0012

Canyon Fuel Company, LLC
Soldier/Dugout Canyon Mines
P.O. Box 1029
Wellington, Utah 84542

File in:
❑ Confidential
❑ Shelf
☒ Expandable
Refer to Record No 0012 Date 03192004
In C/007/018, 2004 Incoming
For additional information

Incoming
C/007/018

March 19, 2004

Ms. Pamela Grubaugh-Littig
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple
Suite 1210
Salt Lake City, UT 84114-5801

RE: Chapters 2 and 3, Task # 1784, 1668, 1665 - Canyon Fuel Company, LLC, Soldier Canyon Mine, C/007/018

Dear Ms. Grubaugh-Littig:

Enclosed please find four copies of a submittal to address information requested by UDOGM reclamation specialists concerning the removal of references made to a refuse disposal site and preparation plant. In addition, the reclamation seed mixes have been revised to better reflect the plant species growing in the area adjacent to the disturbed areas. The bond has been revised and submitted as a separate amendment.

An additional copy of the submittal has been delivered to the Price Field Office.

Please contact Vicky Miller at (435) 636-2869, if there are any questions concerning this submittal.

Sincerely yours,

Vicky S Miller

Vicky S. Miller

Cc: Dave Spillman (enclosures)
Price Field Office (enclosures)

RECEIVED
MAR 19 2004
DIV. OF OIL, GAS & MINING

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Canyon Fuel Company, LLC
Mine: Soldier Canyon Mine **Permit Number:** C/007/018
Title: Revisions to Chapters 2 & 3, C/007/018 - # 1665, 1668 & 1784
Description, Include reason for application and timing required to implement:

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes ☒ No 15. Does the application require or include soil removal, storage or placement?
☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes ☒ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes ☒ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

David Spillman
Print Name

David Spillman, Engineering Manager
Sign Name, Position, Date 3/19/04

Subscribed and sworn to before me this 19 day of Mar, 2004

Notary Public

My commission Expires: 12-15, 2006
Attest: State of Utah } ss:
County of Carbon

DIONNE M. OMAN
NOTARY PUBLIC • STATE of UTAH
1015 EAST 2640 SOUTH
PRICE, UTAH 84501
COMM. EXPIRES 12-15-2006

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining
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Form DOGM- C1 (Revised March 12, 2002)

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Soldier Canyon Mine **Permit Number:** C/007/018
Title: Chapter 2 &3 Revisions , C/007/018 - Tasks # 1665, 1886 & 1784

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐	☒	☐	Chapter 2, including Table of Contents, Chapter 2 tables have been moved to the end of the chapter. A tab labeled "Tables" is included.
☒	☐	☐	Appendix 2-G
☐	☐	☐	Chapter 3, Pages 3-14 and 3-15
☐	☒	☐	Appendix 3-E
☐	☒	☐	Figure 3.41-1
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining
March 19, 2004	RECEIVED MAR 1 9 2004 DIV. OF OIL, GAS & MINING

LIST OF APPENDICES

Soil Map Unit Descriptions

The mapping unit descriptions, which describe the characteristics of the soils overlying the proposed LOM area are written in standard SCS format. For definitions of terms, refer to the Glossary (Appendix 2-B). Each map unit description discusses the kinds and proportions of soils within the unit, the location of the unit on the landscape, and the kinds of vegetation occurring on the soils. In addition, the descriptions identify edaphic characteristics related to soil use and management.

The map unit legend in Table 2.22-2 presents the symbol for each of the 23 soil mapping units which occur in the proposed LOM area. The symbols are those approved for publication by the SCS. Included in the map unit descriptions are the SCS Land Capability Classifications. The capability classes indicate the suitability of various soils for different kinds of crops. The classes are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for economic uses. The soils in the area were placed in three capability classes: VI, VII, and VIII. Class VI soils have severe limitations that generally make them unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife areas. Class VII and VIII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to range, woodland, or wildlife areas.

The small letter "e" added to the capability class denotes a subclass. It indicates that the main limiting factor is risk of erosion. Erosion is considered to be the main factor limiting use of the soils in the area. Another important risk factor to be considered is the soil factor ("s"). This symbol is used to denote shallow, droughty, or stony soils.

