1A	Premining Contours
Plate 5-2	Surface Area Lila Canyon Mine (Official Disturbed Area Boundary Map)
Plate 5-3	Subsidence Control Map
Plate 5-3	CONFIDENTIAL Subsidence Control Map with Raptor Information
Plate 5-4	Coal Ownership
Plate 5-5	Mine Map
Plate 5-6	Post Mining Topography
Plate 5-7A-1	Mine Site Cross Sections
Plate 5-7A-2	Mine Site Cross Sections
Plate 5-7A-3	Mine Site Cross Sections
Plate 5-7A-4	Mine Site Cross Sections
Plate 5-7B-1	Mine Site Cross Sections
Plate 5-7B-2	Mine Site Cross Sections
Plate 5-7B-3	Mine Site Cross Sections
Plate 5-7C	Reclaimed Profile
Plate 5-8	Coal Handling Facilities
Plate 5-9	Portal Plan and Sections

## Chapter 5

### 500. ENGINEERING

#### 510. Introduction

This section presents the engineering portion for the Lila Canyon Extension to the Horse Canyon Mine Reclamation Plan and is based upon previous publications, permit applications for the adjacent Sunnyside and South Lease areas and design which follows basic engineering standards. The objective of this chapter is to provide sufficient engineering design to support the mining and reclamation plan for the Lila Canyon Mine which is part "B" of the Horse Canyon Permit (ACT/007/013) and to satisfy the rules found in R645-301-500. All of the activities associated with the coal mining and reclamation operations are designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plan. The engineering section of the permit application is divided into the introduction, the operation plan, operational design criteria, reclamation plan, and performance standards. All design criteria associated with the operation and reclamation plan have been met.

#### 511. General Requirements.

**511.100** The permit application includes a description of the proposed coal mining and reclamation operations with appropriate maps, plans, and cross sections.

**511.200** A description of the proposed mining operation and its potential impacts to the environment as well methods and calculations utilized to achieve compliance with design criteria is addressed within this chapter.

**511.300** A description of the proposed reclamation plan is included in this chapter.

#### 512. Certification

**512.100.** Cross Sections and Maps that require certification have been prepared by, or under the direction of, and certified by a qualified, registered, professional engineer, with assistance

from experts in related fields when needed. Cross Sections and Maps will be updated as needed or required by the Division. Listed below are some of the maps and cross sections that have been certified by a qualified registered professional engineer.

- 512.110.** A map showing the extent of known existing mine workings and the approximate year mined has been included and certified by a qualified registered professional engineer and included as Plate 5-1.
- 512.120.** All Surface facilities and operations are shown on the appropriate maps and have been certified by a qualified registered professional engineer.
- 512.130** Maps showing final surface configuration with cross sections have been included and certified by a qualified registered professional engineer. (See Plate 5-6, 5-7c, and Appendix 5-4)
- 512.140** Appropriated hydrology drawings and cross sections have been certified by a qualified registered professional engineer. (See Chapter 7)
- 512.150** Geologic cross sections and maps that are required to be, have been certified by a qualified registered professional engineer. See Chapter 6 and Plate 7-1B.
- 512.200** Plans and Engineering Designs which may include: Excess spoil piles, durable rock fills, coal mine waste, impoundments, primary roads and variances from approximate original contour. These Plans and Designs have been certified by a qualified registered professional engineer if appropriate.
- 512.210** Lila Canyon Mine is an underground operation, therefore it is anticipated that no excess Spoil will be produced. This section does not apply.
- 512.220** The professional engineer experienced in the design of

earth and rock fills has certified that the durable rock fill design will ensure the stability of the fill and that the fill meets design requirements.

- 512.230** The professional engineer experienced in the design of coal mine waste piles has certified the design of the coal mine waste disposal facility. (See Appendix 5-7)
- 512.240** Prudent engineering practices was used in the design and construction of impoundments in the permit area. The impoundment designs have been certified by a qualified registered professional engineer. (See Plate 7-6)
- 512.250** The professional engineer has certified the design and construction or reconstruction of primary roads as meeting the appropriate design criteria.
- 512.260** The operator is not requesting a variance from the approximate original contours (AOC).

### **513. Compliance With MSHA Regulations and MSHA Approvals.**

- 513.100** Neither Coal processing waste dams or embankments are anticipated during the term of this permit. Therefore, this section is not applicable.
- 513.200** Planned impoundments and sedimentation ponds do not meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a). Therefore, this section is not applicable.
- 513.300** Underground development waste transported to the surface, coal processing waste and excess spoil will not be disposed of underground. However, material such as overcast material, rock falls, and slope material, not transported to the surface, may be disposed of underground according to the appropriate MSHA regulations.
- 513.400** Refuse piles meet the requirements of MSHA, 30 CFR 77.214 and 30 CFR 77.215 and all appropriate R645 regulations. (See Appendix 5-7)
- 513.500** Shafts, drifts, adits, tunnels, exploratory holes, entryways or

other opening to the surface from the underground will be capped, sealed, backfilled or otherwise properly managed consistent with MSHA, 30 CFR 75.1711.

- 513.600** Surface water discharges into the underground mine workings is not anticipated or planned, Therefore, this section is not applicable.
- 513.700** Surface mining within 500 feet to an active underground mine is not planned nor anticipated. Therefore, this section does not apply.
- 513.800** Coal mine waste fires plans will be submitted to MSHA and the Division for their approval prior to extinguishing any coal mine waste fires. (See Appendix 5-3)

#### **514. Inspections**

All engineering inspections, except the quarterly inspections of impoundments not subject to MSHA, will be conducted by a qualified registered professional engineer or other qualified professional specialist under the direction of the professional engineer.

- 514.100** Lila Canyon is an underground operation and it is not anticipated that any spoil will be produced. Therefore, this section does not apply.
- 514.200** Refuse Piles. A professional engineer or specialist experienced in the construction of similar earth and waste structures will inspect the refuse pile during construction.
  - 514.210** Regular inspections by the engineer or specialist will also be conducted during placement and compaction of coal mine waste materials. If it has been determined that a danger of harm exists to the public health and safety or the environment, more frequent inspections will be conducted. Inspections will continue until the refuse pile has been finally graded and revegetated or until a later time as required by the Division.
  - 514.220** The refuse pile inspections will be performed at least quarterly throughout construction and during the

following construction periods:

- 514.221** In addition to quarterly inspections, an inspection will be performed during foundation preparation which includes the removal of all organic material and topsoil;
- 514.222** Since no under-drain or protective filter systems are planned, this section is not applicable.
- 514.223** In addition to quarterly inspections, an inspection will be performed during the installation of the final surface drainage systems.
- 514.224** In addition to quarterly inspections, an inspection will be performed after the final grading and the facility has been revegetated.
  
- 514.230** The division will be provided a certified report prepared by, or under the supervision of, the qualified registered professional engineer after each inspection. The report will certify that the refuse pile has been constructed and maintained as designed and in accordance with the approved plan and R645 Rules. This report will include statements stating the appearances of instability, structural weakness, and other hazardous conditions if found. (See Appendix 5-1)
  
- 514.240** Since protective filters and under-drain are not required in the current design criteria this section is not applicable.
  
- 514.250** Required refuse pile reports will be retained at or near the mine site in an area convenient to the resident agent and the qualified registered professional engineer. Appendix 5-1 is an example of the refuse pile inspection form.
  
- 514.300** Impoundments

- 514.310** A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments.
- 514.311** During construction inspections will be made on a regular basis and upon completion of the pond the inspections will be performed at least yearly. Inspections will continue yearly until the pond is removed or the performance bond is released.
- 514.312** After each inspection the qualified registered professional engineer will promptly provide to the Division, a certified report. This report will state that the impoundment has or has not been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include a discussion of any appearances of instability, structural weakness or other hazardous conditions. All so included in the report will be the depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability.
- 514.313** Required impoundment inspection reports will be retained at or near the mine site in an area convenient to the resident agent and the qualified registered professional engineer. Appendix 5-2 is an example of the impoundment inspection form.
- 514.320** Since the pond contained in the Lila Canyon Project is less than 20 feet high and stores less than 20 acre-feet of water it is not subject to MSHA, 30 CFR 77.216. Therefore, this section does not apply.

## **515. Reporting and Emergency Procedures.**

- 515.100** If a slide occurs, the operator will telephone DOGM to notify them of the situation and recommend remedial measures to be

taken to alleviate the problem. Additional remedial measures required by DOGM will be implemented.

**515.200** During impoundment inspections any potential hazards noted will be reported to DOGM along with measures to be implemented to eliminate the hazard.

**515.300** In the case of temporary cessation of operations the following will apply:

**515.310** All provisions of the approved permit will be complied with during temporary cessation or abandonment.

**515.311** In case of temporary cessation the operator will support and maintain all surface access openings to underground operations, and secure surface facilities in areas in which there are no current operations, but operations are to be resumed under an approved permit.

**515.312** Since Lila Canyon Mine is an underground operation this section does not apply.

**515.320** Prior to a temporary cessation of coal mining and reclamation operations which is expected to last longer than 30 days, or when a temporary cessation is extended longer than 30 days, the operator will submit to the Division a notice of intention to cease or abandon operations. The following will be included in the notice of temporary cessation.

**515.321** The temporary cessation notice will contain the exact number of surface acres and the horizontal and vertical extent of subsurface strata included in the permit area. In addition a description of the reclamation activities accomplished and activities such as backfilling regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

**515.322** Since the Lila Canyon Mine is an underground operation this section does not apply.

**516. Prevention of Slides:** Since the Lila Canyon Mine is an underground operation this section does not apply.

## **520. Operation Plan.**

At first glance it would appear to a non-mining person that the best access to UEI's leases would be from the existing (sealed) Horse Canyon portals using the current Horse Canyon surface disturbance. However, the existing Horse Canyon site is not suitable for a large longwall operation. The old Horse Canyon Mine was not designed to produce 4.5 million tons as will be Lila. Some strategic pillars in the old mains were extracted upon retreat preventing any future access. The number of entries in the old works are not adequate for ventilation purposes. Portions of the old mine are flooded preventing reentry. The distance from the old portals to the current leases would result in unacceptable travel times for crews and supplies. Rehabilitating and maintaining an old mine is extremely hazardous and expensive. As a result of the conditions described above it has been determined that new portals at the Lila Canyon site is the most logical and only feasible access to the permittee's coal leases.

## **Mine Facilities List Lila Canyon Mine**

A list of new structures and facilities follows:

### **Buildings**

- 1) Office/Bathhouse
- 2) Shop Warehouse
- 3) Security Shack

### **Utilities**

- 4) Mine Substation
- 5) Under Ground Power Lines
- 6) Water Treatment Plant
- 7) Potable Water Tank

- 8) Process Water tank
- 9) Sewer Tank
- 10) Drain Field

#### **Mine Facilities**

- 11) Ventilation Fan
- 12) 60-inch Conveyor from tunnels to Coal Stockpile
- 13) (ROM) Underground Belt from Stockpile to Crusher
- 14) 48-inch Conveyor from Crusher to Loadout Bin
- 15) 48-inch Conveyor from Loadout Bin to Truck Loadout
- 16) Reclaim Tunnel, Escape Tunnel, Fan and Fan House
- 17) ROM Storage Pile, Coal Stacking Tube
- 18) Crusher Screen Plant
- 19) Truck Scale and Loadout
- 20) Coal Loadout Storage Bin
- 21) Guardrails
- 22) Underground Pipes
- 23) Chain Link Fence

#### **Support Facilities**

- 24) Non-Coal Waste Area
- 25) Equipment & Supplies Storage Area
- 26) Topsoil Pile
- 27) Refuse Pile
- 28) Sediment Pond
- 29) Slope Access Road / Portal Access Road
- 30) Rock Slopes
- 31) Mine Facilities Road / Truck Loadout Road
- 32) Office/Bathhouse/Warehouse Asphalt Parking Area
- 33) Mine Parking
- 34) Fuel Tanks
- 35) Powder and Cap Magazines
- 36) Culvert locations are shown on Plate 7-2.
- 37) Coal pile Road (Slope between the coal pile road and the portal access road will be evaluated after road construction and be labeled either disturbed or undisturbed, as appropriate, on an As-Built site map.

A description of new structures and facilities follows:

#### **Office/Bathhouse**

The office and bathhouse building is shown on Plate 5-2. This

building will jointly house all support personnel such as accounting, administration, engineering, and safety and will provide a comfortable office environment for all employees. Bathhouse and toilet facilities will be found for all employees at this location. The bathhouse will be provided for a location for underground miners to change from clean street clothes to clothing suitable for underground use. The area will be provided showers for employees for use after their scheduled work shifts so they can clean up prior to returning home. Both the bathhouse and office buildings will be of prefabricated construction and will rest on a concrete pad. The pad dimensions will be approximately 150' by 100' by 12". The facility will be designed to accommodate up to 145 employees working rotating shifts.

### **Shop Warehouse**

The shop warehouse building is shown on plate 5-2. Parts and supplies consumed during the mining process will be stored in the warehouse to be issued as needed. The shop area will be used to perform minor equipment repairs and overhauls. The shop warehouse will be a prefabricated modular type building approximately 100' by 150' and will rest on a 4" concrete pad.

### **Security Shack**

The Security Shack shown on Plate 5-2, when used will provide security to the mine site. The security shack will be used primarily at times when the mine is not in production. Security may be provided to protect the public from hazards associated with a mine site and to protect company property from unauthorized use. The security shack will be approximately 10' by 20' by 8' and will be of prefabricated construction and will rest on a 4" concrete slab.

### **Mine Substation**

The mine substation will be located as shown on Plate 5-2 will provide power to surface and underground areas of the mine property. The substation will comprise of approximately four transformers setting on a concrete pad approximately 20' by 20' by 12" and fully fenced. The total area of the substation is approximately 40' by 40'. Power will be fed into the transformers at 46 KVA and will be transformed down to usage voltages for both the surface and underground facilities. It is anticipated that voltages of 110, 220, 440 will be used on the surface and 12,470 volts will be utilized underground. The mine substation will be constructed in a way to fulfill all appropriate MSHA regulations.

### **Underground Power Lines**

Within the disturbed area it is anticipated all power lines will be underground. Underground lines will be run where feasible. As builds will be provided. Underground Power Lines will be left in place upon reclamation.

### **Water Treatment Plant**

The water treatment plant is located on the north-east side of the surface facility area. The plant will rest on a 15' by 15' slab. Process water will flow through the treatment plant at which time it will be treated and made suitable for potable water uses. The potable water will be stored in the potable water tank until it is used. The location of the water treatment plant can be found on Plate 5-2.

### **Potable Water Tank**

Water treated by the water treatment plant and intended to be used as potable water will be stored in this 15' diameter by 20' high tank. The tank will set on a 15' by 15' concrete pad designed for adequate support of the tank. The location of the potable water tank can be found on Plate 5-2.

### **Process Water Tank**

Process water, water to be used for mine use or to be treated for potable use, will be stored in this tank. The 15' diameter by 20' high process water tank will rest on a 15' by 15' concrete pad. Process water tank will be filled by using mine discharge water or may be hauled in from off site. The location of the process water tank can be found on Plate 5-2.

### **Sewer Tank**

The sewer tank has been designed to facilitate 145 employees working on rotating shifts. The sewer tank will be located under the south end of the office and bathhouse parking area. The location of the sewer tank can be found on Plate 5-2. The design for the Sewer Tank can be found in Appendix 5-4.

### **Drain Field**

The drain field has been designed to facilitate 145 employees working on rotating shifts. The drain field will be located at a lower elevation and

south of the sewer tank. The location of the drain field can be found on Plate 5-2. The design for the drain field can be found in Appendix 5-4.

### **Ventilation Fan**

The ventilation fan will be accessed and installed from underground. The ventilation portal will be driven from underground and broken from inside out. The location of the portal and fan is shown on Plate 5-2. Fan power will be run underground. Fan access for maintenance and monitoring will be from the underground works. The need for surface fan access is not anticipated at this time, access will be from underground.

### **60-inch Conveyor from tunnels to Coal Stockpile(Main Conveyor)**

The Run of Mine underground belt will provide for a means for coal to be conveyed from the working faces to the run of mine coal storage pile on the surface. The belt will provide capacity to convey to the surface, all coal mined in the underground workings. Preliminary design suggests that the conveyor that extends from the bottom of the rock slopes to the stacking tube at the coal storage area, shown on Plates 5-2 and 5-8, will have the following specifications: 60" wide, speed approximately 700 fpm with a length of approximately 320 feet long. Since the ground beneath the conveyor will not be disturbed due to the steepness and remoteness of the area, this conveyor will be completely contained within a tube type structure.

### **(ROM) Underground Belt from Stockpile to Crusher**

The Reclaim conveyor will provide for a means for coal to be conveyed from the coal stockpile to the crusher. The belt will provide capacity to convey to the crusher at a rate suitable for crushing. Preliminary design suggests that the reclaim conveyor, shown on Plates 5-2 and 5-8, will have the following specifications: 48" wide, speed approximately 500 fpm with a length of approximately 280 feet long. The portions of the conveyor running on the surface will be covered.

### **48-inch Conveyor from Crusher to Loadout Bin**

The Loadout conveyor will provide for a means for coal to be conveyed from the crusher to the loadout bin. The belt will provide capacity

to convey to the loadout at the same rate as the Reclaim conveyor. Preliminary design suggests that the Loadout conveyor, shown on Plates 5-2 and 5-8, will have the following specifications: 48" wide, speed approximately 500 fpm with a length of approximately 210 feet long. The portions of the conveyor running on the surface will be covered.

#### **48-inch Conveyor from Loadout Bin to Truck Loadout**

The Truck conveyor will provide for a means for coal to be conveyed from the loadout bin to the trucks being loaded. The belt will provide capacity to convey to the trucks at a rate suitable for truck loading. Preliminary design suggests that the truck conveyor, shown on Plates 5-2 and 5-8, will have the following specifications: 48" wide, speed will vary with a length of approximately 50 feet long. The portions of the conveyor running on the surface will be covered.

#### **Reclaim Tunnel, Escape Tunnel, Fans**

Design for the escape and reclaim tunnels is not complete. Standard practice is to construct the tunnels from either concrete or corrugated metal. The reclaim tunnel is approximately 275' long with a 14' diameter. The escape tunnel will be approximately 100' long with a diameter of 4'. Appropriate safety and environmental concerns will be addressed upon detailed design. The preliminary layout is shown on Plates 5-2 and 5-8.

#### **ROM Storage Pile**

The run of mine storage pile receives coal directly from the underground works and provides storage for the coal until it is crushed and loaded into trucks for transportation to a unit train loadout. The coal from the underground run of mine belt will be dropped into a stacking tube located in the center of the run of mine storage pile. This tube will help reduce any fugitive dust. The stacking tube will be approximately 80' high and will allow for approximately 27,000 tons of open storage in the run of mine storage pile. The run of mine storage pile is shown on Plates 5-2 and 5-8.

#### **Crusher**

The enclosed crusher will crush coal from the 8" minus down to a 2"

minus size, at the rate of approximately 500 tons per hour. No screening is anticipated at this time. The crushed coal will leave the crusher and be stored temporarily in a 500 ton storage bin located at the truck loadout. The crusher location is shown in Plates 5-2 and 5-8.

### **Truck Scale and Loadout**

Coal will be reclaimed from the coal storage bin, weighed and then loaded into coal haul trucks for transportation to the various unit train loadouts. A small loadout shack will be constructed to provide cover and protection for the various equipment and controls need for the coal loading process. The truck scale and loadout are shown on Plates 5-2 and 5-8.

### **Coal Storage Bin**

The coal storage bin is part of the truck loadout and is shown of Plate 5-2. The coal storage bin is where crushed coal is stored waiting to be loaded into coal haul trucks. The bin provides for surge capacity and allows for better control of crushing time. The coal storage bin provides for a enclosed dry location for temporary crushed coal storage. Coal is delivered from the crusher to the coal storage bin by use of a 48" covered surface conveyor running at a speed of approximately 500 FPM. The preliminary layout is shown on Plates 5-2 and 5-8.

### **Coal Stacking Tube.**

The final design for the coal stacking tube is not yet complete. Preliminary design indicates that the stacking tube will be approximately 15' Diameter and approximately 80 feet high. Standard practice is to construct the tube of either concrete or steel. The preliminary layout is shown on Plates 5-2 and 5-8.