Soil Description

Surface Facilities Expansion and County Road Relocation

To satisfy the R614 regulations, for the Applicant to expand its surface facilities (coal handling and preparation facilities) and relocation of the county road, additional soil investigations were required. The Applicant contracted Earthfax Engineering, Inc. and had the SCS visit (Appendix 2-G) the proposed expansion and relocation areas to perform the needed soil investigations.

Test plots constructed to test the efficacy of substitute materials will continue to be evaluated as a part of this permit application. This program was initiated under the previous Soldier Canyon Mine permit. Vegetation Field Trials/Test Plots Conditions were reported in Soldier Canyon Mine's Annual Reports beginning in 1985 through 1992. Other vegetation information is included in the 1994 thru 1996 annual reports.

The test plots reflect representative soils types plus the approved seed mix and the recommended types and application rates for both fertilizer and mulch.

One test plot is located by the sewage lagoons on the loam soils which are present in the area. The second test plot area is located adjacent to the No. 2 fan installation, approximately 1200 ft north of the office and warehouse. A third test plot currently exists on the topsoil stockpile, located downstream of the sediment pond. The sandy loam textured topsoil was seeded and covered at the suggested mulch rate (1-2 t/ac) with straw which was tacked down using anchored jute netting.

Much of the area requiring revegetation following the surface facilities expansion and county road relocation, were previously disturbed by early coal exploration activities and installation of a natural gas pipeline. Of the above mentioned mine-related activities, the county road relocation project was performed on mostly undisturbed soils. These soils were salvaged and protected as required by the regulations. The installation of the stream culvert extension produced approximately 4800 yd^3s of soil material which could be used as substitute topsoil. These soils were sorted to ensure that the substitute topsoil contains approximately 10% rock fragments of the 10-12 inch or greater size. By sorting this material, approximately 3794 yd^3s will be substitute topsoil and the boulders larger than 10-12 inches will be stored as landscape boulders/riprap. The topsoil and landscape boulders/riprap are stored at the topsoil storage area. Two composite samples (#1 and #2) were taken and sent to Intermountain Labs for analysis. The results of laboratory analysis conducted on the two composite samples taken from the excavated stream channel soils indicate an overall "good" to "fair" material suitability for revegetation (Table 2.24-2).

Vegetation growth on the substitute topsoil pile, constructed from the stream channel soils, will test the efficiency of the substitute material.

Prior to placement and use of this material as subsoil or substitute topsoil, the material will be analyzed as previously stated in this section.

~~The table below summarizes the information in this section regarding fill volumes estimated to be available to cover pre-SMCRA disturbances.~~

~~********~~

~~Location~~	~~Description~~	~~Substitute Topsoil Yardage~~
~~Parking lot~~	~~approx. 9800 yd³x40% fine grained~~	~~3920 yd³~~
~~Upper Storage Yard~~	~~approx. 5300 yd³x60% fine grained~~	~~3180 yd³~~
~~Crib Wall~~	~~approx. 3700 yd³x50% overburden~~	~~1850 yd³~~
~~Sediment Pond (REI yard)~~	~~appr. 1062 yd³-600 yd³ overburden~~	~~1262 yd³~~
~~#2 Fan~~	~~salvaged during construction~~	~~310 yd³~~
		~~10,522 yd³~~

Refer to Section 2.32 for topsoil and subsoil yardage volumes and Section 5.42.20 for soils at the central facilities area to be salvaged during reclamation activities.

~~As previously mentioned, these soils and the culvert backfill material will be analyzed prior to the time of reclamation to determine the best available material to cover the pre-SMCRA disturbances.~~ The material identified as suitable substitute topsoil will be removed and stockpiled away from active sites, until all backfilling and grading procedures are completed. This will entail segregating the more coarse, rockier material during backfilling, and placement on the bottom of the fill with the finer grained materials being salvaged and stockpiled until they can be distributed on the surface.

Topsoil Storage Site - All of the horizons of the Hernandez soil encountered within the 4.5 acre parcel area is suitable for use in reclamation.

The soils contain no appreciable amounts of gravel that would preclude them from reclamation.