### **Culverts**

A complete list and design for the culverts can be found in Appendix 7-4 Tables 9 and 10, and are shown on Plate 7-2. A summary of the culverts follows:

<u>Culvert</u>	<u>Length</u>	<u>Width</u>
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DC-5	40'	18"
DC-6	60'	24"
DC-7	40'	24"
DC-8	40'	18"
DC-9	40'	18"
UC-1	530'	60"

### **Guard Rails**

Approximately 1,520 feet of Guard rails will be installed on the mine access road according to the detailed engineering plan being prepared. Appropriate MSHA and UDOT requirements will be taken into consideration.

### **Underground Pipes**

Locations of the underground pipes have yet to be determined. Once detailed engineering design is completed the underground pipes will be added to Plate 5-2 or other appropriate Plates. Under ground pipes will be left in place upon reclamation.

### **Chain Link Fence**

Approximately 1,500' of a six foot high chain link fence will be constructed as shown on Plate 5-2. The fence will be constructed to protect the public, and provide security along the section of county road that runs adjacent to the property.

### **Non-Coal Waste Area**

An area for non-coal waste has been identified on Plate 5-2. Non-coal waste such as papers, timbers, cans, and miscellaneous scrap that is brought to the surface will be disposed of in a metal bin or "dumpster" located in the non-coal waste area identified on Plate 5-2. Metal will be separated from other forms of trash for salvage. Material not salvageable will be transported to the East Carbon Development Corporation (ECDC) dump or other approved disposal site for permanent disposal. Once a dumpster has reached capacity, the full dumpster will be replaced with an empty dumpster, and then the full dumpster will be hauled by a contract hauler to the specified disposal site.

### **Equipment & Supplies Storage Area**

The equipment and supply storage area is approximately 350' by 400'. This storage area will be used to store mine supplies and equipment from the time of delivery until they are needed underground. Supplies such as timbers, bolts, plates, rock-dust, pipes, resin, screens, concrete blocks, steel, cables, and numerous other materials may be stored in this area. Equipment both new and used will be stored in this area. Many various longwall pieces such as shields, pan-lines, shears, chains, head and or tail drives, transformers, belt drives, pumps and numerous other material will be stored in this storage area. This secure area provides for a good storage area for diesel, gasoline, hydraulic, and roadway chemicals. All oil tanks will have appropriately designed berms or retaining walls. The equipment and supplies storage area is shown on Plate 5-2. Any explosives will be stored here according to appropriate MSHA regulations. Rock dust bins will be located in this area.

### **Topsoil Pile**

The topsoil pile has been located on the south west end of the surface facilities. The pile has been designed to contain adequate topsoil for redistribution according to the reclamation plan found in Chapter 5. The proposed location provides for good protection from wind contamination as well as protection from mine related activities. The location of the topsoil pile is shown on Plate 5-2.

### **Refuse Pile**

The refuse pile has been designed to provide a location for the storage of underground development waste that is brought to the surface and for any excess slope rock which will be generated and not used as fill. The capacity of the pile is designed for approximately 44,400 yd<sup>3</sup> which is in excess of projected needs. The refuse pile design is shown in Appendix 5-7 and shown on Plate 5-2. The areas for the rock slope material and for underground development waste are adjacent and adjoining and will be treated as one area or structure.

### **Sediment Pond**

The sediment pond has been design to provide for adequate sediment

protection for the project area. All water running off the disturbed area will be routed into the sediment pond for treatment. The sediment pond has been designed according to the appropriate R645 regulations and the designs can be found in Appendix 7-4 and Plate 7-6. Because the sediment pond does not fit into the requirement of 30 CFR 77.216(a) an MSHA number for the proposed pond is not required. The sediment pond is located on the southwest end of the property and shown on Plate 5-2.

### **Slope Access / Portal Access Road**

The slope access road splits off the facility access road near the northeast corner of the equipment and supply storage area, and follows an alignment that takes into consideration grade and direct access. The slope access road will be used to provide access to the rock slopes which in-turn provided access to the underground workings. The slope access road will be used as access for all men, material and equipment need in the mine. Since the slope access road provides for frequent access for men, equipment and materials for a period of six months or longer the slope access road is classified as a primary road. The slope access road will be designed, constructed, and maintained according to appropriate R645 regulations. The slope access road is shown on Plate 5-2.

### **Rock Slopes**

Access to the underground workings of the Lila Canyon Mine will be provide by two rock slopes driven from the top of the Mancos shale up-dip to the intersection of the coal seam. One portal will proved for access for men, equipment and material to the mine. The second access slope will contain the run of mine belt line from the underground workings of the mine to the run of mine stock pile. There is a possibility that only one larger slope will be driven and then divided. to provide for two separate entries. The two 1,227 foot long slopes will slope up at approximately 12%, from a starting elevation of approximately 6150'. The intersection of the coal seam and the rock slope will take place at approximately 6,300 feet elevation. The length of the slopes were minimized by taking advantage of the coal seam dip which is approximately 12% to the east. The rock material removed from the slopes will be used as fill material for the surface facilities. The rock slope material / underground development waste will contain mostly shale, sandstone and mudstone. Traces of coal may be found but the amount will be insignificant. There are no known coal seams or significant rider seams found below the Sunnyside Seam in the Lila Canyon Portal Area. The rock slope locations are shown on Plate 5-2.

### **Mine Facilities Road / Truck Loadout Road**

The mine facility road shown on Plate 5-2 begins at the edge of County Road 164 and allows for access to the various surface facilities. The road has been located in the most practical location taking into consideration grade, stability, and alignment. Employees will use this road to access the office & bathhouse facilities. Coal haul trucks will use this road to access the scales and truck loadout. All supplies will be hauled on a short portion of this road from the supply storage area to the slope access road. The road will be paved during construction of the facilities and before coal mining operations begin in order to minimize dust and provide good surface for heavy truck traffic as well as facility access. The facility access road will be approximately 24' wide to provide for two lane traffic and will have the appropriate drainage controls to insure long term life and low maintenance. The road has been constructed and will be maintained according to the appropriate R645-534 and R645-527 regulations.

### **Coal Pile Road**

The Coal Pile Road is shown on plate 5-2. The Coal Pile Road will be 15' wide and will follow the existing contours approximately 400' from the Portal Access Road to the ROM coal pile. A typical cross section similar to the ancillary road can be found in Appendix 5-4 (Figure 1).

### **Office/Bathhouse/Warehouse Parking Area**

Parking will be as shown on Plate 5-2. Parking facilities for office, mine, and warehouse employees will be provided jointly as shown. This area will also provide parking for all vendors, and visitors. The surface of the 150' by 475' area will initially be graded and graveled but may eventually be paved. The parking area is located and designed to allow for convenient and safe parking of personal vehicles. The sewer tank and drain field will be located on the south end of this parking area.

### **Mine Parking**

A mine parking area will be provided as shown on Plate 5-2. The mine parking area is where all mine and mine related mobile equipment will be parked when on the surface. This is the location where the underground work crews will be loaded into man trips for transportation to the various work areas. The mine parking area will initially be graded and graveled but

eventually may be paved. The mine parking area will be approximately 100' by 200'.

### **Fuel Tanks**

Fuel tanks will be located in the Equipment & Supplies Storage Area and be installed as discussed under Equipment & Supplies Storage Area. A 1,500 gallon diesel tank, 500 gallon hydraulic tank and a 500 gallon gasoline tank will be needed.

### **Powder and Cap Magazines**

Powder and cap magazines will be mobile temporary, and supplied by the explosive distributor. Upon reclamation the powder and cap magazines will be returned to the distributor.

As per the approved Air Quality Order haul roads will be paved and unpaved roads and pad areas used by mobile equipment will be treated with water or dust suppressant, open stockpiles will be watered as conditions warrant.

**521.** Included in this section are maps, cross sections, narratives, descriptions and calculations used to satisfy the relevant requirements. This section describes and identifies the lands subject to coal mining and reclamation operations covering the estimated life of the project.

**521.100** This application includes the cross sections, maps and plans needed to present the relevant information required by the Division. This information includes the following:

**521.110.** Plate 5-1 Shows area previously mined and approximate dates of mining.

**521.111** Plate 5-1 of part 'B' and 2-2 of part 'A' shows the location and extent of known workings of inactive, or abandoned underground mines. The surface portals or mine openings to the surface are shown. Plates 5-1 and 2-2 of part 'A' have been prepared and certified by or under the direction of a registered professional engineer.

Doelling lists several coal mines and mining activity in within or adjacent to the permit area. Doelling lists the Calkins prospect, the Lila Canyon prospect, and the Prentiss prospect. In addition Doelling lists several coal mines Prentiss, Utah Blue Diamond, Blue Diamond and Heiner Mines. The research has shown that the Prentiss, Utah Blue Diamond, Blue Diamond and Heiner Mines were engulfed by the Book Cliffs mine. The Lila Canyon prospect refers to the old Lila Canyon mine fan portals used to ventilate the Geneva (Horse Canyon mine. The Calkins prospect is believed to have been engulfed by the Geneva mine.

An outcrop fire has been detected in an area north of the exiting permit area "A". The fire is off the permit area and located in an area that has been sealed from the old horse canyon works. The outcrop fire is not anticipated to cause any problems with mining at the Lila Canyon Mine.

**521.112** No surface mined areas are found within the permit area. Therefore, this section does not apply.

**521.120** Three existing structures, a 48" and a 60" CMP culvert located near the new proposed sediment pond, and the Little Park Road can be found at the Lila Canyon Mine. The existing culverts are shown on plate 5-1A and the road on Plate 5-1. Existing Horse Canyon facilities are discussed in part "A" of this plan.

**521.121** There are no buildings within 1000 feet of the proposed permit area for the Lila Canyon Mine, Part "B".

**521.122** There are no subsurface man-made features, other than the culverts discussed in 521.200, within, passing through, or passing over the proposed permit area for Part "B".

**521.123** Plate 4-1, as well as others, shows the existing

county road 126 which is located partly within 100 feet of the proposed permit area. In Addition, the Little Park road is located above the surface facilities within the permit area. The Little Park road is also shown on plate 4-1

**521.124** There are no known existing areas of spoil, waste, coal development waste, or non-coal waste disposal, dams, embankments, other impoundments, and water treatment and air pollution control facilities within part "B" of the proposed permit area. This section is not Applicable.

**521.125** There are no existing sedimentation ponds, permanent water impoundment, coal processing waste banks or coal processing waste dams near or within the permit area.

**521.130** Landowner and right of entry maps are included in the permit application. These maps and cross sections show the following:

**521.131** Plate 4-1 shows the surface ownership and Plate 5-4 shows the coal ownership of land included in or contiguous to the permit area.

**521.132** The applicant has the legal right to enter and begin coal mining and reclamation operations on all areas shown within the permit area. The permit area is shown on Plates 5-3 and 5-4 as well as others.

**521.133** Coal mining or reclamation operations are planned within 100 feet of a public road. There are no plans to relocate public roads.

**521.133.1** Emery County has given permission to conduct coal mining or reclamation operations within 100 feet of the county road. (See Appendix 1-4)

**521.133.2** The current permit does not propose any relocation of public roads. Therefore, this section

is not applicable.

- 521.140** Mine maps and permit area maps and or cross-sections will clearly indicate the following:
- 521.141** Plate 5-1 shows the permit boundary and Plate 5-2 shows the disturbed area boundary. Additional subareas that might require additional permits are addressed in Section 112.800 and 4-1B.
  - 521.142** The underground workings are shown on Plate 5-5.
  - 521.143** The proposed disposal site for placing the slope rock is shown on Plate 5-2 as well as other appropriate plates.
- 521.150** Plates 6-2, 6-3, and 6-4, show surface contours that represent the existing land surface configuration of the proposed permit area.
- 521.151** The Plates show the surface contours for all areas to be disturbed as well as over the total permit area. The Plates showing the surface contours has been prepared by or under the supervision of a registered engineer.
  - 521.152** No previously mined areas are included within Part "B". Therefore this section does not apply.
- 521.160** The maps, plates, and cross sections associated with this chapter clearly show:
- 521.161** Proposed buildings, utility corridors, and facilities are shown on Plate 5-2 as well as others.
  - 521.162** Area of land affected according to the sequence of mining and reclamation is shown on the appropriate plates.
  - 521.163** Land for which a performance bond will be posted is shown on the appropriate plate. Plate 5-2 as well as others show the area for which the

- performance bond will be posted. All disturbed areas within the permit boundary has been bonded.
- 521.164** Coal storage and loading areas are shown on Plate 5-2 and certified as required. Additional information can be found in Appendix 5-4.
- 521.165** Topsoil, and waste piles are shown on Plate 5-2 as well as others.
- 521.166** The waste disposal areas are shown for non-coal waste and underground mine waste on Plate 5-2.
- 521.167** No explosives are expected to be stored on site. However, if explosives are stored they will be stored as discussed in Section 520. on Plate 5-2.
- 521.168** Since Lila Canyon mine is an underground operation this paragraph is not applicable.
- 521.169** The refuse pile is shown on Plate 5-2 and discussed in Appendix 5-7.
- 521.170** Transportation facility maps describing roads, and conveyor maintained within the permit is shown with descriptions of roads, embankments, culverts, and drainage structures are presented in section 520 and are shown on Plates 5-2, and 7-2.
- 521.180** Support facilities are described in section 520 and are shown on Plate 5-2. Plate 5-2 is the official disturbed area boundary map.
- 521.190** Other relevant information required by the Division will be addressed.
- 521.200** Signs and markers will:
- 521.210** Signs and markers will be posted maintained, and removed by the person who conducts the coal mining and reclamation operations.

- 521.220** Signs and markers will be of uniform design that can be easily seen and read and be made of durable material and conform to local laws and regulations.
- 521.230** Signs and marker will be maintained during all activities to which they pertain.
- 521.240** Mine and Permit Identification Signs.
- 521.241** Mine and permit identification signs will be displayed at each point of access from public roads to areas of surface operations and facilities on permit areas.
- 521.242** Since Lila Canyon Mine is an underground operation, this section is not applicable.
- 521.243** Mine and permit identification signs where required, will show the name, business address, and telephone number of the permittee and the identification number of the permanent program permit authorizing coal mining and reclamation operations.
- 521.244** Mine and permit identification signs will be retained and maintained until after the release of all bonds for the permit area.
- 521.250** Perimeter Markers
- 521.251** The perimeter of all areas affected by surface operations or facilities before beginning mining activities will be clearly marked with perimeter markers.
- 521.252** Since Lila Canyon Mine is an underground operation this section is not applicable.
- 521.260** Buffer Zone Markers
- 521.261** Signs will be erected to mark buffer zones as required and will be clearly marked to prevent disturbance by surface operations and facilities.

**521.262** Since Lila Canyon Mine is an underground operation this section is not applicable.

**521.270** Topsoil Markers. Markers will be erected to mark where topsoil or other vegetation-supporting material is physically segregated and stockpiled.

## **522. Coal Recovery**

Additional Details can be found in the R2P2 on file at the BLM Office.

Effective barrier and pillar designs are essential for safe and productive underground mining. Barrier pillars will be sized according to accepted engineering practices. One or more of the following methods may be used to properly size barrier pillars: Dunn's Rule, the Old English Barrier Pillar Law, Pennsylvania Mine Inspector's Formula, Ash and Eaton Impoundment Formula, Pressure Arch Method, British Coal Rule of Thumb, North American Method, Holland Rule of Thumb, or Holland Convergent Method.

Regardless of the methods or care taken to properly size barrier pillars the true effectiveness on any design can only be determined by conducting full-scale in-mine performance evaluations. Mine experience and history in the local area will have as much influence on pillar sizes as does the engineering formulas.

Barrier pillars will be utilized to isolate the abandoned Horse Canyon Mine from the new Lila Canyon Mine. Barrier pillars will also be used to simplify ventilation, to provide independent escape routes and to possibly retain large quantities of mine water. Barrier pillars will be employed along the outcrop in order to maintain ventilation courses.

A barrier pillar where no second mining will be allowed within the barrier will be used to protect the escarpments. The width of the escarpment barrier will be determined by implementing a 21.5° angle of draw project downward from the surface to the coal seam. Development mining or first mining will be allowed within the escarpment barrier.

For longwall mining applications the abutment loading is of prime importance. Initial longwall pillars will be designed using the ALPS method. Again mine experience and history in the local area will have as much influence on pillar sizes as does the engineering formulas.

Mine pillars will be sized taking into consideration the coal strength, depth of cover, width and height of pillars using one or more of the following methodologies: Obert-Duvall, Holand-Graddy, Holland, Salamon-Munro, or Bieniawski. Again mine experience and history in the local area will have as much influence on pillar sizes as does the engineering formulas.

### **523. Mining Methods:**

Mining will begin in Section 15, T16S, R14E, in the Sunnyside seam. Development of the Sunnyside seam will be in a down dip direction toward the east. The seam will be accessed by two 1,200 foot slopes driven up at 12% from the base of the cliffs.

Production during the first year is estimated to be 200,000 tons, the second through the fifth year production should be between 1,000,000 and 1,500,000 using continuous mining methods. If and when tonnage demand increases to justify longwall mining, production could peak as high as 4,500,000 tons a year and continue at that level for the life of the mine.

Mine production will begin with the slope construction. Once the coal is encountered development will continue using continuous miners and various haulage types. Battery, cable, or continuous haulage may be used in conjunction with continuous miners in development. Continuous miners will account for all the production during the first two to five years. Mining will consist of driving mains, developing room and pillar panels and gate entries for future longwall mining.

The majority of the second mining will be performed using longwall equipment. However, in isolated areas room and pillar type of mining may be used in areas not suitable for longwall mining. Longwall panels are sited approximately parallel lengthwise to the strike with a slight up dip orientation to provide drainage for the development faces. This practice will be applied to the continuous miner panels wherever possible. (See plate 5-5)

Roof control and ventilation plans will be submitted to MSHA and approved prior to any underground mining activities.

An air quality permit from the State Division of Air Quality has been obtained and will be modified as needed.

Ventilation of the mine will be by an exhaust type system. It has been

estimated that 900,000 cfm will be required at full production. Intake air will be supplied by slopes and entries from the surface.

A water supply system will be installed. Potable water from an approved source will be hauled by truck and stored in a mine site storage tank located near the man and coal slope portals. Alternative sources for potable water are being considered. A treatment plant may be indicated. Process water will be hauled from the Price River or other approved source by truck and stored in another mine site storage tank. It is anticipated that once the old two entry development panel is encountered that adequate process water may be obtained from the old works. This process water will provide for dust control, water to the mine and fire suppression. Mine water will be used with the process water. See Appendix 7-3 (PHC) for water usage calculations.

Dust suppression will be accomplished by the use of sprays on all underground equipment as required. Sprays will also be used along sections of the conveyors and at transfer points.

No major de-watering concerns are anticipated at this property. The workings are expected to produce some water with more water being produced as the depth of mining increases. Part of this water will be used for dust suppression. The remainder will be collected in sumps and pumped to mined out sections of the mine or to the surface and treated when necessary.

Underground mining equipment to be used at Lila Canyon is typical of most room-and-pillar and longwall mine. A list of major equipment which may be used underground is listed below additional equipment not on the list may be used as needed.

- Continuous Miners
- Roof Bolters
- Battery Shuttle Cars
- Electric Shuttle Cars
- Diesel Ram Cars
- Feeder Breakers
- Continuous Haulage Units
- Battery Scoops
- Diesel Scoops
- Diesel Service Vehicles
- Diesel Material Haulers
- Diesel
- Belts and Terminal Groups
- Battery and Diesel Man Trips

Longwall Shields  
Longwall Pan-lines  
Longwall Shears  
Longwall Stage-loaders  
Longwall Pumps  
Various Water Pumps  
Various Transformers and Switches  
Rock Drills  
Loaders

**523.100** No Surface Coal Mining and Reclamation Activities are proposed to be conducted within the permit area within 500 feet of an underground mine, therefore this section is not applicable.

**523.200** No Surface Coal Mining and Reclamation Activities are proposed with 500 feet of an underground mine, therefore this section is not applicable.

**523.210** No Surface Coal Mining and Reclamation Activities are proposed to be conducted within the permit area within 500 feet of an underground mine, therefore this section is not applicable.

**523.220** No Surface Coal Mining and Reclamation Activities are proposed to be conducted within the permit area within 500 feet of an underground mine, therefore this section is not applicable.

**524. Blasting and Explosives:** Surface blasting activities incident to underground coal mining is planned for the Lila Canyon mine during construction of the access slopes only.

**524.100** Steps have been taken to achieve compliance with the blaster certification program and is described in this permit application.

**524.110** Surface blasting involving 5 lbs of explosives or more will be conducted under the direction of a certified blaster.

- 524.120** Blasting certificates will be carried by the blasters or will be on file at the permit area during blasting operations.
- 524.130** The blaster and at least one other person will be present at the firing of a blast.
- 524.140** Persons responsible for blasting operations at a blasting site will be familiar with the blasting plan, if required, and site-specific performance standards and give on-the-job training to persons who are not certified and who are assigned to the blasting crew or assist in the use of explosives.
- 524.200** Since the planned blasting does not meet the requirements of 524.211 or 524.212 a blast design is not included in the permit application. If in the future blasting falls under section 524.200 then a plan will be submitted to Division for approval.
- 524.210** Since the planned blasting does not meet the requirements of 524.211 or 524.212 anticipated blast designs are not required.
- 524.300** Since planned blasting requires more than 5 lbs of explosives the preblasting survey is addressed where applicable in this permit application.
- 524.310** There are no dwellings or other structures located within one-half mile of the permit area owned by anyone but the operator. The operator will prepare the preblast survey if required. Notification procedures implied in this section are not applicable.
- 524.320** Since the operator is the only owner of structures and no dwelling exist within one-half mile of any part of the permit area this section is not applicable.
- 524.330** Because the operator is the only owner of structures or dwellings within one-half mile of any part of the permit area, this section is not applicable.
- 524.340** Because the operator is the only owner of structures or dwellings within one-half mile of any part of the permit

area, this section is not applicable.

**524.350** Because the operator is the only owner of structures or dwellings within one-half mile of any part of the permit area, this section is not applicable.

**524.400** The blast schedule is as follows:

**524.410** Since there are no residents within one-half mile of the projected blasting site this section does not apply.

**524.420** All surface blasting will be conducted between sunrise and sunset unless nighttime blasting is approved by the Division.

**524.430** Since there are no residents within one-half mile of the projected blasting site this section does not apply.

**524.440** Since there are no residents within one-half mile of the projected blasting site a flexible blasting schedule is allowable. Surface blasting may take place anytime during daylight hours, unless approved differently by the Division.

**524.450** Because of the remote location of the Lila Canyon Mine, over six miles from the nearest locality (Columbia), this section does not apply.

**524.460** Since the town of Columbia is the nearest locality, and is over six miles distance from the permit area, this section does not apply.

**524.500** The blasting signs, warnings and access control is described below.

**524.510** Blasting signs will meet the specifications of R645-301-521.200. The following will apply.

**524.511** Signs reading "Blasting Area" will be conspicuously placed at the point where any road provides access to the blasting area.

- 524.512** The signs posted at all entrances to the permit area from public, roads, or highways will be placed in a conspicuous location and will state "Warning! Explosives in Use" and will clearly list and describe the meaning of the audible blast warning and all clear signals that are in use.
  
- 524.520** Audible warning and all-clear signals of different character or pattern will be given. Each person within the permit area will be trained in the meaning of the signals.
  
- 524.530** Access within the blasting area will be controlled until an authorized until the operator has reasonably determined the following:

  - 524.531** No unusual hazards, such as imminent slides or undetonated charges, exist; and
  - 524.532** Access to and travel within the blasting area can be safely resumed.
  
- 524.600** Adverse blasting effects are described as follows:

  - 524.610** Blasting will be conducted to prevent injury to persons, damage to public or private property outside the permit area, adverse impacts on any underground mine, and change in the course, channel, or availability of surface or ground water outside the permit area.
  
  - 524.620** Airblast Limits

    - 524.621** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
    - 524.622** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.

- 524.630** Monitoring: Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.640** Ground Vibration: Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.650** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.660** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.670** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.680** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.690** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, sections 524.620 through 524.632 and 524.640 through 524.680 do not apply.
- 524.700** Records of blasting operations will be maintained at the mine site for at least three years and will be available for inspection by the Division or the public. Blasting records will contain the following information.
- 524.710** Blasting records will include.

- 524.711** The name of the operator will be on the blasting record.
- 524.712** The location, date, and time of the blast will be recorded on the blasting record.
- 524.713** The name, signature, and certification number of the blaster will be recorded on the blasting record.
- 524.720** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area, this section does not apply.
- 524.730** Weather conditions will be recorded on the blasting record.
- 524.740** A record of the blast will include the following:

  - 524.741** The type of material blasted will be recorded on the blasting record.
  - 524.742** Sketches of the blast pattern including number of holes, spacing, burden, decks, and delay pattern will be recorded on the blasting record.
  - 524.743** The diameter and depth of holes will be recorded on the blasting record.
  - 524.744** The type of explosives used will be recorded on the blasting record.
  - 524.745** The total weight of the explosives used per hole will be recorded on the blasting record.
  - 524.746** The maximum weight of explosives detonated in an eight-millisecond period will be recorded on the blasting record.
  - 524.747** Information on the initiation system will be recorded on the blasting record.

**524.748** The type and length of the stemming will be recorded on the blasting record.

**524.749** Mats or other protections used will be recorded on the blasting record.

**524.750** Since all structures are either owned by the permittee and not leased to another person or are located over six miles distance from the permit area a record of seismographic and airblast information is not required.

**524.760** Since a blasting schedule is not required this section does not apply.

**524.800** The operator will comply with the various appropriate State and Federal laws and regulations in the use of explosives.

**525. Subsidence:** The permittee will comply with the appropriate R645-301-525 requirements.

**525.100 Subsidence Control Plan**

**525.110** Plate 5-3 shows the location of State appropriated water and 5-3 (Confidential) shows the eagle nests that potentially could be diminished or interrupted by subsidence.

**525.120 SUBSIDENCE POTENTIAL (See also Section 5.4 of Part "A")**

A review of renewable resources in and adjacent to the permit area found resources consisting of ground water, grazing, timber, and water supply. Subsidence from underground coal mines has been believed to affect overlying forest and grazing resource lands in the following ways:

- Formation of surface fissures which intercept near surface soil moisture thus draining the water away from the root zone with deleterious effects.
- Alterations in ground slope and destabilization of critical slopes and cliffs.

- Modification of surface hydrology due to the general downward migration of surface water through vertical fractures.
- Modification of groundwater hydrology including connection of previously separated aquifers and reduction in flows of seeps and springs which rely upon tight aquitards for their flow.
- Emissions of methane originating from the coal seam through open fissures to the surface or at least the base of the surficial soil which has been known to have deleterious effects on woody plants.

Because these renewable resources exist with and adjacent to the permit area, a subsidence control plan is required. This plan is presented in Section 525.400.

A great deal of baseline data is available from many mining settings to develop subsidence damage criteria for surface structures (Bhattacharya et al. 1984). The formation of cracks and fissures are the general effects of subsidence and can have minor deleterious effects on groundwater resources without any fissuring to the surface. In the arid areas of Utah, impacts to and modification of the groundwater regime can be disruption of flow from natural seeps and springs which rely on the permeability contrast of interbedded sandstones and shale for their flows. These water resources are generally near surface occurrences and are essentially surface waters and subject to the same limiting damage criteria as surface water bodies. Subsidence damage to surface water bodies has been studied by a number of workers including Dunrud (1976), Wardell and Partners (1976), and U.S. Bureau of Mines (1977). The results of the Wardell and Partners studies of subsidence effects in a number of countries indicates that the limiting strain for the onset of minor impacts to surface waters is approximately  $5 \times 10^{-3}$ . The SME Mining Engineering Handbook also suggests a limiting extension strain value of  $5 \times 10^{-3}$  for pasture, woodland, range or wildlife food and cover.

Table 10.6.19 in the Mining Engineers Handbook suggests

that the minimum safe cover required for total extraction of the coal resources under surface waters is approximately 60 times the seam thickness for coal beds at least 6 feet thick or approximately 450 feet. In their review of the foregoing, Singh and Bhattacharya (1984) recommended that the same limiting safe strain values and cover thickness ratios be used for protecting groundwater resources over coal mines. Where extension strain is greater than this limiting value, it is likely that surface fissures and cracks may develop. As the strain value decreases below the limiting value, the potential for surface damage decreases.

Figure 1 in Appendix 7-3 shows a typical subsidence profile. As shown in Figure 1, the zones are: a caved zone that occurs in the 6 to 10 times the thickness of the coal seam, a fractured zone which occurs 10 to 30 times the thickness of the coal seam, and deformation zone which occurs 30 to 60 times the thickness of the coal seam, and finally, a soil zone which occurs on the ground surface.

The longwall panels in the Lila Canyon Mine will have dimensions of approximately 950 feet wide and up to 7,000 feet long and 2,000 feet deep. Using the methods described in the National Coal Board's *Subsidence Engineers' Handbook*, the S/m ratio for this geometry would be 0.38 where "S" is the maximum subsidence and "m" is the seam extraction thickness. For an average seam extraction thickness of 10.5 feet, the total subsidence would be 4.0 feet. However, as described above, the major impacts of this subsidence are due to extension strains and not total vertical subsidence. The prediction of average extension strain is accomplished with the use of the formula:

$$+E = 0.75 S/h \text{ where } S=\text{subsidence, and } h=\text{depth of cover}$$

The solution of this equation for the Lila Canyon Mine configuration discussed above produces a predicted, average extension strain of  $1.5 \times 10^{-3}$  which is less than the limiting strain of  $5 \times 10^{-3}$  for protecting surface waters, groundwater sources, pasture, woodland, range or wildlife food and cover. Thus, it is unlikely that the gradual compression expected over much of the subsidence area will have any deleterious effects

on the overlying renewable surface resources. The cover thickness of 1,000 to over 2,000 feet, over most of the mine area is also much greater than the limiting thickness of 630 feet recommended by International Engineers Inc. (1979) (10.5' x 60). The table below shows the expected subsidence amount and expected extension strain for longwall panels at various mining depths. These calculations were done for a flat multiple seam mining. There are adjustments for single seam mining and for dipping seams. However, these adjustments are minor and are not expected to result in significant changes in values.

**Maximum Subsidence  
& Expected Extensive  
Strain (NCB 1975)**

		Feet	Meters		
Panel Width =		900	274		
Seam Height =		10.5	3		
Depth of Cover		Width to Depth (a)	Maximum Subsidence(S)		Extension Strain (E)
Feet	Meters	Ratio	Feet	Meters	x 10 <sup>3</sup>
500	152	0.9	9.5	2.9	14.2
1000	305	0.75	7.9	2.4	5.9
1100	335	0.71	7.5	2.3	5.1
1200	366	0.68	7.1	2.2	4.5
1300	396	0.65	6.8	2.1	3.9
1400	427	0.59	6.2	1.9	3.3
1500	457	0.54	5.7	1.7	2.8
2000	610	0.38	4.0	1.2	1.5
2500	762	0.28	2.9	0.9	0.9

The most favored technique until recently has been the use of the empirical charts developed by the National Coal Board (NCB). The above calculations were obtained using the empirical charts developed by the National Coal Board (NCB). Comparisons, as stated in the SME handbook, of US subsidence data with NCB predictions highlight the following differences between coalfields in the US and UK: Most of the studies in the US are limited to the Eastern US coalfields with a very limited data base applicable to western conditions.

With the exception of Illinois, maximum subsidence factors observed in US coalfields are less than predicted by NCB.

The limit (draw angles in the US coalfields tend to be less than the 35 degree value generally accepted by NCB.

The points of inflection of the subsidence profiles over US coal mines are generally closer to the panel centerline compared to the NCB profile. This effect is dependent not only on the percentage of competent strata in the overburden but also on their locations relative to the ground surface and their thickness.

Surface strains and curvatures observed over US longwall panels have been shown to be significantly higher than NCB predictions, almost four times larger in many cases.

The pace at which subsidence occurs depends on many controls including the type and speed of coal extraction, the width, length and thickness of the coal removed, and the strength and thickness of the overburden. Observations of subsidence by Dunrud over the Geneva and Somerset Mines indicate that subsidence effects on the surface occurred within months after mining was completed, and the maximum subsidence was essentially completed within 2 years of the completion of retreat mining.

Dr. Roy Sidle found in his study of Burnout Creek that subsidence impacts to streams are temporary and self healing.

The Sidle Study is representative of the conditions found in the Lila area because:

- the lithology is very similar between the Book Cliffs and the Wasatch Plateau
- the cover thickness ranges from 600 - 800 feet which falls within the range expected at Lila, and
- the seam thickness of 8-10 feet is in the same range expected at Lila.

An Executive Summary of his study and published findings follows:

**Title : Stream response to subsidence from underground coal mining in central Utah**

**2. Authors: Sidle-RC Kamil-I Sharma-A Yamashita-S**

Short-term geomorphic and hydrologic effects of subsidence induced by longwall mining under Burnout Creek, Utah were evaluated. During the year after longwall mining, 0.3-1.5 m of subsidence was measured near impacted reaches of the mountain stream channel. The major channel changes that occurred in a 700-m reach of Burnout Creek that was subsided from 1992 to 1993 were: (1) extent glides; (2) increases in pool length, numbers and volumes; (3) increases in median particle diameter of bed sediment in pools; and (4) some constriction in channel geometry. Most of the changes appeared short-lived, with channel recovery approaching pre-mining conditions by 1994. In a 300-m reach of the South Fork drainage that was subsided from 1993 to 1994, only channel constriction was observed, although any impacts on pool morphology may have been confounded by heavy grazing in the riparian reaches during the dry summer of 1994. Similar near-channel sedimentation and loss of pool volume between 1993 and 1994 were noted throughout Burnout Creek and in adjacent, unmined James Creek. Subsidence during the 3-year period had no effect on baseflows or near- channel landslides.

No major impacts of subsidence to the surface, caused by the underground mining methods proposed during the permit term are anticipated.

The coal seam is approximately 12.5 feet thick with only about 10.5 feet being extracted, and the depth of cover ranges from 0' to approximately 2,300'. The rocks overlaying the coal seam are sandstones and mudstones with some thin bands of coal. Due to the strength of the overburden, and depth of workings, even with full seam extraction, only minimal subsidence, if any, is anticipated.

Some surface expressions of tension cracks, fissures, or sink holes may be experienced but should be insignificant. The chances of subsidence-related damage to any perceived renewable resource is minimal.

All dirt roads above the mine are in areas in excess of 1,000 feet of cover or in areas where mining will not take place. The chance of subsidence negatively effecting these dirt roads is minimal. However, in the unlikely event that cracks, fissures or sink holes are observed as a result of subsidence, the road will remain accessible by regrading and filling in the cracks, fissures or sinkholes.

The unnamed ephemeral channel in the southwest corner of the permit area is located in an area where no mining is planned or over the top of a bleeder system that will not be second mined. The chance of subsidence negatively effecting this ephemeral channel is minimal. However, in the unlikely event that cracks, fissures or sink holes are observed as a result of subsidence the channel will be regraded and the cracks, fissures or sinkholes will be filled in by hand methods due to its inaccessibility.

A small portion of Little Park Wash, which is ephemeral, has less than 1,000 feet of cover in the southwest corner of the permit area. The portion with less than 1,000 feet of cover runs diagonally across one longwall panel and then parallel to the bleeder system in the second longwall panel. In the unlikely event that cracks, fissures or sink holes are observed as a result of subsidence the channel will be regraded and cracks, fissures or sinkholes will be filled in. Since this stream channel is accessible and is traversible by 4 wheel drive, access for repairs would not be a problem. If any subsidence repairs cannot be fixed using hand methods, small earth moving equipment could be used.

DWR and BLM Wildlife Biologists, in consultation with the Division, have determined that any loss of snake dens to subsidence would be random and a minor impact to the population of snakes.

**525.130**

A survey was conducted within the proposed permit area and adjacent area and it was determined that limited renewable resource lands exist within the area

surveyed. Limited areas were found which contribute to the long-range productivity of water supply or fiber products. No structures exist within the permit area in which subsidence, if it occurred, could cause material damage or diminution for reasonably foreseeable use. See Plates 5-5 and 5-3 for areas of potential subsidence. Identification and data for the State appropriated water supplies can be found in chapter 7 section 727.

All State Appropriated water rights within the maximum limit of subsidence that could be affected, are either owned by the Operator or by the BLM. The BLM has been notified of the water rights survey by means of the submittal of the permit application.

According to Mark Page (State Water Rights), there is not a water conversation district associated with Lila Canyon Mine.

#### **525.200. Protected Areas**

- 525.210.** Since there are no public buildings or other facilities such as churches, school or hospitals, and since there are no impoundments with a storage capacity of more than 20 acre-feet, this section does not apply.
- 525.220.** Since R645-301-525.210 does not apply, this section does not apply.
- 525.230.** Since there are no planned operations under urbanized areas, cities, towns, and communities, or adjacent to industrial or commercial buildings, major impoundments, or perennial streams this section does not apply.
- 525.240.** A detailed plan of the underground workings, including maps and descriptions of significant features of the underground mine, including the size, configuration, and approximate location of pillars and entries, extraction ratios, measures taken to prevent or minimize subsidence and related damage, and areas of

full extraction can be found in the R<sup>2</sup>P<sup>2</sup> on file with the BLM local and state offices.

**525.300.** Subsidence control.

**525.310.** Measures to prevent or minimize damage.

**525.311** No attempt will be made to prevent subsidence in any area except where the escarpment near the outcrop is to be protected and to insure that subsidence remains within the permit area. The use of continuous miners in a pillar section as well as longwall technology provides for planning subsidence in a predictable and controlled manner. Some surface expressions of tension cracks, fissures, or sink holes may be experienced but should be insignificant. The chances of subsidence related damage to any perceived renewable resource is minimal. The value and foreseeable use of the surface lands will not be affected by potential subsidence.

**525.312** Since there are no buildings or occupied residential dwellings or structures within the Lila Canyon project area this section does not apply.

**525.313** Room-and-pillar mining in addition to longwall methods will be used at the Lila Canyon Mine.

**525.400.** Since state-appropriated water supplies exist on the surface, 525.400 has been addressed.

**525.410** Coal will be removed using a combination of continuous miner and long wall methods as described in sections 522 and 523. Sequence and timing for the development of underground workings are also discussed in sections 522 and 523.

**525.420** Plate 5-5 shows the underground workings and depicts areas where first mining or partial mining will be utilized to protect the escarpment and raptor nests that may exist on the escarpment, and to insure that subsidence remains within the permit area. State-appropriated water rights are shown on Plates 5-3, 5-5 as well as

normal water monitoring program any cracks observed will be noted and reported to DOGM.

Two areas of the permit have stream reaches with less than 1,000 feet of cover over the coal seam. As discussed in Section 525.120, it is not envisioned that subsidence will negatively impact these areas. However, during and following mining near these areas, special attention will be paid to these areas during the ground surveys.

The ground survey will consist of walking and photographing the various areas of the surface over the mine where subsidence might occur. If evidence of subsidence is identified, the area of subsidence will be surveyed and the extent of the disruption identified. Depending on the extent and location of the damage, mitigation measures will be reviewed and implemented. Due to the fact that mitigation options change with time as new technology and measures are developed, better options may be implemented in the future. However, UEI provides a commitment that where subsidence damage affects uses of the surface, the land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence. The surface effects will be repairs as described in Section 525.500.

**525.450** Subsidence control measures.

- 525.451.** No backstowing or backfilling of voids used as a subsidence control measure is planned at this time. Therefore, this section is not applicable.
- 525.452.** Support pillars as a subsidence control measure is not anticipated at this time. However, an area of partial mining where an unmined coal block will be left for subsidence control is shown on Plate 5-5. First mining indicates an area where a block of coal is roomed leaving pillars for support with no mining of the remaining pillars. Partial mining as shown on Plate 5-5 indicates an area where a block of coal has been isolated

without the rooms being developed. Both first mining and partial mining will leave support that can be used to control subsidence. If the partially mined area shown on Plate 5-5 is ever roomed out, the area now defined as partially mined would become an area defined as being first mined.

- 525.453.** An outcrop barrier of coal will be left to protect the escarpments at the outcrop. As per the R2P2 only first mining will be allowed within 200' of the outcrop. Mains, submains, and ventilation portals will be allowed within the outcrop.
- 525.454** No measures will be taken on the surface to prevent material damage or lessening of the value or reasonable foreseeable use of the surface.
- 525.460.** Anticipated effects of planned subsidence may include tension cracks, fissures, or sink holes. Areas of minimal ground lowering may be anticipated. The chances of subsidence-related damage to any perceived renewable resource is minimal.
- 525.470.** Since no urbanized areas, cities, towns, public buildings, facilities, churches, schools, or hospitals exist within the permit area this section does not apply.
- 525.480.** There are no plans to change or modify the mining plan to protect any springs or seeps. Springs with water rights will be monitored for flow and quality as described in Chapter 7 Section 731.211. UEI has committed to provide for mitigation of any lost water rights as per Chapter 7 Section 727.
- 525.490.** Other information specified by the Division as necessary to demonstrate that the operation will be conducted in accordance with R645-301-525.300 will be provided.
- 525.500.** Repair of damage.
- 525.510.** If effects of subsidence are confirmed, any material damage to the surface lands will be restored to the

extent technologically and economically feasible. The land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence.