1. Using Table 6 from the "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" prepared by the Utah Division of Oil Gas and Mining (UDOGM) in 1988 the soils are suitable for Vegetative Root Zones. The pH values range from 7.42 to 8.27 which classifies as good, the Electrical conductivity ranges from 0.135 to 0.163 mmhos which classifies as good. Sodium Absorption Ratios (SAR)

range from 1.32 to 6.78. The acceptable SAR range for vegetative root zones is 0-4 for "Good" and 5-8 for "Fair". All horizons sampled with the exception of the 2 to 12" horizon fall within the good category. The 2" to 12" zone falls within the fair category which has limits of 2-8. Saturation capacity ranges from 27.9 to 39.5%, well within the prescribed limits of 25-80%. Gradation analyses indicate that the percent rock is less than the uppermost limit of 15 for 3 inch rock at all depths. Both Selenium and Boron are less than the prescribed limits of 0.1 and 5.0 ppm respectively. Table 2.24-3 shows the laboratory analysis results for Haverdad Loam soil adjacent to the topsoil storage area. The analysis information pertains to the Waste Rock Disposal Area which was not constructed. Refer to Appendix 2-D for copies of the the Haverdad Loam soil analyses. For additional information pertaining to soils associated with the "topsoil storage area" refer to Appendix 2-F and UDOGM Technical Analysis dated 3/29/91, ACT/007/018/91-1, Folder #2, Page 4, R614-301-22-300-Soil Description.

2.31.4

The Applicant has an approved topsoil storage site to accommodate the storage of topsoil, substitute topsoil and landscape boulders/riprap associated with the surface facilities expansion and road relocation. The topsoil storage area was expanded to 8.6 acres to allow storage of growth medium from the Dugout Canyon Mine, of the 8.6 acres, 7.8 acres are disturbed. Approximately 2.3 acres of the storage site is being used for the storage of topsoil, substitute topsoil and landscape boulders/riprap for the Soldier Canyon Mine, an additional 5.5 acres is being used to store growth medium and landscape boulders/riprap from the Dugout Canyon Mine.

Additional information pertaining to the topsoil storage site is located in Appendices 2-E and 2-F. Quantities of growth medium available for use during reclamation of the Soldier Canyon mine site are located in Sections 2.24 and 2.32. ~~The topsoil storage site encompasses 4.5 acres, of which 2.3 acres is presently approved for the stockpiling of the above mentioned material. The remainder or 2.2 acres, will be used for storing the topsoil and substitute topsoil removed from other areas.~~

Presently the topsoil storage site is arranged as shown on Exhibit 5.21-2. The area designated as topsoil/substitute topsoil storage will not be stripped of topsoil, but will be cleared of any vegetative cover prior to placement of other topsoil. The area designated as landscape boulders/riprap storage will be stripped of topsoil to a depth of 17 inches prior to placement of boulders. Vegetation that is removed will be burned, buried or hauled off to the nearest landfill for disposal.

Topsoil and substitute topsoil will be placed on a stable gradually sloping site with enough compactive effort applied during placement to maintain competence of the embankment. Any further placement of topsoil, after the initial piles are revegetated and stabilized, will necessitate the formation of new topsoil piles to eliminate disturbance to the established piles. Vegetation will be established to limit erosion. The topsoil/substitute topsoil will be protected from excessive erosion and instability by the following means:

* Placed on a stable site with proper identification signs
* Construction of runoff control and diversion measures around the site
* Completing necessary annual <u>interim</u> reclamation measures to ensure that an adequate stand of vegetation cover is maintained.

topsoil. The Interim(Temporary) Seed Mixture (1991) was designated for use on the topsoil/substitute stockpiles (Technical Analysis 3/29/91, ACT/007/018/91-1, Folder #2, Page 11, R614.301-353 - Revegetation). The seed mixture included Intermediate wheatgrass, Slender wheatgrass, Thickspike wheatgrass, Western wheatgrass, yellow sweet clover and alfalfa. Refer to Soldier Canyon Mine's annual reports for information pertaining to vegetation studies.

2.32 Topsoil and Subsoil Removal

Central Mine Facilities

As a result of soil thickness surveys and SCS's recommendation, the Applicant will remove the material down to the very stoney layer. Therefore, where topsoil is less than six inches thick, it and the unconsolidated material immediately below will be treated as topsoil.