**525.520.** Since no structures exist within or adjacent to the permit area which could be damaged by subsidence, should it occur, this section does not apply.

**525.530.** The Little Park Road exists in the subsidence zone. In the unlikely event the road is damaged by subsidence, UEI will repair the damage as per Section 525.120.

**526.** A narrative explaining the construction, modification, use, maintenance and removal of the mine facilities follows. Additional information can be found in Appendix 5-4 and Chapter 8.

**526.100** Mine Structures and Facilities.

**526.110** The only existing structures are found in Horse Canyon (Part "A" of this permit) and are the remains of the United States Steel operation. Horse Canyon has received phase II bond release and the remaining structures have been left in place for future use. Only three existing structures, a 60" and a 48" CMP culverts located near the new proposed surface facilities, and the County road on top of Little Park, can be found within the Lila Canyon Permit. The existing culvert is shown on plate 5-1A. The existing road on Little Park can be found on Plate 5-1 as well as most other plates showing the surface area of the Lila Canyon Permit. Several vehicle ways will be used for water and subsidence monitoring. These ways branch off the Little Park Road and generally follow the ephemeral drainages. The ways are shown on Plate 5-1 as well as most other plates showing the surface area of the Lila Canyon Permit. More detail of the existing Little Park Road can be found in App. 5-4.

**526.111** The location of the existing culverts is shown on Plate 5-1A.

**526.112** Most of the existing 48" culvert is outside the

permit boundary and is the Counties responsibility. UEI will grade the site so that during reclamation and operations surface flows will be directed away from the 48" culvert. The 60" culvert is in poor condition and will be replaced by the county. UEI will add on to the culvert during the operation and reclamation phase. The bottom 30' is the responsibility of the County, the upper portion is the responsibility of UEI.

**526.113** It is believed that the existing culverts were installed with the road construction around 1940.

**526.114** Since the existing culvert is going to be removed upon construction of the sediment pond this section does not apply.

**526.115** Since the existing culvert is going to be removed upon construction of the sediment pond this section does not apply. The County road and the culvert within the disturbed area boundary will be modified or reconstructed by the County.

**526.115.1.** Since the existing culvert is going to be removed upon construction of the sediment pond this section does not apply. See Appendix 5-4 for existing road details.

**526.115.2.** Since the existing culvert is going to be removed upon construction of the sediment pond this section does not apply. See Appendix 5-4 for existing road details.

**526.115.3.** Since the existing culvert is going to be removed upon construction of the sediment pond this section does not apply. See Appendix 5-4 for existing road details.

**526.115.4.** Since the existing culvert is going to be

removed upon construction of the sediment pond this section does not apply. See Appendix 5-4 for existing road details.

**526.116** The only coal mining and reclamation operations that are planned within 100 feet of the County Road are office complex, sediment pond, topsoil pile, and security shack. The permit area adjacent to the county road will be fenced to protect the public from the sediment pond and other mine associated buildings. Other than fencing no additional measures are planned after the construction phase. During construction measures to control traffic on the County Road will be taken to protect the public from construction related hazards.

**526.116.1.** A cooperative agreement with Emery County as stated in Appendix 1-4 requires a six foot chain link fence to be constructed adjacent to the Lila Canyon Road to provide safety to the general public in the proximity to the mine site and mine related structures and activities.

**526.116.2.** At the current time there are no plans to relocate any public road.

**526.200** Utility Installation and Support Facilities.

**526.210** All coal mining and reclamation operations will be conducted in a manner which minimizes damage, destruction, or disruption of services provided by oil, gas, and water wells, oil, gas, and coal-slurry pipelines, railroads, electric and telephone lines, and water and sewage lines which may pass over, under, or through the permit area, unless otherwise approved by the owner of those facilities and the Division. Since no existing services are found within the projected disturbed area, no negative impact to any service is anticipated.

A BLM and State Lands Utility Right-of-Way has been applied for to contain an access road, rail from the existing main line near highway 10, electric power, phone lines, and gas service. This ROW is not included within the MRP and will not fall under the R645 regulations.

**526.220** The new support facilities are described in section 520 and in Appendix 5-4 and shown on plate 5-2 and will be operated in accordance with the mine reclamation plan. Plans and drawings for each support facility to be constructed, used or maintained within the permit area are found in Appendix 5-4, Plates 5-7A, 5-7B, and 5-8.

**526.221** The new facilities designs shown in Appendix 5-4 prevents or controls erosion and siltation, water pollution, and damage to public or private property, and:

**526.222** The new facilities designs shown in Appendix 5-4 minimizes damage to fish, wildlife, and related environmental values; and minimizes additional contributions of suspended solids to stream flow or runoff outside the permit area to the extent possible by using the best technology currently available.

Islands of undisturbed areas within the permit area will be visually monitored for coal fines deposition. If monitoring reveals coal fine deposition, then water sprays on the area from which the fines are originating will be warranted as per August 27, 1999 Approval Order.

**526.300** Water pollution control facilities consist of sedimentation control and properly designed sewage systems.

The sedimentation control is accomplished by containing all disturbed area runoff in a properly sized sedimentation pond. Complete designs are presented in Appendix 7-4 and on Plate 7-6.

The sewage system will consist of a septic tank and drainfield. The system is shown on Plate 5-2. Complete

designs are presented in Appendix 5-4.

The drain field design and layout is shown on plate 5-2b and details are shown in Appendix 5-4.

**526.400** Since Lila Canyon Mine is an underground operation this section does not apply.

**527. Transportation Facilities.**

**527.100** All new roads within the disturbed area have been classified as primary except for the coal pile road which is used infrequently.

**527.110** See Sections 527.120 and 527.130.

**527.120** The Slope Access Road / Portal Access Road and the Mine Facilities Road / Truck Loadout Road will be used frequently for access for a period in excess of six months, and or will transport coal, they are classified as primary roads.

**527.121** See 527.120 above.

**527.122** See 527.120 above.

**527.123** Since none of the new roads planned within the disturbed area will be retained for an approved postmining land use this section does not apply.

**527.130** The Coal Pile Road is used infrequency and will be classified as ancillary.

**527.200** A detailed design and description for each road, and conveyor to be constructed used, and maintained within the proposed permit area is included in Appendix 5-4. The roads are show on Plate 5-2.

**527.210** The specifications for each road width, road gradient, road surface, road cut, fills, embankments culverts, drainage ditches and drainage structures are shown on Plate 5-2 and in Appendixes 5-4 and 7-4.

- 527.220** Since no alteration or relocation of natural drainage ways is anticipated this section is not applicable.
- 527.230** Roads shall be maintained in manner that allows them to meet their design standards throughout their use.
- 527.240** If any of the roads on the disturbed area is damaged by a catastrophic event, the road will be repaired as soon as practical after the damage has occurred.
- 527.250** Steep cut slopes or requests for alternative specifications are not anticipated at this time therefore this section does not apply.

**528. Handling and Disposal of Coal, Overburden, etc:**

A narrative explaining the construction modifications, use, maintenance and removal of coal, overburden, excess spoil and coal mine waste.

- 528.100** Coal will be mined using continuous miners and longwall equipment. The coal will be transported from the face and deposited on the underground mine belts using shuttle cars or continuous haulage equipment. The coal will be transported by a series of conveyor belts from the section to the run of mine stockpile. The coal will be removed from the run of mine stockpile by a reclaim belt to an enclosed crusher. Once crushed the coal will be conveyed to a storage bin from which it will loaded in to coal haul trucks for transportation to a unit train loadout.
- 528.200** Overburden: Lila Canyon is an underground operation and it is not anticipated that any material that overlays the coal seam, consolidated, or unconsolidated, other than topsoil, will be disturbed. Therefore, this section does not apply.
- 528.300** Spoil, coal processing waste, mine development waste, and noncoal waste removal, handling, storage, transportation, and disposal areas and structures are discussed below.
- 528.310** Excess Spoil: Since Lila Canyon is an underground operation it is not anticipated than any spoil will be generated. Therefore this section does not apply.
- 528.320** Coal Mine Waste: Coal processing waste and underground development waste brought to the surface,

will be placed in disposal areas within the permit area which are approved by the Division for this purpose. Rock removed from the access slopes will be placed in the refuse pile area. Portions of this material, not containing coal, will be used as structural fill for the shop/warehouse. The areas for the rock slope material and for underground development waste are adjacent and adjoining and will be treated as one area or structure. The refuse pile is shown on Plate 5-2 and in Appendix 5-7.

- 528.321** Coal processing waste produced from the crusher will not be returned to any abandoned underground workings. Any and all of the coal processing waste from the crusher will be deposited in the refuse pile shown on plate 5-2 and in Appendix 5-7.
- 528.322** Refuse Piles. Each pile will meet the requirements of MSHA, 30 CFR 77.214 and 30 CFR 77.215, meet the design criteria of R645-301-210, R645-301-512.230, R645-301-513.400, R645-301-514.200, R645-301-515.200, R645-301-528.320, R645-301-536 through R645-301-536.200, R645-301-536.500, R645-301-536.900, R645-301-542.730, R645-301-553.250, R645-301-746.100, R645-301-746.200, and any other applicable requirements.
- 528.323** Burning and Burned Waste Utilization.
- 528.323.1.** Coal mine waste fires will be extinguished by the person who conducts coal mining and reclamation operations, in accordance with a plan approved by the Division and MSHA. The plan will contain, at a minimum, provisions to ensure that only those persons authorized by the operator, and who have an understanding of the procedures to be used, will be involved in the extinguishing operations. The coal mine waste fire plan can be found in Appendix 5-3. MSHA approval is not

required unless you have an actively burning fir. (Phone conversation with Billy Owens MSHA Denver 5/31/05)

**528.323.2.** No burning or burned coal mine waste will be removed from the permitted disposal area.

**528.330** Noncoal Mine Waste.

**528.331** Noncoal mine wastes including, but not limited to, grease, lubricants, paints, flammable liquids, garbage, abandoned mining machinery, lumber and other combustible materials generated during mining activities will be placed and stored in a controlled manner in a designated portion of the permit area. The noncoal mine waste will be placed in dumpsters and emptied on a as needed basis. The designated noncoal waste area is shown on Plate 5-2.

**528.332** It is anticipated that final disposal of noncoal mine wastes will be at the ECDC facility near East Carbon City. Concrete will be disposed of in a specified area, refer to Plate 5-6 for this location. The disposal site will be located under the reclaimed coal stockpile. This area will receive the maximum fill during reclamation. Placement of this fill around the concrete will help to eliminate runoff. This will ensure that leachate and drainage does not degrade surface or underground water. The noncoal mine waste will be placed in dumpsters and emptied on a as needed basis.

**528.333** The noncoal mine waste will be disposed of at the ECDC facility near East Carbon City.

**528.334** Notwithstanding any other provision to the R645 Rules, any noncoal mine waste defined as "hazardous" under 3001 of the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580, as amended) and 40 CFR Part 261 will be

handled in accordance with the requirements of Subtitle C of RCRA and any implementing regulations.

**528.340** A description of the disposal methods for placing underground waste and excess spoil generated at surface areas according to R645-301-211, R645-301-212, R645-301-412.300, R645-301-512.210, R645-301-512.220, R645-301-514.100, R645-301-528.310, R645-301-535.100 through R645-301-535.130, R645-301-535.300 through R645-301-535.500, R645-536.300, R645-301-536.600, R645-301-542.720, R645-301-553.240, R645-301-745.100, R645-301-745.300, and R645-301-745.400 is covered in sections 535, and 536.

**528.350** 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 R645-301-528.330, R645-301-537.200, R645-301-542.740, R645-301-553.100 through R645-301-553.600, R645-301-553.900, and R645-301-747 is included.

**528.400** Dams, embankments and other impoundments.  
See Section 700 and Appendix 7-4.

**529. Management of Mine Openings:**

The permit application includes a description of the measures to be used to seal or manage the openings within the proposed permit area. New slope or drift openings required to be sealed shall be sealed with solid, substantial, noncombustible material for a distance of at least 25 feet into such openings. The closure design for portals, slopes, and drifts, can be found in Appendix 5-6.

**529.100** Shafts or other exposed underground opening when no longer in use will be cased, lined, or otherwise managed as approved by the Division. All openings exposed by mining operations within the permit area will be permanently closed unless approved for water monitoring.

**529.200** For the purposes of Underground Coal Mining and Reclamation Activities:

- 529.210** Mine entries which are temporarily inactive, but have a further projected useful service under the approved permit application, will be protected by barricades or other covering devices, fenced, and posted with signs, to prevent access into the entry and to identify the hazardous nature of the opening. These devices will be periodically inspected and maintained in good operating condition by the person who conducts the activity.
- 529.220** Since no portals are projected to return underground development waste, coal processing waste or water to the mine, this section does not apply. There is no current need to return any waste to the underground workings.
- 529.300** Section 529 does not apply to holes drilled and used for blasting.
- 529.400** No openings have been identified for use to return coal processing waste to underground workings. Therefore this section is not applicable.

### **530. Operational Design Criteria and Plans.**

- 531.** General plans for the sediment pond and refuse pile are found within this section.
- 532.** Sediment control measures can be found in Chapter 7.
- 532.100** The smallest practicable area will be disturbed during the life of the project. Progressive backfilling, grading, and prompt revegetation of applicable will be completed as per R645-301-353.200.
- 532.200** Backfilled material will be stabilized to promote a reduction of the rate and volume of runoff in accordance with R645-301-537.200, R645-301-552 through R645-301-553.230, R645-301-553.260 through R645-301-553.420, R645-301-553.600, and R645-301-553.900.
- 533.** Impoundments.
- 533.100** Since no impoundments meeting the criteria of 30 CFR

77.216(a) this section does not apply.

- 533.200** The only impoundment planed for this site is the sediment pond. The sediment pond is a temporary structure. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1 and on Plate 7-6.
- 533.210** The sediment pond will be incised, except for the dam/road embankment. This embankment will be reconstructed and compacted to at least 95%. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1 and on Plate 7-6.
- 533.220** Where fill is to be placed, natural ground shall be removed 12" below the structure. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1 and on Plate 7-6.
- 533.300** Rip-rap or other protection (culverts, concrete) will be placed at all inlets and outlets to prevent scouring. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1. Also see Plate 7-6.
- 533.400** External slopes of the impoundment will be planted with an approved seed mix to help prevent erosion and promote stability. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1 and on Plate 7-6.
- 533.500** This section does not apply, there are no vertical highwalls associated with this impoundment.
- 533.600** Since no impoundments are planned that meet the criteria of MSHA, 30 CFR 77.216(a) this section does not apply.
- 533.700** Design and construction requirements, as well as operation and maintenance requirements are detailed in Appendix 7-4, Section 3.1.

**534. Roads.** The designs for surface roads can be found in Appendix 5-4.

- 534.100** The roads have been designed, located, constructed and will be maintained to:

  - 534.110** The roads have been designed, located, constructed and will be maintained to prevent or control damage to public or private property.
  - 534.120** Nonacid or nontoxic-forming substances will be used in road surfacing.
  - 534.130** The designs for the roads can be found in Appendix 5-4.
  - 534.140** The reclamation plan for the roads can be found in section 542.600.
  - 534.150** The roads have been designed to prevent or control erosion, siltation and air pollution.

- 534.200** Appropriate limits for grade, width, and surface materials have been used in the design of the roads.
- 534.300** Primary Roads. Primary roads will meet the requirements of R645-301-358, R645-301-527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600, R645-301-542.600, and R645-301-762, any necessary design criteria established by the Division, and the following requirements. Primary roads will:
  - 534.310** The roads will be located insofar as practical, on the most stable available surfaces.
  - 534.320** The roads will be surfaced with rock, crushed gravel, asphalt, or other material approved by the Division as being sufficiently durable for the anticipated volume of traffic and the weight and speed of vehicles using the road;
  - 534.330** The roads will be routinely maintained to include repairs to the road surface, blading, filling potholes and adding replacement gravel or asphalt. It will also include

revegetating, brush removal, and minor reconstruction of road segments as necessary.

**534.340**

Culverts if required will be designed, installed, and maintained to sustain the vertical soil pressure, the passive resistance of the foundation, and the weight of vehicles using the road.

**535. Spoil:** It is anticipated that no spoil will be produced at the Lila Canyon Mine therefore this section is not applicable.

**536. Coal Mine Waste:** The proposed Lila Canyon Mine will produce 2 separate types of coal mine waste:

1. Normal coal processing waste or refuse and;
2. Underground development waste.

Disposal of each of the 2 types of coal mine waste will be the same and both type will be deposited in the refuse storage area shown on plate 5-2.

The rock slope material / underground development waste will be examined and tested as necessary to determine acid- or toxic-forming potential.

Coal Processing waste and any underground development waste containing too much coal to leave underground, will be disposed of in the refuse storage area as described further in this chapter and in Appendix 5-7.

It is not anticipated that any underground waste other than the rock slope material / underground development waste will be brought to the surface. Coal processing waste and underground development waste brought to the surface will be placed in a controlled manner and have a design certifications describe under R645-301-512 if appropriate.

**536.100**

The refuse pile has been designed using current prudent engineering practices and will meet design criteria established by the Division. See Appendix 5-7.

- 536.110** The refuse pile will be designed to attain a minimum long-term slope stability safety factor of 1.5. See Appendix 5-7.
- 536.120** The refuse pile will be constructed on natural ground once the topsoil has been removed according to section 230.232. There are no underground mine workings in the immediate area of the refuse pile. All mine workings are found at a higher elevation than the refuse pile.
- 536.200** Underground development waste brought to the surface and coal processing waste deposited in the refuse pile will be deposited according to the plan described in Appendix 5-7.
- 536.210** Refuse Pile construction described in Appendix 5-7, will ensure mass stability and prevent mass movement during and after construction;
- 536.220** Refuse Pile construction per the plan in Appendix 5-7 will not create a public hazard; and
- 536.230** Will prevent combustion.
- 536.300** Since no spoil fills will be generated this section does not apply.
- 536.400** Since there will not be any impounding structures constructed of coal mine waste this section does not apply.
- 536.500** As discussed in Section 536 and 536.300, it is proposed to dispose of the rock slope material / underground development waste within the refuse disposal area as structural fill as shown on Plate 5-2.
- 536.510** It is not anticipated that coal mine waste will be disposed of in any area off the permit area. Therefore this section does not apply.
- 536.520** It is not anticipated that coal mine waste will be disposed of in any area off the permit area. Therefore this section does not apply.
- 536.600** In areas where slope rock or coal processing waste is deposited, the topsoil will be removed and stored in the topsoil

stockpile area until reclamation.

- 536.700** It is not anticipated that coal processing waste will be returned to abandoned underground workings therefore this section does not apply
- 536.800** Since no coal processing waste banks, dams, or embankments are planned for the Lila Canyon Mine therefore, this section does not apply.
- 536.900** Refuse Piles. (See Appendix 5-7) The refuse pile is designed to meet the requirements of R645-301-210, R645-301-512.230, R645-301-513.400, R645-301-514.200, R645-301-515.200, R645-301-528.322, R645-301-528.320, R645-301-536 through R645-301-536.200, R645-301-536.500, R645-301-536.900, R645-301-542.730, R645-301-553.250, R645-301-746.100 through R645-301-746.200, and the requirements of MSHA, 30 CFR 77.214 and 30 CFR 77.215.

**537. Regraded Slopes.**

- 537.100** Each application will contain a report of appropriate geotechnical analysis, where approval of the Division is required for alternative specifications or for steep cut slopes under R645-301-358, R645-301-512.250, R645-301-527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-534.300, R645-301-542.600, R645-301-742.410, R645-301-742.420, R645-301-752.200, and R645-301-762.

**540. Reclamation Plan. (See Appendix 5-8 for reclamation plan.)**

**541. General.**

- 541.100.** The operator is committed to performing all reclamation as in accordance with R645 rules.
- 541.200.** N/A. The operator is not involved in surface mining activities.
- 541.300.** The operator is committed to the removal of all equipment facilities and structures upon cessation of mining activities.

**541.400.** The operator will address all reclamation activities as referenced in Chapter 5 of this document.

**542 Narratives, Maps and Plans.**

**542.100.** See Table 3-3 time table based on project reserves markets and life of mine.

**542.200.** The perimeter of the disturbed area contains approximately 42.6 surface acres within the disturbed area but only 25.3 acres will be disturbed leaving 17.3 acres of undisturbed islands within the disturbed area. The following R645 regulations will give detailed description and reclamation procedures to address these areas of disturbance. The reclamation plan for the sediment pond and drainage control structures can be found in Appendix 7-4.

Topsoil amounts can be found in Section 232.100 and are calculated from Plate 203. Concrete amounts can be calculated from the text in Section 520. Coal Mine Waste volumes can be found in Appendix 5-7. Volumes were calculated using a Cad system.

**542.300.** Included.

**542.310.** Included. (See Plates 5-6 & 7-7)

**542.320.** There will not be any surface facilities left post mining.

**542.400.** Not applicable. No surface facilities will remain post bond liability period.

**542.500.** A reclamation time table is included as Table 3-3.

**542.600.** All roads within the disturbed area will be reclaimed immediately after they are no longer needed for mining and reclamation operations.

- 542.610.** The time table of reclamation activities will enable the roads to be removed concurrently with reclamation activities. So, no closures specific to traffic would be anticipated.
- 542.620.** All bridges and culverts will be removed concurrent with reclamation.
- 542.630.** All disturbed areas will be ripped and top soiled prior to revegetation activities in compliance with all applicable R645 regulations. (See Appendix 5-8)
- 542.640.** Road surfacing materials such as sand and gravel, which are not suitable for revegetation establishment will be buried on site and covered with a minimum of two feet of material that would support vegetation. Concrete will be disposed of in the designated area and covered with four feet of cover. Asphalt will be disposed of off site, either in a landfill or sent to a recycling facility.
- 542.700.** Final Abandonment of Mine Openings and Disposal Areas.
- 542.710.** Appendix 5-6 depicts a typical seal that will be constructed at all mine openings.
- 542.720.** No excess spoil is anticipated at this time.
- 542.730.** All coal mine waste will be placed in the waste disposal area as shown on Plate 5-2 and reclaimed in accordance with R645 regulations.
- 542.740.** Disposal of Noncoal Mine Wastes.
- 542.741.** All non coal waste will be temporarily stored on site in approved waste bins and commercially picked up and transported to an approved disposal site. Non Coal waste generated during reclamation (such as concrete structure, buried culverts, utility

lines, septic systems etc.) will be buried in the refuse disposal area and covered with a minimum of four feet of fill.

**542.742.** No noncoal waste will be stored on site or disposed of on site during the life of the mine.

**542.800.** A detailed cost break down is included in Chapter 8. Appendix 8-1 relative to bonding.

**550 Reclamation Design Criteria and Plans.** Each permit application will include site specific plans that incorporate the following design criteria for reclamation activities.

**551.** All underground openings will be sealed as detailed in Appendix 5-6.

**552.** Permanent Features.

**552.100.** In course of reclamation, areas that have been recontoured and top soiled will be "pock-marked" creating small basins that will facilitate vegetation establishment as well as minimizing erosion.

**552.200.** No permanent impoundments will be left post reclamation.

**553.** The operator will comply with all regulations applicable to underground mining activities relative to backfilling and grading as required by R645 regulations.

Some minor cut slopes along the reclaimed road may be left after reclamation due to the difficulty and inability to reclaim all material pushed over the side while making the road cut. See plate 5-7B-1 cross section 16+00 for details. UEI will make reasonable efforts to minimize the cut slopes being left.

**553.100.** Disturbed Areas. Disturbed areas will be backfilled and graded to:

**553.110** The operator will obtain a post mining topography

similar in form as what existed premining.

- 553.120** Since Lila Canyon is an underground operation, no spoil piles will be created. Minor highwalls may be created with the development of the rock slope portals. Upon completion of mining these entries will be seal as per Closure for Mine Openings Appendix 5-6 and all highwalls will be eliminated during the reclamation phase of the operation. Plate 5-9 shows the proposed portal plan. During reclamation, suitable material will be placed against the portals. This material will be shaped to eliminate the highwall and to bring the slope back to the approximate original contour. A Cat model 216/226 or equivalent will be used to complete the final grading of the fan portal. After final grading the 216/226 will be airlifted out using a KMAX helicopter or equivalent.
- 553.130** All fill slope will have a static safety factor of 1.3 as shown in Appendix 5-5.
- 553.140** Erosion and water pollution will be minimized on site by the use of drainage control structures (burms, channels and silt fence) and the use of small depression, soil tackifiers, mulch and sediment pond design. No water is anticipated leaving the reclaimed site prior to adequate treatment in the form of retention and/or filtration that does not meet and/or exceed UPDES standards.
- 553.150** The post mining land use of wildlife and domestic grazing should be enhanced to some degree with the revegetation of a more desirable seed mix and a vegetative cover in excess of what was present premining.
- 553.200** Spoil and Waste.
- 553.210** All underground development waste brought to the surface and coal processing waste generated on

the surface as a result of coal processing will be placed in the coal mine waste (refuse) disposal area and reclaimed in accordance with R645 regulations.

**553.220** Since no spoil will be produced this section does not apply.

**553.221** All vegetation and /or organic material will be removed prior to any coal mine waste being stored.

**553.222** All useable topsoil or topsoil substitute will be removed from the structural fill and refuse areas prior to use. Table 2-1 shows estimates of salvageable soil by soil type based on current NRCS soil inventories. The location of the soil storage are shown on Plate 5-2. This material will be spread over the recontoured structural fill and refuse areas prior to seeding and mulching.

**553.223** Since no spoil will be produced this section does not apply.

**553.230** All recontoured areas will be compacted to minimize slippage. The area will then be over laid with topsoil and ripped. In addition the area will be "pock-marked" to minimize the potential for erosion as well as enhance revegetation establishment. It is not anticipated that soil will be disturbed in areas to steep for equipment to operate.

**553.240** The refuse and structural fill areas will have slopes of less than 8% upon final recontouring and revegetated to enhance the post mining land use of grazing and wildlife habitat.

**553.250** The refuse pile design is shown in appendix 5-7.

**553.260** The operator will commit to all applicable R645 regulations relative to disposal of coal processing

waste.

**553.300** Any combustible materials or acid and toxic forming materials exposed used or produced during mining will be disposed of in the refuse disposal area and treated as refuse. This material will be covered by four feet of fill. Noncoal waste will be disposed of as described in Section 528.331.

**553.400** Cut-and-fill terraces may be allowed by the Division

**553.410** No cut and fill terraces will be required.

**553.420** No terraces will be required for post mining land use.

**553.500-540 and 553.600-553.650.500**

The only area that falls under these provisions are the reclaimed Horse Canyon mine which lies in the north west portion of the lease area and is addressed under approved MRP Act #0013 (Part "A").

**553.700-553.900**

This operation will only involve underground mining and as such the above referenced regulations do not apply.

**560.** Performance Standards. Coal mining and reclamation operations will be conducted in accordance with the approved permit and requirements of R645-301-510 through R645-301-553.

# Table of Contents

700. HYDROLOGY .....	Page -1-
710. Introduction .....	Page -1-
711. General Requirements .....	Page -1-
712. Certification .....	Page -1-
713. Inspection .....	Page -1-
720. Environmental Description .....	Page -2-
721. General Requirements .....	Page -2-
722. Cross Sections and Maps .....	Page -3-
723. Sampling and Analysis .....	Page -4-
724. Baseline Information .....	Page -4-
725. Baseline Cumulative Impact Area Information .....	Page -39-
726. Modeling .....	Page -39A-
727. Alternate Water Source Information .....	Page -40-
728. Probable Hydrologic Consequences (PHC) Determination .....	Page -44-
729. Cumulative Hydrologic Impact Assessment (CHIA) .....	Page -46-
730. Operation Plan .....	Page -46-
731. General Requirements .....	Page -46-
732. Sediment Control Measures .....	Page -66-
733. Impoundments .....	Page -68-
734. Discharge Structure .....	Page -69-
735. Disposal of Excess Spoil .....	Page -70-
736. Coal Mine Waste .....	Page -70-
737. Noncoal Mine Waste .....	Page -70-
738. Temporary Casing and Sealing of Wells .....	Page -70-
740. Design Criteria and Plans .....	Page -70-
741. General Requirements .....	Page -70-
742. Sediment Control Measures .....	Page -70-
743. Impoundments .....	Page -77-
744. Discharge Structures .....	Page -79-
745. Disposal of Excess Spoil .....	Page -79-
746. Coal Mine Waste .....	Page -79-
747. Disposal of Noncoal Waste .....	Page -81-
748. Casing and Sealing of Wells .....	Page -81-
750. Performance Standards .....	Page -81-
751. Water Quality .....	Page -81-
752. Sediment Control Measures .....	Page -81-
753. Impoundments and Discharge Structures .....	Page -82-
754. Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste .....	Page -82-
755. Casing and Sealing of Wells .....	Page -82-
760. Reclamation .....	Page -82-
761. General Requirements .....	Page -82-
762. Roads .....	Page -83-

763. Siltation Structures .....	Page -83-
764. Structure Removal .....	Page -83-
765. Permanent Casing and Sealing of Wells .....	Page -83-

### List of Appendices

Appendix 7-1	Baseline Monitoring
Appendix 7-2	Water Monitoring Data (Horse Canyon)
Appendix 7-3	Probable Hydrologic Consequences
Appendix 7-4	Sedimentation and Drainage Control Plan
Appendix 7-5	U.P.D.E.S. Permits
Appendix 7-6	Seep/Spring Inventory
Appendix 7-7	Surface Water Characterizations
Appendix 7-8	Monitoring Location Descriptions
Appendix 7-9	Right Fork of Lila Canyon Flow and Geomorphic Evaluation
Appendix 7-10	Peak Flow Calculations
Appendix 7-11	Pump Information

### List of Plates

Plate 7-1	Permit Area Hydrology
Plate 7-1A	Permit Area Hydrology (Geologic Map)
Plate 7-1-B	Hydro-Geologic Cross Section
Plate 7-2	Disturbed Area Hydrology & Water Shed Map
Plate 7-3	Water Rights
Plate 7-4	Water Monitoring Locations
Plate 7-5	Proposed Sediment Control
Plate 7-6	Proposed Sediment Pond
Plate 7-7	Post Mining Hydrology

### List of Figures

Figure 7-1	Stratigraphic Section	End of Chapter
Figure 7-2A	Water Level Map - Spring and Fall 2002	End of Chapter
Figure 7-2B	Seasonal Water Level Fluctuations in Piezometers	End of Chapter

### List of Tables

Table 7-1	1985 Spring & Seep Survey Results	Page 9
Table 7-1A	Peak Flow Simulations of Undisturbed Drainages in the Lila Canyon Mine Area	Page 25
Table 7-1B	Period of Record Monthly Climate Summary	Page 36
Table 7-2	Water Rights	Page 38
Table 7-3	Water Monitoring Stations	Page 55
Table 7-4	Surface Water Monitoring Parameters	Page 57
Table 7-5	Ground Water Monitoring Parameters	Page 58

water level is probably representative of the level of water collected in the rest of the mine. Therefore, to be conservative, it is assumed that the Geneva exploration entries driven south from the Horse Canyon Mine into the proposed Lila Canyon mining area do contain water since the tunnels elevation is approximately 5855 feet.

The Horse Canyon Mine has been closed and the surface area reclaimed. With no significant inflow to the old workings, no discharges are occurring from any of the portal areas nor are expected in the future. It is known however, that water has collected in the old entries. As future mining activities, for the proposed Lila Canyon Mine, will be occurring near this area of collected water in the old exploration entry workings, it is likely that some of this water will be intercepted by the proposed Lila Canyon Mine (see Plate 7-1). Water may then have to be pumped from the mine. Because of undulating floor and unknown void areas, it is impossible to determine the amount of water that would be pumped. The rate of pumping, if any, would be determined by the water discharge system design. All water discharged from the mine would be discharged at UPDES Site # 002A which is Site L-5-G, and will meet all UPDES standards. DOGM has specified planning to include a mine discharge of 500 gpm maximum.

An inspection of the Horse Canyon area following mining has shown no diminution of reasonably foreseeable use of aquifers. Since mining ceased in 1983, subsidence should have occurred within two years. However, no deterioration of the aquifers in the area was identified. Mining has not yet begun on the Lila Canyon site; however, since the structure and groundwater regime is similar to the Horse Canyon area, no diminution or deterioration of groundwater resources is expected in this area.

As the mining in the Lila Canyon Mine will be from the same seam and the adjacent strata are the same and the over and underburden are the same, occurrences of ground water in the Lila Canyon Mine are expected to be similar to the Geneva Mine (Horse Canyon). The water quality is expected to be the same as the water encounter in the Horse Canyon Mine. Samples taken underground from the Horse Canyon Mine (MRP part "A" Appendix VI-1) to the north of the Lila Canyon Mine and from well S-32 (MRP part "B" Appendix 7-1) by Kaiser to the south of the Lila Canyon Mine show the water from the level of the coal seam to be a calcium, sodium-sulfate type water. Therefore, it is likely that the water from the strata between these two points from the same strata will be very similar.

Inflows of water encountered while mining are expected to reduce to seeps or dry up in a short period of time. If a significant water inflow is

encountered, the water, which is not needed for underground operations, will be collected, treated as necessary, and pumped to the surface for discharge under the terms of the UPDES permit.

Groundwater Systems. In the Lila Canyon Lease area, the groundwater regime consists of two separate and distinct multilayered zones. The upper zone consists of the Wasatch Group which consists of the Colton Formation, the undifferentiated Flagstaff Limestone-North Horn Formation, and the Price River Formation. These formations contain groundwater in perched aquifers. These perched zones are classified as aquifers because they supply groundwater in sufficient quantities for a specific use (as specified by R645-100-200). The lower zone consists of the Blackhawk Formation (where the coal seams are located). This formation consist of low-permeable strata which contain groundwater in isolated saturated zones. Based on the definition in the State coal mine regulations (R645-100-200), there is no aquifer in the lower saturated zone, because the water is not developed for a specific use nor does the strata transmit sufficient water to supply water sources. Additionally, there is no discharge from this zone along any fault or fracture or in any adjacent canyons. The two zones are separated by the Castlegate Sandstone. This zone is a porous, fairly clean sandstone. According to Fisher, et.al. (1960), the Castlegate Sandstone does not have any shales, clays, siltstones, or mudstones. The lower zone is underlain by the Mancos Shale, a very impermeable marine shale.

Geologic conditions in the permit and adjacent areas are described in detail in Chapter 6 of this P.A.P. Though discussed in several publications for the general Book Cliffs area, formal aquifer names have not been applied to any groundwater system in the permit and adjacent areas because the geometry, continuity, boundary conditions, and flow paths of the groundwater systems in the area differ somewhat from the general published discussions. However, the data do suggest that groundwater systems in each of the bedrock groups are sufficiently different from each other to justify the informal designation of groundwater systems based on bedrock lithology. Thus, the informal designation of the Upper zone - Colton, Flagstaff/North Horn, and Price River and the Lower zone - Castlegate, Blackhawk, and Mancos groundwater systems is adopted herein.

The majority of groundwater in the permit and adjacent areas generally occurs within perched aquifers in the upper zone overlying the coal-bearing Blackhawk Formation. In the lower zone groundwater occurs in isolated saturated zones in the Blackhawk Formation. Hydrogeologic conditions within the permit and adjacent areas are summarized below:

### Upper Groundwater Zone

Colton Formation. The Colton Formation outcrops in the northeast portion of the permit and adjacent areas. This formation consists predominantly of fine-grained calcareous sandstone with occasional basal beds of conglomerates and interbeds of mudstone and siltstone. Data presented in Plates 7-1 and 7-1A and Appendices 7-1 and 7-6 indicate that 16 springs issue from the Colton Formation within the permit and adjacent areas.

Waddell et al. (1986) evaluated the discharge of springs in the formation for the period of June to September 1980. The measured discharge rate generally declined during the 4-month period of evaluation. This suggests that the groundwater system has a good hydraulic connection with surface recharge and that most of the annual recharge quickly drains out of the system.

Groundwater issuing from the Colton Formation has a total dissolved solids ("TDS") concentration of 300 to 600 mg/l (as measured by specific conductance and laboratory analyses of TDS). The pH of this water is slightly alkaline (7.5 to 8.1). Insufficient data are available to describe seasonal variations in these parameters.

The water is a calcium-magnesium-bicarbonate type (see Appendix 7-1). The data also indicated total iron concentrations of <0.04 to 4.89 mg/l. Total manganese concentrations ranged from <0.01 to 1.29 mg/l.

Undifferentiated Flagstaff-North Horn Formation. The Flagstaff-North Horn Formation outcrops across much of the northern and central portion of the permit area. This formation consists of an interbedded sequence of sandstone, mudstone, marlstone, and limestone. Most springs and a major portion of the volume of groundwater discharging from the permit and adjacent areas issue from the Flagstaff-North Horn Formation. According to Plates 7-1 and 7-1A and Appendices 7-1 and 7-6, 36 springs issue from the Flagstaff-North Horn Formation within the permit and adjacent areas.

Groundwater discharge rates for springs issuing from the Flagstaff-North Horn Formation are greatly influenced by seasonal variations in precipitation and snowmelt, with most discharge corresponding to the melting of the winter snow pack during the spring months. Discharge is highest following the spring snowmelt and decreases to a trickle by the fall (Appendices 7-1 and 7-6). Many springs issuing from the Flagstaff-North Horn Formation have been noted to dry up each year.

### Recharge and Discharge Relations

Recharge in the permit and adjacent areas occurs from precipitation to the exposed strata. Plate 7-1a shows the major zone of recharge. This recharge area corresponds to the outcrop and exposure of the Colton/Flagstaff-North Horn Formations. No perennial surface water streams or surface water bodies exist within the permit or adjacent areas which contribute water to the groundwater systems. The majority of infiltration is a near surface occurrence into the alluvial fills within the drainages. The deeper sediments underlying the drainages (Blackhawk and Mancos) consist of low transmissivity strata which would prohibit the vertical movement of groundwater.

Recharge rates were calculated by Waddell and others (1986, p. 43) for an area in the Book Cliffs. Waddell estimated recharge at about 9 percent of annual precipitation. Lines and others (1984) indicate the mean annual precipitation along the Book Cliffs in the area of the Horse Canyon Mines is about 12 inches, indicating a recharge rate of just over 1 inch per year.

The recharge and discharge areas for local perched aquifers in the upper zone (Colton, Flagstaff-North Horn and Price River Formations) generally lie within the drainage areas of Horse and Lila Canyons. These local systems are complex and highly dependent on topography. Recharge water from precipitation or snowmelt enters the Colton or Flagstaff-North Horn Formations and moves downward until it encounters low permeability shale or claystone layers in the formations, where almost all of the water is forced to flow horizontally to springs. The springs exhibits substantial variability in discharge in response both to spring snowmelt events and to drought and wet years. Discharge rates as great as 20 gpm have been recorded from the springs during the high-flow season, and discharge rates as low as 1 gpm are not uncommon during late summer. The effects of the drought occurring in the late 1980s and early 1990s are clearly evident in the flow records.

Recharge to the lower zone including the Castlegate Sandstone, Blackhawk Formation, and Mancos Shale is of limited magnitude, due to the limited area of exposure of the formations to steep outcrops and the presence of low-permeability units in overlying North Horn and Price River Formations. Additionally, the clay layers in the upper Blackhawk, which contain approximately 80 percent clays, siltstones, mudstones, and shales, are all highly restrictive to vertical groundwater movement (Fisher and others, 1960). Further, no surface water bodies are present to act a supply sources to the deep ground water system.

Recharge to the lower zone probably occurs primarily from vertical movement of water through the overlying formations and is probably greatest

Surface waters in this part of the Book Cliffs drain to the Price River. The Price River flows to the Green River which, in turn, flows to the Colorado River. It is anticipated that only during extremely long duration, high-intensity thunderstorms that flow from the ephemeral drainages within the permit area would reach the Price River. Due to the length of channel and the limited volume of runoff, the majority of flow is lost to channel losses, as indicated in Appendix 7-9.

Lines and Plantz (1981, p. 33) conducted three seepage surveys of Horse Canyon Creek in 1978 and 1979. The results of the surveys show no consistent trends through time. Mine discharges created difficulties in interpretation of the data because there was no indication of whether the mine was or was not discharging water at the time of the surveys. However, Horse Canyon Creek below the mine is a losing stream, due to the visual observation of low flows decreasing downstream of the mine (professional observations, Thomas Suchoski, 1979-1980 & 1984-86). Flow in the channel adjacent to the mine facility entry portal on several occasions during mine inspections during the spring period were approximately 4 to 6 inches deep, with a flow width of 15 to 20 feet. Downstream of the mine in the area of the roadside refuse pile, the flow would be 2 to 3 inches deep with a flow width of 10 to 12 feet. Channel slopes in both areas were similar. No diversions are present along this reach of the channel to reduce the flow. Therefore, the channel flow decrease is the result of infiltration and evaporation of the water within the channel.

The Lila Canyon drainage is normally dry, flowing only in response to precipitation runoff or rapid snowmelt. The mine facilities will be located in the Right Fork of Lila Canyon.

In January 2004, an assessment of the geomorphic character of the Lila Canyon channel, downstream of the proposed mine site, was conducted to address DOGM comments. A series of channel cross-section measurements were taken and the bed and bank materials visually observed. During this evaluation, it was discovered that a diversion structure had been installed just above the confluence of the Right Fork of Lila Canyon and Grassy Wash (see Appendix 7-9 and Figure 7-3). This diversion structure will divert all flow from the drainage and convey it by diversion channel to a stock pond located in the SW/4, SW/4 of Section 28, T. 16 S., R. 14 E. Subsequently, it was determined that the improvements were part of a BLM range improvement project. This structure has significantly modified the drainage pattern for this area. Flows that previously would have flowed into Grassy Wash will now be detained in the stock pond.

The closest perennial stream to the permit area is Range Creek. The drainage is located approximately 6 miles east of the proposed Lila Canyon permit area boundary (see Plate 7-1a).

Range Creek is in a broad, south-southeast oriented drainage that has been eroded into the Roan Cliffs. A western extension of the Roan Cliffs (Patmos Ridge) lies between Range Creek and the Book Cliffs. The proposed Lila Canyon operation is on the west side of Patmos Ridge. The Colton Formation is exposed at the surface from Patmos Ridge east to the main body of the Roan Cliffs, and between these two escarpments Range Creek has eroded into but not through the Colton Formation. Approximately eleven miles southeast of the permit area, just upstream of Turtle Canyon, Range Creek has eroded through the Colton, Flagstaff, and North Horn Formations, but it reaches the Green River without having eroded through the Upper Price River Formation. The nearest Blackhawk outcrop is 10 miles further south, along the Price River.

Argument has been made that Range Creek receives recharge from a regional aquifer which is likely from the lower saturated zone that the Lila Canyon Mine will be mining or that the overlying perched upper zone might be drained by the mining activities and affect the flows contributing to and in Range Creek.

To address these concerns, the following issues were evaluated. An evaluation of the elevation difference between the saturated ground-water zone in the Blackhawk Formation and stream flows in the Range Creek drainage was conducted, especially for the reaches nearest the permit area. Also, the thickness and composition of the strata between the coal seam and the creek was conducted. Further, the potential for diminishment of spring and tributary flows to the Range Creek drainage resulting from subsidence impacts within the recharge area to the overlying strata was evaluated.

If the deeper ground water in the Blackhawk Formation were to flow following either the gradient indicated by the piezometers (see Figure 7-1) or geologic dip (see Plate 7-1B), the water would flow well below Range Creek (800 to 1,200 feet) in the reaches nearest the Lila Canyon Mine and for many miles downstream.

Additionally, the thick section of strata between Range Creek and the Blackhawk Formation would impede hydraulic interaction between any deep ground water and the surface (Plates 7-1A and 7-1B). It is estimated that the vertical separation between the Blackhawk and Range Creek at the base of the Colton would be about 1,200 feet.

Based on the stratigraphic column in the area, the overall percentage of less permeable strata is 47 percent. Looking at the distribution of the less permeable strata, the majority is in the upper lithographic units. The Colton and North Horn-Flagstaff contain about 1940 feet of less permeable units, while the Price River and Blackhawk contain about 480 feet. Therefore, there is little potential for water to move vertically between the upper and lower zones. The main direction of water movement will be horizontally within the strata.

Further, the elevation of Range Creek in the area of concern ranges from 6890 to 5740 feet (see Plate 7-1A). The coal seam exposure along the Book Cliffs ranges from 5,500 to 6,000 feet. Therefore, for water to flow from the coal seam to Range Creek the flow would need to overcome a hydraulic head difference of 200 plus feet, just based on the initial elevation and not accounting for dip of the formations. There is insufficient head and no source of water to provide the driving head for such conditions.

In regard to subsidence affecting the potential recharge to the springs and tributaries to Range Creek, as described in Chapter 5, Section 525, the subsidence limits from the proposed mining are required to be limited to the area of the permit boundary. Therefore, the recharge area to Range Creek that the mine might affect is limited to that portion of the recharge area within the permit boundary.

To determine the recharge area to Range Creek, a review of the relationship of the proposed permit area, location of Range Creek and the geology in the area, as shown on Plate 7-1A, in the reach nearest to the proposed mine, was conducted. As is evident on Plate 7-1A, the Little Park drainage has eroded through the Colton and North Horn Formations and into the Price River Formation, while the Range Creek drainage has not eroded through the Colton Formation. Based on this and the previous discussion of the high percentage of low permeable strata within the Lower Colton and North Horn-Flagstaff formations, there is limited potential for recharge to the springs and tributaries from areas below the bottom of the Colton Formation. Figure 7-3 presents a representation of the likely characterization of the method of recharge to these springs. The potential impact area from the mine is, therefore, that portion of the permit area that is east of the Horse Canyon and Little Park drainages which is above the Colton - North Horn-Flagstaff contact within the area of maximum subsidence.

Based on a projection of the direction of dip (N68°E), the recharge area of the Range Creek drainage that might be affected by the mine would be from just

north of Little Horse Canyon south to Cherry Meadow Canyon. Figure 7-4 presents a localized view of this area with recharge potential along the west side of the Range Creek drainage. The total recharge area to this portion of the Range Creek drainage is approximately 18,150 acres.

Based on a review of Figure 7-4, the portion of the permit boundary that meets the potential impact area criteria is approximately 183 acres. Therefore, the percentage of the recharge area that might be intercepted by catastrophic subsidence is 1.0 percent. As catastrophic subsidence is unlikely due to the cover over the coal seam for most of this area (2,000ft +) (see Figure 7-4), this percentage is conservatively high. Such a small percentage would not be measurable within the Range Creek drainage.

If such an occurrence were to happen, based on the hydraulic conductivity (0.1gpd/ft<sup>2</sup>) and porosity (0.25) of the formation and the anticipated gradient (0.1ft/ft), the average linear velocity of flow through the formation would be about 0.006ft/day. This results in an estimated duration, for the reduced recharge to move laterally through the Colton Formation and reach the Range Creek drainage, to be about 8,700 to 11,300 years.

As a result of the five to six miles horizontal distance from proposed permit area to Range Creek (see Plate 7-1a) and the isolating effects of the over 1,000 feet of low-permeability, isolating strata between the coal seam and the creek elevation (see Plate 7-1B and Table above) and the limited potential and impact of subsidence damage to the recharge area, it is not likely that the Lila Canyon Mine will adversely effect Range Creek. Due to these conditions, no baseline or other sampling has been gathered nor is anticipated on Range Creek.

Additional concerns have been raised regarding the potential impact that water extracted from the Blackhawk Formation as a result of the mining activities would have on the downstream drainages, specifically the Price and Green Rivers. Initial evaluation indicates that the distance within the Blackhawk Formation between the mine and the Price River is over 12 miles. This distance alone would preclude any significant impact.

As further evidence, as discussed in Appendix 7-3, it is difficult to determine the amount of water that will be extracted by the mining activities. For design purposes, DOGM has required that a value of 500 gpm be used. This is thought to be very conservative. If this volume were extracted, the yearly total would be about 800 ac-ft per year. As there are no significant springs that discharge from the Blackhawk Formation, the loss of this flow would be minimal. Also, as discussed in Appendix 7-3, the addition or loss of this flow would result in a

0.9% flow change to the Price River and a 0.02% flow change to the Green River. In both cases, this flow change would be less than could be measured by standard methods.

The Horse Canyon drainage is monitored in accordance with the approved monitoring plan for the permit. There have been no samples taken in the Lila Canyon or Little Park Wash drainages because no flow has been observed during the monitoring activities. Factors that contribute to the lack of data are: accessibility to the sites during the winter period and immediately after summer rain storm events is generally not possible, due to safety issues and a physical lack of flow.

**Access and Safety.** Safety issues have hampered field work on several projects in the area. When the soils in the area get wet they become very slick and pose access and safety issues. During the IPA drilling, EarthFax had significant difficulty in getting equipment and vehicles up and down the access road following several small rain storms. In one case, they had one of their vehicles slide into the embankment rocks along the Horse Canyon access road (drop in the area was about 400 feet).

Access during rainstorms through the channels in the area is dangerous. During the avian study for the Westridge mine, Mel Coonrod (EIS) and Frank Howe (DWR) were caught in a channel during a rainstorm and lost their vehicle to flooding. This occurred on Nine Mile Creek at the dry canyon crossing in March or April of 2000. Conditions in this drainages are similar to drainages within the Lila Canyon Permit Area.

During winter and early spring periods, there have been times when the access road has been blocked with several feet of snow making access with the field equipment impossible.

UAE's position is that collection of environmental data is not worth of the loss of life or limb. Therefore, when the conditions are unsafe, the site is labeled inaccessible. At all other times, the sites are visited and if no flow is encountered it is reported as such.

**Physical Lack of Flow.** The lack of flow data in the sampling effort is not a failure of the sampling effort. The lack of flow at these sample sites is data which documents the normal conditions in the site area. If the streams were flowing 50 percent of the time, it is likely that the sampling efforts would encounter flow on an infrequent basis. However, if the flow for the short return periods is extremely small or none existence, it will be difficult to obtain and

provide samples of these events. This lack of flow shows that the drainages do not have a base flow component and there is no regional aquifer discharging to the deeply incised canyons and drainages in the area. The sequence of sampling efforts have demonstrated further, that there are no long-term flow events occurring in the mine permit area or adjacent areas. Also, spring photographs show disturbances in the stream channels from the previous fall period sampling efforts, indicating that for some years no flow occurred from the fall to spring measurement events. Additionally, the peak flow simulation results show that for small return periods, 2 to 5 year events, runoff flows are not expected and that the duration of any flow events would be of extremely limited duration.

Therefore, a pattern has been identified of a set of drainages that only flow in direct response to precipitation or rapid snow melt. The flow events are localized, sporadic events with no consistent sequence and timing and are extremely limited in duration.

U.S. Steel conducted water quality monitoring of the Horse Canyon drainage. These monitoring efforts were conducted prior to the development of DOGM's present Water Monitoring Guidelines, and as a result the data is quite limited. The most recent results of these water monitoring efforts are presented in Appendix 7-2 and historic results are included in the DOGM electronic database.

The data collected from Horse Canyon follows the same pattern documented by Waddell, et.al. (1986). The pattern shows that the TDS concentrations for surface waters on the lower Blackhawk and out onto the Mancos Shale range from 1000 mg/l and increase to 2,000 to 2,500 mg/l. Additionally, the highest concentrations of suspended sediment will occur during high-intensity runoff from thunderstorms, and the lowest concentrations will occur during low flow or snow melt events.

Therefore, because of the similarity of the water quality data, the water quality expected from the drainages in the area of the proposed mine will be similar to the water quality found in the Horse Canyon drainage.

Monitoring efforts did not include remote or automatic sampling efforts because of inherent problems attempting to implement these methods for this application. It has been suggested that crest-staff gauges, single-stage samplers, ISCO instruments, etc. could be used to collect samples. These are methods that the USGS uses for developed remote sampling sites. However, none of the UEI sampling sites are developed. In the case of crest gauges, for these methods

to be reliable and feasible, the sites need to be developed with concrete or bedrock lined channel sections. For the channel configurations at the UEI sites, the channel bottoms generally consist of movable beds. These are channels that change configuration from storm to storm. As a result of channel erosion and deposition, the stage discharge relationship of the channel changes with each storm event. Therefore, while the crest gauge would indicate that a flow event may have occurred, the ability to determine what the flow rate was is greatly compromised. To be able to overcome this, it would be necessary to construct lined channel sections in remote channel areas. In some cases, this would require the construction of access ways and cement trucks to haul in the materials necessary. This would likely cause more damage than it is worth.

Single stage and automatic samplers have problems with holding time on many water samples being exceeded and routine clogging of the inlets to the sample bottles or equipment. Holding time exceedence would occur when a storm event occurred immediately after a sampling event and a sample was collected. As discussed in the section on RF sampling, the difficulties with telemetry in the canyons and remote areas generally preclude its use in these conditions. As a result, the sample would remain in an unpreserved and unrefrigerated state for the duration of the period until the site was next visited. In the hot summer conditions, common in the area, the water quality of unpreserved and unrefrigerated samples would not be representative of the water in the drainage during the flow event. Changes to water quality parameters would be expected with changes in temperature of the sample, concentration due to evaporation of the sample, and extended contact of the water with the sediment collected in the sample bottle. Therefore, the water quality data would not be usable for determining the baseline or impact conditions.

Maintenance problems have been common problems with the use of remote samplers. Generally, these samplers work fairly well in perennial sampling environments. However, in ephemeral environments where the flows tend to be "flashy" - short duration events which carry a heavy sediment and debris load, these samplers encounter significant problems.

Several samplers were installed as apart of the Westridge Mine sampling efforts. After several abortive attempts at utilizing them for flow and quality measurements, they were removed because the data was unreliable and suspect.

Radio Frequency telemetry (RF) sensing equipment has also been considered. However, as most of the monitoring sensors require line of sight and these sites

are in remote, incised canyons or drainages, that was not considered a viable option.

As a result of these difficulties, it was determined that these methods would not provide any better data than was already being collected. The concerns with what conclusions erroneous or questionable data would generate versus limited good data lead to the decision that these methods would not be used.

**724.300 Geologic Information** Detailed geologic information of the permit and adjacent areas is included in Section 600, with specific strata analyses, as required, in Section 624.

**724.310 Probable Hydrologic Consequences.** The geologic data indicate that no toxic- or acid-forming materials are known to exist in the coal or rock strata immediately below or above the seam (see Section 624.300). The probable hydrologic consequences of the proposed operation will be discussed in Section 728 and Appendix 7-3 of this application.

**724.320 Feasibility of Reclamation.** The geologic data in Section 600 provides sufficient detail to allow: the evaluation of whether toxic- or acid-forming materials are expected to be encountered in mining; subsidence impacts; whether surface disturbed areas are designed to be constructed in a manner that will allow for reclamation to approximate original contour; and whether the operation plans have been design to ensure that material damage to the hydrologic balance does not occur outside of the permit area. These issues are evaluated in the R645 rules and discussed in Section 728 of this application.

#### **724.400 Climatological Information**

##### **724.410 Climatological Factors**

**724.411 Precipitation** The closest weather recording station to the Lila Canyon Mine is located at Sunnyside, Utah. Based on the relatively close proximity and similar locations (west exposure of the Book Cliffs) the data from this station will be used to verify precipitation amounts and other weather conditions for the Lila Canyon Mine.

Precipitation data from the Sunnyside station has been gathered from 1971 to 2000, showing an average annual precipitation of 14.74 inches.

The information was downloaded from the Western Regional Climate Center, as shown on Table 7-1B.

A rain gauge will be installed at the site, once construction and operations start, to comply with the reporting requirements of the air quality permit.

**724.412 Winds.** The average direction of the prevailing winds is West to East, and the average velocity is 2.74 knots.

**724.413 Temperature.** Mean temperatures in the proposed mine area range from a high of 58.0 degrees F to a low of 33.4 degrees F. See Table 7-1B.

**724.420 Additional Data.** Additional data will be supplied if requested by the Division to ensure compliance with the requirements of R645-301 and R645-302.

**724.500 Supplemental Information** N/A - The determination of the PHC in Section 728 does not indicate that adverse impacts on or off the proposed permit area may occur to the hydrologic balance, or that acid-forming or toxic-forming material is present that may result in the contamination of ground-water or surface-water supplies.

**724.700 Valley/Stream** N/A - The proposed plan does not include mining or reclamation operations within a valley holding a stream or in a location where the permit area or adjacent area includes a stream which meets the requirements of R645-302-320.

## **725. Baseline Cumulative Impact Area Information**

**725.100 Hydrologic and Geologic Information** Hydrologic and geologic information for the mine area is provided in Sections 600, 724 and in the PHC Determination in Appendix 7-3. This information includes the available information gathered by the applicant. Additional information is available for the areas adjacent to the proposed mining and adjacent areas from state and federal agencies.

**Table 7-1B**

Sunnyside, Utah (428474) Period of Record Monthly Climate Summary
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Period of Record: 1971 - 2000													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Average Max. Temp(F)	33.7	38.4	44.1	54.0	63.5	76.2	82.4	80.3	71.3	58.3	42.8	34.9	56.8
Average Min. Temp(F)	13.9	17.5	21.8	30.0	38.3	47.2	53.6	52.2	44.7	34.6	22.8	15.3	32.8
Average Total Precip (in.)	0.80	1.01	1.30	1.22	1.22	0.85	1.46	1.50	1.80	1.67	1.14	0.78	14.74

Unofficial values based on averages/sums of smoothed daily data, Information is computed from available daily data during the 1971-2000 period. Smoothing, missing data and observation-time changes may cause these 1971-2000 values to differ from official NCDC values. This table is presented for use at locations that don't have official NCDC data. No adjustments are made for missing data or time of observation. Check NCDC normals table for official data.

**725.200 Other Data Sources** As indicated above, additional information is available for the cumulative impact area. In addition to the base line data for the proposed mining, additional pertinent hydrologic data is available from adjacent mines and permits and government reports.

**725.300 Available Data** Necessary hydrologic and geologic information is assumed to be available to the Division in this P.A.P.

**726. Modeling** Where ever possible actual surface and ground water information is supplied in this application. However, the following models were used to supplement the data.

Storm 6.2, a program to calculate runoff flows was used to calculate runoff from some disturbed area drainage areas.

Hydroflow Hydrograph program by Intelisolve was used to simulate the runoff and routing from the undisturbed drainages above the proposed mine.

A simulation of transmission losses to determine potential impacts from mine water discharge to the Price River and fishery was completed using a spreadsheet based on the NRCS channel loss evaluation.

**727. Alternate Water Source Information** A search was conducted of the State of Utah Water Rights files for all rights occurring within, and adjacent to, the permit area for a distance of one mile. The location of those rights are shown on Plate 7-3. A description of each of the rights is tabulated in Table 7-2.

Any State-Appropriated water supply that may be damaged by mining operations will either be repaired or replaced. As soon as practical, after proof of damage by mining in Lila Canyon, of any State-Appropriated water supply, UEI will replace the water. Water replacement may include sealing surface fractures, piping, trucking water, transferring water rights, or construction of wells. The preferable method of replacement will be sealing of surface fractures effecting the water supply. As a last resort UEI will replace the water by transferring water rights or construction of wells.

As noted in the table, the majority of rights are owned by UEI for industrial use. Other rights owned by the B.L.M. or individuals are primarily for stockwatering.

holes and other geologic data, appear to be nearly static at elevation 5990 in this area (see Figure 7-1).

Water level in the mine would have to raise approximately 310' to reach the rock slope/coal seam contact and result in a gravity discharge. Water monitoring results and other historical data in the area do not indicate this is likely to occur.

**731.522 Surface Entries after January 21, 1981** This is not known to be an acid-producing or iron-producing coal seam; however, proposed portals are located to prevent gravity discharge from the mine (see Section 731.521).

**731.600 Buffer Zones** All streams within the permit area are either ephemeral or intermittent by rule with ephemeral flow. As such, buffer zones are not required; however, to provide additional protection, the Operator will install stream buffer zone signs in locations shown on Plate 5-2 and maintain the buffer zones during the operation.

**731.700 Cross Sections and Maps** The following is a list of cross-sections and maps provided in this section of the P.A.P.

Plate 7-1	Permit Area Hydrology Map
Plate 7-2	Disturbed Area Hydrology/Watershed
Plate 7-3	Water Rights Locations
Plate 7-4	Water Monitoring Location Map
Plate 7-5	Proposed Sediment Control Map
Plate 7-6	Proposed Sediment Pond
Plate 7-7	Post-Mining Hydrology

All required maps and cross-sections have been prepared by, or under the supervision of, and certified by a Registered Professional Engineer, State of Utah.

**731.710 General Area Hydrology** Plate 7-1.

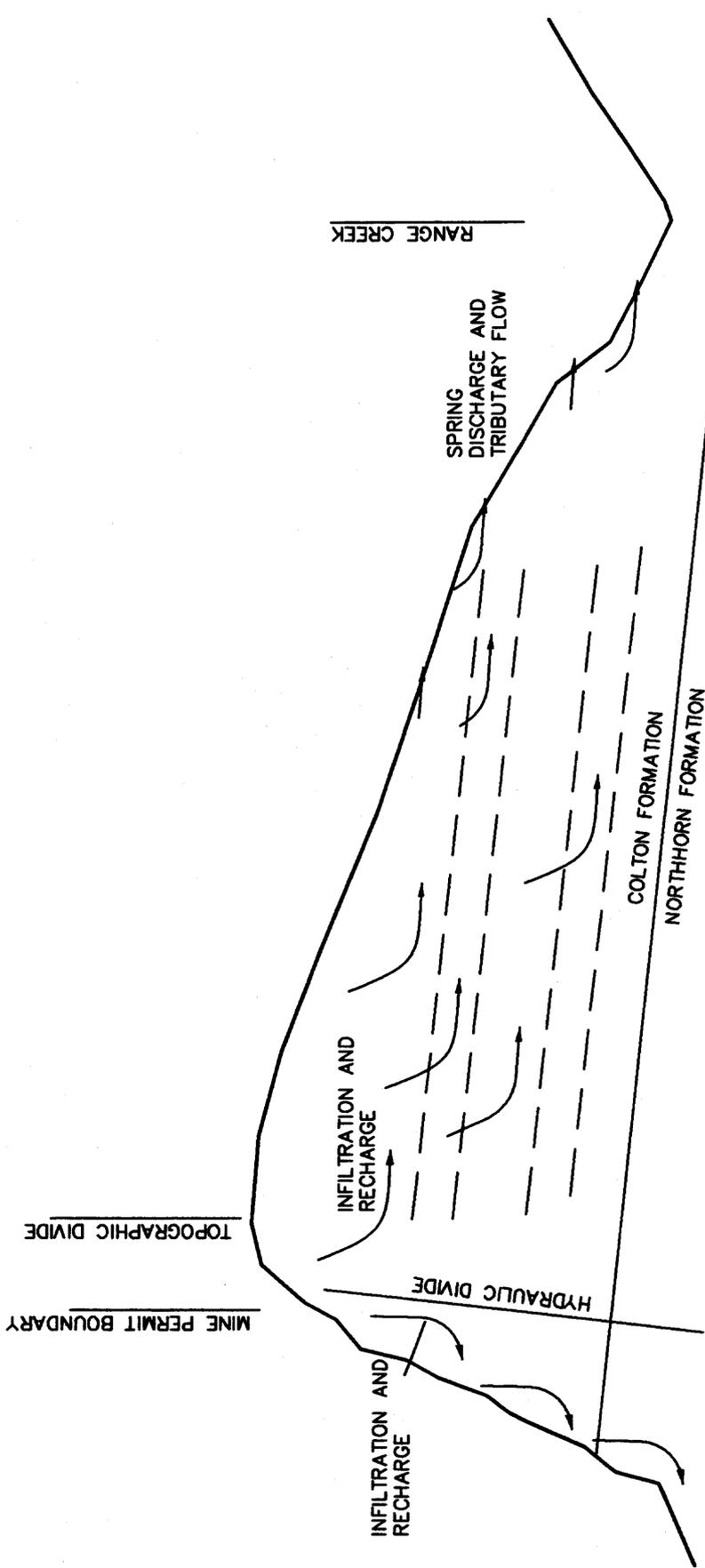


FIGURE 7-3. SPRING AND TRIBUTARY RECHARGE SCHEMATIC

**Appendix 7-3**

**Probable Hydrologic  
Consequences Determination**

Updated January 2006



decrease in head will have the direct effect of decreasing the inflow rate into the mine. Additionally, the volume of water required to "fill the mine" would also have to fill the strata above the mine, which has been dewatered throughout the history of the mine.

Based on these factors it is unlikely that the groundwater level in the lower groundwater zone will ever rise to the level of the portal, at any portal location for either the Horse Canyon or Lila Canyon Mines. Hence, there should be no natural discharge of groundwater through any of the sealed portals. To verify this, stand pipes will be incorporated into the grading plans for the portals so that water levels can be checked annually.

**Groundwater and Surface Water Availability.** Potential impacts to the availability of surface and groundwater from the Lila Canyon Mine operations include both decreased and increased stream flows and spring discharges caused by mine-related subsidence, bedrock fracturing, and aquifer dewatering. These potential impacts are discussed below.

#### Potential for Decreased Spring and Stream Flows

To date, while surface subsidence has been identified as a result of coal mining in the nearby Horse Canyon Mine, no impact or disruption of spring and seep of stream flows have been identified. Bedrock fracturing routinely occurs, depending on the overburden thickness, in the rock units overlying mined coal seams. Given the limited number of springs and limited groundwater resources of the Castlegate Sandstone and Blackhawk Formations in the permit and adjacent areas, subsidence or fracturing would affect the hydrologic balance in the area only if zones of increased vertical hydraulic conductivity were created which extended through the Price River Formation into the North Horn-Flagstaff and Colton Formations.

When subsidence occurs as a result of mining, there are four zones that occur above the mined out area. As shown in Figure 1, the zones are: a caved zone that occurs in the 6 to 10 times the thickness of the coal seam, a fractured zone which occurs 10 to 30 times the thickness of the coal seam, and deformation zone which occurs 30 to 60 times the thickness of the coal seam, and finally, a soil zone which occurs on the ground surface. Damage to surface and groundwater resources generally occur in the caved and fractured zones. Little or no damage occurs in the deformed zone. With only localized effects felt in the soil zone. As discussed in Section 525.120, the strains for the rock in the

proposed mine area, as a result of mining, should limit subsidence deformation to those areas where the overburden is less than 630 feet.

Where surface disruption or cracks appear, the general mechanism is extension of the soil mantle. Natural processes will heal these crack over time. Runoff and snowmelt will wash sediments into the crack and fill any voids created. As this process progresses, the crack disappear and the surface runoff and snowmelt return to normal courses. In the Wasatch Plateau and Book Cliffs area, the clays in the area are expansive and tend to seal these cracks very rapidly. Sidel, et.al. (1996) found that minor surface changes in the area of Burnout Creek recovered within two years.

As indicated in Figure 7-4 of the PAP, the majority of the identified springs and seeps are located outside of the maximum limits of subsidence. Therefore, the potential impact is significantly reduced.

Several lines of evidence suggest that mining-related subsidence and bedrock fracturing have not resulted in decreased stream flows or groundwater discharge in the vicinity of the nearby Horse Canyon Mine. Although considerable seasonal and climatic variability are noted in the hydrographs of springs in the permit and adjacent areas, data for both Horse Canyon Creek and springs which overlie the Horse Canyon Mine workings do not show discharge declines which may be attributed to either subsidence or bedrock fracturing (see Appendices 7-1 and 7-6).

Active groundwater systems in the Colton, Flagstaff-North Horn, and Price River Formations are separated from the Blackhawk Formation by the Castlegate Sandstone. As discussed in Section 724.100, this formation contains no springs and is not considered to be a major groundwater resource. Past mining in the Horse Canyon Mine has not increased the rate of spring discharge from the Price River Formation, indicating that groundwater is not being diverted into this formation. The absence of increased saturation in the Price River Formation indicates that vertical zones of artificially-increased hydraulic conductivity or secondary porosity do not extend into the Price River Formation and from thence into the overlying active groundwater systems of the North Horn-Flagstaff Formations.

Data presented in Appendices 7-1 and 7-6 and summarized in Section 724.100 indicate that the low-permeability lower groundwater system, in the vicinity of mined coal seams, contains groundwater which is compartmentalized both vertically and horizontally. Coal mining locally dewateres isolated, overlying

saturated rock layers in the Blackhawk Formation but does not appear to draw significant additional recharge from overlying or underlying zones.

Additionally, the springs which supply most of the local flow discharge from the Flagstaff-North Horn or Colton Formations. These formations or aquifer are perched from the underlying lower groundwater zone and the intervening formations contains swelling clays which tend to heal small fractures. Also, since the perched aquifer materials are isolated and lenticular, there is a greater probability that fractures in one area will not drain all the different perched aquifers because they are not interconnected.

The very low permeability and vertical gradients in Blackhawk Formation rock layers underlying actively mined coal seams in the Horse Canyon Mine and the absence of significant discharge into the mine from these layers indicates that mining does not draw groundwater from the underling portions of the Blackhawk and Mancos Shale. Additionally, the distinctive solute composition of Mancos Shale groundwater has not been observed inside the Horse Canyon Mine indicating that the saturated zones in the Blackhawk and Mancos are separate.

From the above discussion, it appears that the Horse Canyon Mine has not decreased groundwater discharge in overlying or underlying groundwater systems. Hence, it is unlikely that coal mining will effect the discharges of any spring as a result of mining in the Lila Canyon permit and adjacent areas.

As discussed in Section 724.200, as a result of the five to six miles horizontal distance from proposed permit area to Range Creek (see Plate 7-1a) and the isolating effects of the over 1,000 feet of low-permeability, isolating strata between the coal seam and the creek elevation (see Plate 7-1B and Table above) and the limited potential and impact of subsidence damage to the recharge area, it is not likely that the Lila Canyon Mine will adversely effect Range Creek. Due to these conditions, no baseline or other sampling has been gathered nor is anticipated on Range Creek. For the above reasons Lila Canyon extension does not present any Probable Hydrologic Consequences to Range Creek.

The contamination, diminution, or interruption of any water resources would not likely occur within the mine permit or adjacent areas. Since surface water flows only a limited part of year and will be provided protection by use of sediment controls, the major usable water resources that could potentially be effected in the area would be springs that are currently in use by wildlife and livestock. Most of these springs are located upstream of the permit area or are in areas where subsidence resulting from post-1977 mining is not documented or expected. To

date no known depletion of flow and quality of surveyed springs in the Horse Canyon permit area exists, and none are expected in the Lila Canyon area, based on available data from the Horse Canyon Mine. Although pre-mining data is not available for Horse Canyon, depletion problems from subsidence are not known to have been filed and are not indicated by sampling results in Appendices 7-1 and 7-2. Therefore, it is unlikely an alternative water supply will be needed, although they have been identified in Section R645-301-727.

L-16-G and L-17-G are seeps being monitored in Stinky Spring Canyon. Bighorn sheep have been observed within the canyon but have never been observed drinking the water.

Flows from these springs are historically less than 0.5 gpm and show a general seasonal decrease throughout the season. These sites were not identified during baseline surveys and are believed to exist intermittently and are not always evident. The low flow rates and intermittent nature of these springs suggest that they are local in nature.

These springs are located within the Central Graben, which is a block that has been downdropped between 145 and 250 feet relative to the adjacent bedrock. They occur near the contact between the Mancos Shale and the overlying Blackhawk Formation. The fractured nature of the bedrock along the edges of the Central Graben, as a result of the faulting, likely are the limits of the areal extent of the recharge or source area to the springs. The low-permeability of the surrounding Mancos Shale likely isolate the graben block from groundwater in the surrounding bedrock. Thus, the recharge to the springs is likely limited to the area of the consolidated graben block.

As indicated previously, there is no evidence that mining in the Horse Canyon Mine had any influence on the underlying formations. Therefore it is likely that the Lila Canyon Mine would have similar affects. Due to the springs location and lateral separation from the mine, outside the permit area, outside the limit of subsidence, being separated from the mine block by faulting within the Central Graben, and being 500 to 600 feet below the coal seam, there is no potential for Lila Canyon Mine to negatively impact this spring or recharge sources.

#### Potential for Increased Stream Flows

If sufficient water is encountered in the Lila Canyon Mine workings to require discharge of that water to the surface, the flow of the Right fork of Lila Canyon will be increased. This flow would be ultimately to the Price and Green Rivers.

The impact of such discharge by the development of the Lila canyon extension would be quite limited.

The majority of water discharged from the mine would be water held in storage in the saturated zones above the coal seam. It is unlikely that any water below the coal seam would be affected or drained by the mine workings.

It is difficult to estimate the maximum potential discharge from the mine, however, DOGM has determined that a maximum discharge rate of 500 gpm should be used for design purposes. Based on this discharge, during the life of the operation the water extracted would be 22,600 ac-ft of water. This would be approximately 800 ac-ft per year. Discharge for the Price River at Woodside has a mean annual flow of 88,000 ac-ft/yr. Discharge for the Green River at Green River has a mean annual flow of 4,484,000 ac-ft/yr. Therefore the average discharge at 500 gpm from the mine would be 0.9% of the Price River flow volume and 0.02% of the Green River flow volume. Given the standard fluctuations in the stream flows, this small flow addition would have little effect on the streams.

It should be emphasized that the 500 gpm estimate is considered to be conservatively high. The adjacent Horse Canyon Mine had a maximum discharge of 90 gpm. While the Soldier Canyon Mine farther to the north in the Book Cliffs, the rate of water discharged was estimated to be 15,000,000 gallons per year (approximately 30 gpm).

If water does need to be discharged, it will be sampled and discharged in accordance with the approved UPDES Discharge Permit. If the quality parameters of the mine water do not meet UPDES standards, the water will be treated prior to discharge. Treatment may include holding/settling in the mine, pumping to retaining or sediment ponds, chemical treatment or other approved means to prevent non-compliant discharge.

Based on the results of the evaluation presented in Appendix 7-9, the discharge of this amount of water from the mine is not expected to have a significant impact on the downstream resources. Based on the results from Appendix 7-9, the mine discharge flow will be lost due to transmission losses and percolation within 3.4 miles from the discharge point. Therefore, the discharge will not reach the Price, Green, or Colorado Rivers. The discharge of the water will have a positive impact on the vegetation and wildlife of the area by providing a fairly constant supply of water along this limited reach of the channel.

Based on comparison of upstream and downstream data gathered on Horse Canyon Creek which incorporates the analysis from past mine discharges to the channel, water quality will not be drastically affected in the intermittent drainage in the event of discharge of mine water into the channel. The expected impacts to the channels of the Lila Canyon area are very likely to be similar to those at Horse Canyon due to the close proximity, and similarities of mining and drainage conditions.

**Potential Hydrocarbon Contamination.** Diesel fuel, oils, greases, and other hydrocarbon products will be stored and used at the site for a variety of purposes. Diesel and oil stored in above-ground tanks at the mine surface facilities may spill onto the ground during filling of the storage tank, leakage of the storage tank, or filling of vehicle tanks. Similarly, greases and other oils may be spilled during use in surface and underground operations.

The probable future extent of the contamination caused by diesel and oil spillage is expected to be small for three reasons. First, because the tanks will be located above ground, leakage from the tanks will be readily detected and repaired. Second, spillage during filling of the storage or vehicle tanks will be minimized to avoid loss of an economically valuable product. Finally, the Spill Prevention Control and Countermeasure Plan which will be developed for the site will provide inspection, training, and operation measures to minimize the extent of contamination resulting from the use of hydrocarbons at the site. This plan is not required to be submitted. However, a copy will be maintained at the mine site as required by the Utah Division of Water Quality.

**Road Salting.** No salting of roads will occur within the permit area. Hence, this impact is not a significant concern.

**Coal Haulage.** Coal will be hauled over the county road from the mine portal area to Utah Highway 6 and thence to its ultimate destination. In the event of an accident which causes coal to spill from the trucks, residual coal following cleanup of the spill may wash into local streams during a runoff event. Possible impacts to the surface water are increased total suspended solids concentrations and turbidity from the fine coal particulates. The probability of a spill occurring in an area sufficiently close to a stream channel to introduce coal to the stream bed is considered small.

In addition to spills, wind may carry coal dust or small pieces of coal from the open top of the coal trucks into drainages near the roads. The impact from

fugitive coal dust is considered to be insignificant due to the small amounts lost during haulage in the permit and adjacent areas.

**Water Consumption.** The USFWS have identified that water consumption by underground coal mining operations could jeopardize the continued existence of and/or adversely modify the critical habitat of the Colorado River endangered fish species: Colorado pikeminnow, humpback chub, bonytailed chub, and razor back sucker. The USFWS has determined that water consumption by underground operations could potentially have adverse effects on the Colorado River basin. The USFWS considers consumption to include: evaporation from ventilation, coal preparation, sediment pond evaporation, subsidence on springs, alluvial aquifer abstractions into mines, postmining inflow to workings, coal moisture loss, and direct diversions. These consumption process are discussed below.

Bath House/Office

It has been estimated that the Bath House/Office will consume approximately 35 gallon per day per person for shower and human consumption. This estimate results in a usage of 1,260,000 gal/yr or 3.86 ac.ft.yr.

Evaporation from Ventilation - evaporation rates have been estimated at 2.5 gallons per million cubic feet of ventilated air. This number is dependent on temperature and relative humidity. It is estimated that with the projected usage of 473,040 million cf/yr of air and a loss of 2.5 gallons per million c.f. Therefore, the water consumption for evaporation would be approximately 1,183,600 gallons per year or 3.63 acre feet of water.

Coal Preparation - The operator does not anticipate any coal preparation that would result in water usage.

Sediment Pond Evaporation - The sediment pond is used to hold rain and snow runoff that flows over disturbed areas of the coal mining and reclamation operations until accumulated sediment has dropped out. At that point the water is discharged into a receiving stream. The holding time for this water is planned to be short, therefore, no significant evaporation loss is expected. This would not be considered a consumption mechanism.

Subsidence on Springs - As shown in Appendix 7-8 and discussed in Section 525.120 of the application, the majority of springs cannot be adversely effected by subsidence because of their physical location (off the permit area and outside the area of potential subsidence) or for those within the permit area because of the amount of cover, 1000 feet or more, which as discussed in Section 525.120

are not expected to experience any significant deformation for covers over 450 feet. In the adjacent Horse Canyon mine, which was mined for over 45 years, there have been no reported effects on springs due to subsidence.

Alluvial Aquifer Abstractions into Mines - There will be no water infiltrations from alluvial systems into the mine.

Postmining Inflow to Workings - Postmining all openings will be sealed and backfilled. The proposed mine openings for Lila Canyon are at an elevation where no surface inflow is possible. This coupled with the sealing plan for the portals makes postmining inflows virtually impossible.

Coal Moisture Loss - It has been estimated that coal moisture loss or usage to be estimated at 4.5 gallons per ton of coal mined (see Table 2). Using the estimated usage for mining with an estimated production of 4.5 Million tons per year a usage of 20,250,000 gal per year or 62.12 acre feet can be estimated. It should be noted that due to the extremely low hydraulic conductivity rates measured in the general area, that groundwater movement is very slow. Using the average hydraulic conductivity measured for Blackhawk Sandstone ( $3.0 \times 10^{-6}$  cm/sec) (see Table 1) which is equal to .1 inch per day. Therefore, water encountered underground would take approximately 1,736 years to travel one mile. This water is considered relatively immobile. The water encountered and used underground would not reach the Colorado Drainage in any reasonable time, if ever, and thus water consumed underground cannot negatively effect the Colorado River Basin.

Surface Dust Suppression It has been estimated that usage on the surface for dust suppression will be approximately 10,000 gallon per day or 3,650,000 gallons per year. This results in a usage of 11.20 acre feet per year.

Direct Diversions - no consumption.

Adding the four losses due to mining equals to 80.81 acre feet which is below the mitigation level of 100 acre feet. UEI does hold 362.76 acre feet of underground water rights to offset any consumption. Therefore, it is the opinion of UtahAmerican Energy, Inc. that water consumption by underground coal mining operation will NOT jeopardize the existence of or adversely modify the critical habitat of the Colorado River endangered fish species.

## Conclusion

Based on available data and expected mining conditions, the proposed mining and reclamation activity is not expected to proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial, wildlife or other legitimate purpose.

It should be noted that the determination of no known depletion of flow or quality is based on available data, which is primarily post-mining.

<b>Table 2</b> <b>Projected Water Usage (Quantitative Water Consumption Impact Assessment)</b>	
1- Bath House/Office a. 150 @ 35 gpd/ea. = 5250 x 240	1,260,000 gal./yr.
2- Mining(Coal moisture loss) a. 2 Sections (1) 4.5 M Ton @ 4.5 gal./ton	20,250,000 gal./yr.
3- Fan (Evaporation from ventilation) a. Evaporation (1) 900,000 cfm @ 473,040 M cf/yr. (2) 2.5 gal./M c.f.	1,183,600gal./yr.
4. Surface Dust Suppression 10,000 gallon per day	3,650,000 gal/yr.
<b>Total Usage</b>	<b>26,343,600 gal./yr.</b> <b>(80.81 ac.ft./yr.)</b>

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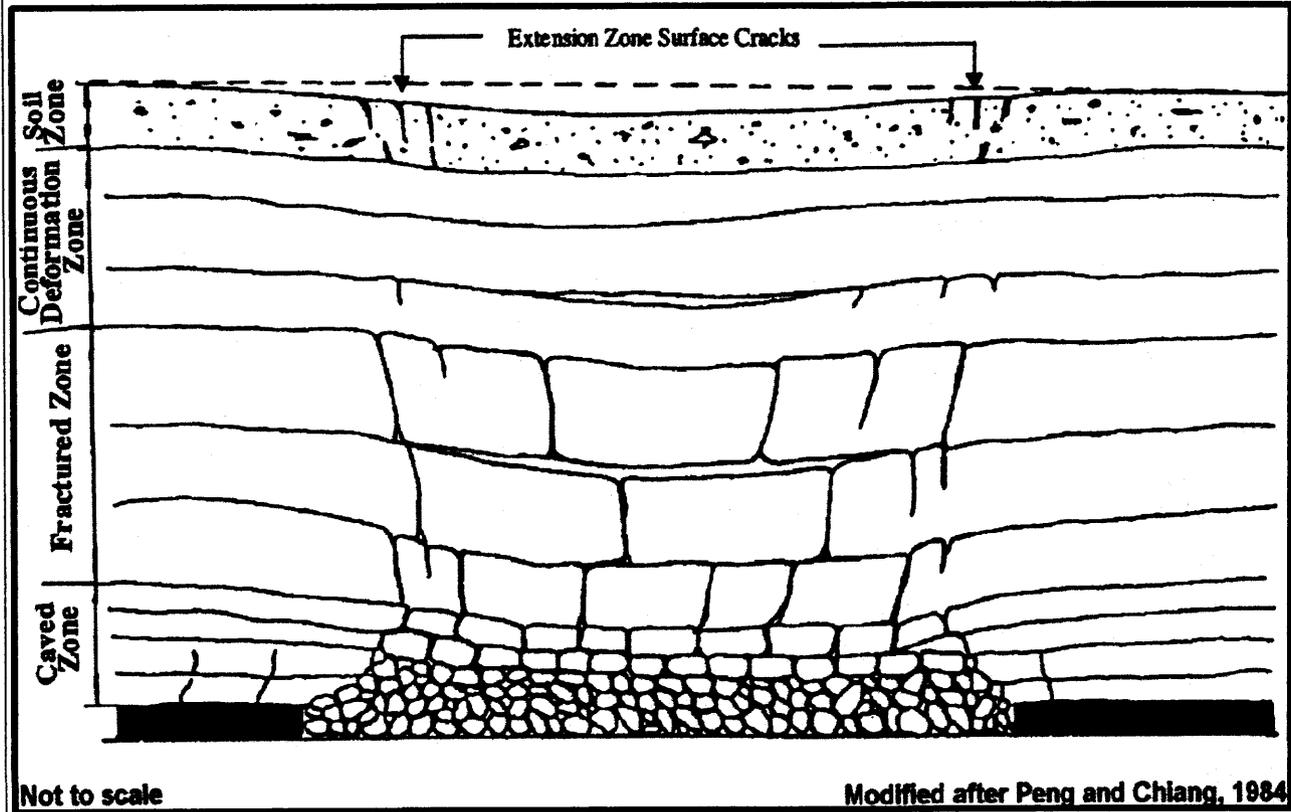
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Table 1						
HYDRAULIC PROPERTIES of STRATA in the WASATCH and BOOK CLIFFS COAL FIELDS, UTAH						
SOURCE		FORMATION				
		Price River	Castlegate	Blackhawk	Star Point	
Soldier Cyn Mine	SC-11G			$2 \times 10^{-7}$ cm/sec*		
	SC-12G			$1.5 \times 10^{-3}$ cm/sec		
	SC-13G			$10^{-6}$ cm/sec		
USGS (Wadde II, 1986)	G95.5	$7.5 \times 10^{-4}$ cm <sup>2</sup> /sec**				
	G93.5		$2.1 \times 10^{-4}$ cm <sup>2</sup> /sec			
	G100.4		$3.2 \times 10^{-5}$ cm <sup>2</sup> /sec			
USGS (Lines, 1985)	(D-17-6) 27bda-1 Horizontal			$5.3 \times 10^{-8}$ cm/sec (ss)		
				$3.3 \times 10^{-11}$ cm/sec(silt)		
				$3.9 \times 10^{-8}$ cm/sec (ss)		
				$3.9 \times 10^{-12}$ cm/sec(shale)		
				$7.0 \times 10^{-11}$ cm/sec(silt)		
					$1.1 \times 10^{-3}$ cm/sec(ss)	
	(D-17-6) 27bda-1 Vertical				$5.3 \times 10^{-8}$ cm/sec(ss)	
					$1.3 \times 10^{-8}$ cm/sec (ss)	
					$4.2 \times 10^{-11}$ cm/sec(silt)	
					$1.4 \times 10^{-8}$ cm/sec (ss)	
					not measured	
					$7.8 \times 10^{-10}$ cm/sec(silt)	
						$3.9 \times 10^{-8}$ cm/sec(ss)
				$2.3 \times 10^{-6}$ cm/sec(ss)		

\* cm/sec = hydraulic conductivity  
 \*\* cm<sup>2</sup>/sec = transmissivity



0' NTS



FIGURE 1. SUBSIDENCE PROFILE

## L-16-G Little Stink

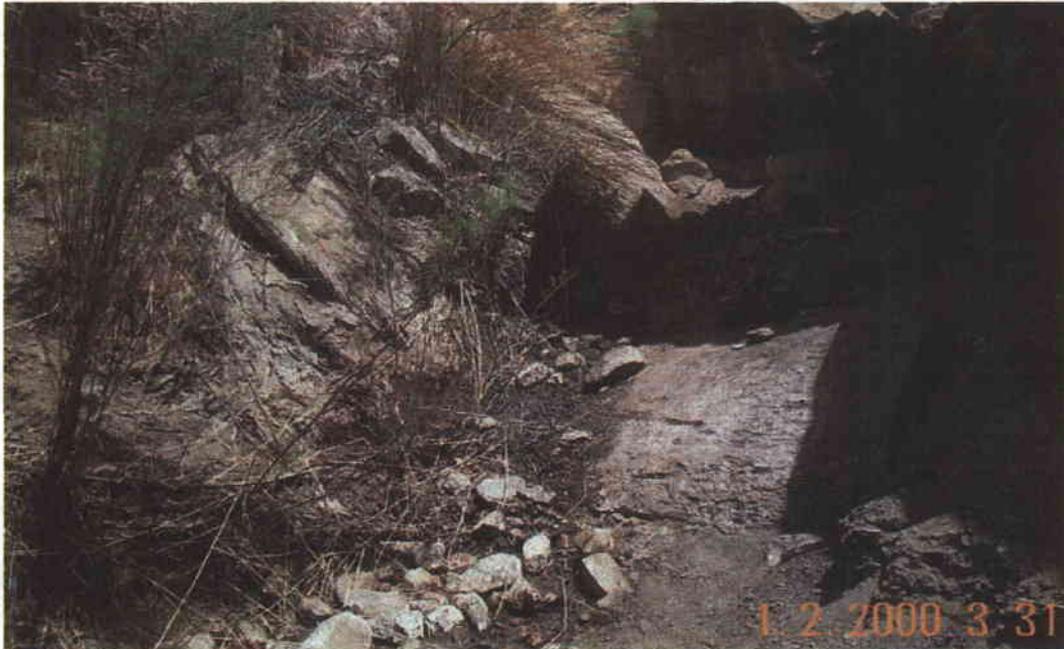


**Location:** Located in what has recently been named Stinky Spring Canyon by the Operator. The seep is located approximately .25 miles to the West of the permit area and within the Central Graben. The seep is located at the top of the Mancos Shale approximately 600 feet below the coal seam in a highly faulted area at an elevation of 5840 feet. The stream reach is intermittent by definition but is ephemeral acting (See Appendix 7-7 & Plate 7-4). The drainage above and below this monitoring location flows only as a result of spring run-off or storm events.

**General:** Due to its location, outside the permit area, outside the limit of subsidence, within the Central Graben, and being 600 feet below the coal seam, there is no potential for Lila Canyon Mine to negatively impact this spring or recharge sources. This location is used by Rocky Mountain Bighorn Sheep; however, no evidence of the sheep using the poor quality water has been documented. The permittee has never observed amphibians at or near this location.

**Vegetation description:** Habitat immediately below this wet seep monitoring site is a mix of grasses and salt desert shrub habitat.

**L-17-G  
Big Stink**



- Location:** Located in what has recently been named Stinky Spring Canyon. The seep is located approximately .25 miles to the West of the permit area, .1 mile above L-16-S, and within the Central Graben. The seep is located at the top of the Mancos Shale approximately 500 feet below the coal seam in a highly faulted area at an elevation of 5920 feet. The stream reach is intermittent by definition but is ephemeral acting (See Appendix 7-7 & Plate 7-4). The drainage above and below this monitoring location flows only as a result of spring run-off or storm events.
- General:** Due to its location, outside the permit area, outside the limit of subsidence, and being 500 feet below the coal seam, there is no potential for Lila Canyon Mine to negatively impact this spring or recharge sources. This location is used by Rocky Mountain Bighorn Sheep; however, no evidence of the sheep drinking the poor quality water has been documented. The permittee has never observed amphibians at or near this location.
- Vegetation description:** Habitat immediately below this wet seep monitoring site is a mix of grasses and salt desert shrub habitat and invasive tamarisk.

Table 3							
PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES IN THE LILA CANYON MINE AREA							
Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
WS1.1	6 hr	0	0	1.39	5.54	9.98	17.18
	24 hr	0.65	3.22	9.31	22.68	39.50	59.77
WS1.2	6 hr	0	0	1.21	6.43	12.77	22.18
	24 hr	0.86	3.82	9.45	20.66	33.99	49.70
WS1 Total	6 hr	0	0	2.37	11.78	22.68	38.79
	24 hr	1.50	6.62	16.96	39.59	67.46	100.70
WS2.1	6 hr	0	0	0	1.84	4.30	7.79
	24 hr	0.17	0.81	2.54	7.96	14.23	24.90
WS2.2	6 hr	0	0	0	1.43	4.14	8.55
	24 hr	0.18	0.91	2.52	6.47	10.70	17.34
WS2 Total	6 hr	0	0	0	2.98	8.20	16.27
	24 hr	0.32	1.67	4.62	12.41	21.56	36.83
WS7.1	6 hr	0	0	2.23	10.43	19.63	33.75
	24 hr	1.29	6.04	15.85	36.15	60.94	90.24
WS8.1	6 hr	0	0	0.85	3.60	6.59	11.34
	24 hr	0.43	2.09	5.76	13.64	23.46	35.09
WS9.1	6 hr	0	0	3.46	16.17	30.46	52.36
	24 hr	2.01	9.38	24.59	56.08	94.53	139.99

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 6.1	6 hr	0	0	1.63	6.48	11.66	20.08
	24 hr	0.76	3.76	10.88	26.5	46.16	69.84
Little Park 6.2	6 hr	0	0	0.93	3.70	6.66	11.47
	24 hr	0.44	2.15	6.21	15.14	26.36	39.89
Little Park 6	6 hr	0	0	2.56	10.18	18.33	31.54
	24 hr	1.20	5.91	17.09	41.63	72.52	109.74
Little Park 6.3	6 hr	0	0	0.32	1.21	2.15	3.70
	24 hr	0.14	0.70	2.17	5.47	9.75	14.92
Little Park 5.1	6 hr	0	0	0.31	1.00	1.73	2.93
	24 hr	0.11	0.59	2.41	7.85	15.16	23.59
Little Park 5.2	6 hr	0	0	0.73	2.75	4.87	8.38
	24 hr	0.32	1.59	4.92	12.40	22.10	33.82
Little Park 5	6 hr	0	0	2.82	11.34	20.41	35.22
	24 hr	1.77	8.54	24.80	61.16	107.32	163.42
Little Park 4.1	6 hr	0	0	0.75	2.58	4.47	7.65
	24 hr	0.29	1.49	5.31	14.72	28.04	43.72
Little Park 4.2	6 hr	0	0	0.76	3.01	5.42	9.33
	24 hr	0.36	1.75	5.06	12.32	21.46	32.47
Little Park 6.4	6 hr	0	0	0.23	0.86	1.53	2.64
	24 hr	0.10	0.50	1.55	3.90	6.95	10.64

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 6.5	6 hr	0	0	0.90	3.58	6.45	11.10
	24 hr	0.42	2.08	6.02	14.66	25.53	38.63
Little Park 4	6 hr	0	0	6.17	24.81	44.74	77.12
	24 hr	2.93	14.01	40.73	101.08	178.91	269.04
Little Park 6.6	6 hr	0	0	0.87	4.44	8.64	14.92
	24 hr	0.58	2.60	6.58	14.58	24.18	35.52
Little Park 3.1	6 hr	0	0	2.35	8.86	15.72	27.03
	24 hr	1.03	5.13	15.87	40.00	71.27	109.07
Little Park 3.2	6 hr	0	0	1.00	4.65	8.76	15.07
	24 hr	0.58	2.70	7.08	16.14	27.20	40.29
Little Park 3	6 hr	0	0	9.73	42.29	77.65	133.01
	24 hr	5.08	23.46	65.66	162.22	284.24	430.10
Little Park 6.7	6 hr	0	0	1.12	6.47	14.50	26.85
	24 hr	1.14	4.69	10.58	21.76	34.48	49.42
Little Park	6 hr	0	0	10.48	47.97	90.92	152.74
	24 hr	6.19	26.34	70.46	170.78	298.11	448.73

**APPENDIX 7-11**

**IPA Piezometer Sampling Information**

**UtahAmerican Energy, Inc.**

**R. Jay Marshall P.E.**

## **IPA HOLES DRILLED FOR WATER-LEVEL MEASUREMENTS ONLY**

In late 1993 and early 1994, Intermountain Power Agency (IPA) drilled three coal exploration holes that were completed as water level piezometers for the South Lease Coal Property in northeast Emery County, Utah.

The exploration holes were drilled to gather information about the physical and chemical qualities of the coal contained within the IPA South Leases and afterwards to obtain water-level measurements. The coal quality holes were completed to allow for the gathering of water-level measurements only. There was never any intention of collecting water quality data from the three exploration holes.

The completion reports were submitted to the BLM, as required by regulation, on December 16, 1998. The completion reports clearly state "Each drill hole was completed as a monitoring well to allow collection of water-level measurements." The completion report go on to state "Periodic water-level depth measurements are subtracted from the surveyed wellhead elevations to facilitate development of potentiometric surface contour maps." (See Exhibit A)

The permit application clearly states in Chapter 7 "The piezometers were installed to provide depth of water only. It is impossible to drop a bailer 1,000 feet and withdraw a water sample without contaminating the sample. . . . Therefore the depth and diameter of the piezometers holes make it impossible to use them for baseline quality." (see Exhibit

B)

Two methods, pumping, and use of a bailer, are commonly used to obtain water samples for quality analysis.

Pumping (not an option)

To obtain a water quality sample by pumping, a pump must be inserted to the bottom of the well, so that the entire water volume within the well bore can be purged a minimum of 3 times to obtain a representative sample of water from the water bearing zone. In the case of the IPA piezometers, a steel casing with a 2-3/8-inch inside diameter and a 20-foot length of 2-inch inside diameter wire-wound stainless steel screen was used to complete each well. This limits the size of pump to less than 2" diameter.

All IPA holes have a bottom depth of greater than 1,000 feet. In the case of IPA #1, the deepest well, a pump would have to be less than 2" in diameter and capable of pumping a maximum of 1,730 feet of head (See Exhibit C-1 and D). To adequately purge the standing water in the well the volume of water standing in the well casing plus the volume of water within the surrounding gravel pack would need to be removed. Based on standard sampling protocol, to properly purge IPA #1 a minimum of 3 volumes would need to be extracted. For this well, that volume would be 879.5 gallons (see Exhibit D).

Based on information that the Division provided regarding a possible 2-inch diameter sampling pump, on December 16, 2005, the Operator contacted Evan Bennett

who is the son of the owner of Bennett Pumps, of Amarillo Texas. Mr. Bennett told the Operator that "they do not make a 2" pump that will pump 1700 feet of head, 1000 feet is maximum". Further more, Mr. Bennett was "not aware of any manufacture who builds a small-diameter pump that will pump any deeper that 1,000 feet".

Exhibit E shows the pump curve for the Bennett pumps. This curve represents the head that water can lifted too. However, it does not account for head losses in the discharge line. As can be seen, the Bennett pump will lift water to 1175 feet with 0 flow. Once the friction and connector losses within the discharge line are accounted for, the effective head limit on the pump is 1,000 feet.

The depth to water in IPA#1 is 1100+ feet. Therefore, the pump would not even lift the water to the ground surface, much less be able to purge the well bore. In the case of IPA #3, the shallowest of all the wells, a pump could reach the water and lift a very limited flow to the surface. Based on the pump curve and accounting for friction losses in the pipe the flow rate would be about 0.1 gpm. Therefore, to be able of purge this well, the pump would need to operate continuously for a minimum of 8.3 days, before a sample could be obtained. From a sampling stand point this is impractical.

Additional research was conducted by the Operator to determine if any other pumps or sampling equipment were available. Exhibit F lists the groundwater monitoring and sampling equipment available from a number of manufacturers and vendors for various sampling options. Based on this research, no manufacturer, supplier, or vendor provides

a pump that will be able to meet the sampling requirements.

Additionally, the sampling equipment for this system would make the sampling effort impractical. Access to these wells is limited to the use of ATV to prevent significant disturbance to the site area. The tubing for the sampler is provided on 500 foot rolls each weighing 300 pounds. To be able to sample these wells UAE would need a minimum of 4 rolls with a power winch to be able to lift the pump and tubing into and out of the holes. Based on the weight and bulk of the equipment it would not be practical to utilize this setup to sample the wells.

Thus, pumping to obtain a water quality sample from these wells is not considered a viable option.

#### Bailer (not an option)

The U.S.G.S. Water-Quality Sampling Protocol (U.S.G.S., 1995 and 1999) recommends that if possible avoid a bailer (see Exhibit G). In the case of IPA #1, the use of a 48" bailer to purge the required volume would be the worst-case situation. The sampling efforts would require dropping and retrieving a bailer 14,658 times at an average depth of 1,420 feet (see Exhibit "D"). This would amount to lifting 21,797 lbs over 1,420 feet. This is impractical for a sampling effort.

Additionally, there are two problems with this method of sampling. First, the use of a bailer in a well that is constructed with steel casing for which you a sampling for iron will

lead to contamination problems. As the bailer is lowered and raised within the well, it will hit the side of the casing and knock off rust that has formed on the inside of the casing from water drips off of the bailer from previous sampling. This rust will either collect in the bailer or fall into the standing water in the well, thereby contaminating the sample. Second, the rust particles which collect in the bailer will over time collect near the bottom seat valve of the bailer and preclude it from closing completely. When this occurs, when the bailer is removed from the water, the bailed sample will drain out before the bailer can reach the surface.

Based on these contamination and mechanical problems and the sheer volume of the bailing effort, the use of a bailer to obtain water quality information for these conditions is not considered a viable option.

As discussed in Chapter 7, adequate ground water information exists without quality information from the IPA piezometers. A minimum of two years of baseline groundwater information has been collected by the Permittee on 10 springs on and adjacent to the permit area. In-mine ground water and mine water discharge samples from the Horse Canyon Mine have been collected. Mine water discharge samples have been collected for a minimum of two years on a monthly basis from sites 001 and 002. Two years of in-mine ground water samples were collected from underground sample site 1E2: 1E-B. Two full years of ground water samples were taken from the underground sump at 2E-B (Results can be found in VI-1 of Part "A"). As this water is from the same seam as will be mined in the Lila Canyon Mine, these samples represent the same water quality.

Early in the Lila Canyon Mine sequence, the mine will breach the existing flooded exploration entries. It is from these entries that the mine water will be obtained for use in the mining process at Lila Canyon. The quality of the water in the exploration entries is the same water as was sampled from the in-mine sites. Thus, the water encountered in the Lila Mine, is expected to be consistent with the quality of the underground water found at sites 1E2, 1E-B, 001, 002, and 2E-B.

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