The stripping depths and quantity of topsoil to be removed prior to any surface disturbances associated with the facilities expansion and road relocation was determined by EarthFax Engineering (Illustration 10.2.12-1, Appendix 10). Three areas of potential disturbance (Area 1, Area 2, Area 3) that may arise, as a result of sight-fitting the facilities were also evaluated for their topsoil recovery potential and are within our proposed limits of disturbance.

A summary of the topsoil and substitute topsoil yardage previously salvaged, to be salvaged ~~and possibly salvaged~~ from the central facilities area are shown below.

FROM	PRESENT LOCATION	YARDAGE
Steam Culvert Extension (substitute)	North of storage yard (SALVAGED)	3794 yd3
Topsoil removed during initial culvert installation	Topsoil Pile east side of Soldier Creek (SALVAGED)	660 yd3
Streambank/Ridge Zone 1 Zone 2	South of #2 Pan east of culvert extension (SALVAGED)	2310 yd3
In situ soils below & adjacent to Topsoil pile	East side of Soldier Creek side slope (SALVAGED)	
Area 1 Topsoil from potential disturbance (0.35 Ac)	West and North of storage yard	735 yd3*
Area 2 Topsoil from potential disturbance (0.09 Acres)	West of storage yard	175 yd3*
Area 3 Potential disturbance for silos and pad construction (0.16 Ac)	North of storage yard	335 yd3*
TOTAL		8009 yd3
TOTAL excluding potential disturbances (Areas 1, 2 and 3)		6764 yd3

AREA STORED	TOPSOIL(yd^3)	SUBSTITUTE TOPSOIL (yd^3)	ROCK/RIPRAP (yd^3)
Topsoil Storage Site "As Built" (Appendix 2-E)			
Landscape Boulders			1,675
Substitute Topsoil		3,794	
Topsoil	2,970		
Topsoil - Soil Removed from beneath landscape boulders/riprap	590		
Substitute Topsoil - No. 3 Fan Exploration Road		620	
Soils in place at Central Facilities Area			
Topsoil at Sediment Pond below REI Fenced Area	310		
Substitute Topsoil Under Parking Area		3,920	
Substitute Topsoil in Sediment Pond Embankment		4,500	
Sub-Totals	3,870	12,834	1,675
TOTAL Topsoil/Substitute Topsoil	16,704		1,675

~~*Note: Of the total acreage within each area, topsoil will only be salvaged where the disturbance will occur. Therefore, the topsoil quantity may be much less.~~

~~The quantities shown are a worst case, assuming the total area is disturbed. When the facilities are constructed, the actual areas of disturbance will be shown and the actual quantity of topsoil salvaged calculated.~~ The salvaged soils have been placed at the Applicant's Topsoil Storage Site (Exhibit 5.21-2).

Cross-sections used in determining volumes for each stockpiles are shown on Figures 2 and 3 in Appendix 2E. Soils salvaged (620 yd^3) from the proposed #3 Fan project are also shown.

~~The total disturbance, including two previous incidental boundary changes and the potential areas of disturbance is 6.4 acres. The following chart gives a break down of the total acreage requiring topsoil redistribution.~~

~~Description~~	~~Area~~	~~Acres~~	~~Yardage 1 foot Replacement depth~~
~~Total disturbance~~		~~6.40~~	
~~Does not need topsoil replacement~~	~~Pipeline Road~~	~~0.56~~	
~~Does not need topsoil replacement~~	~~County Road~~	~~0.74~~	
~~Does not need topsoil replacement~~	~~Stream Channel~~	~~2.25~~	
~~Total Acreage Requiring Topsoil~~		~~2.76~~	~~4453 yd3~~
~~Potential Limits of Disturbance~~	~~Area 1~~	~~0.35~~	
~~Potential Limits of Disturbance~~	~~Area 2~~	~~0.09~~	
~~Potential Limits of Disturbance~~	~~Area 3~~	~~0.16~~	
~~Total Area Requiring Topsoil if Area 1, Area 2 and Area 3 are not disturbed~~		~~2.16~~	~~3485 yd3~~

~~Using the 2.16 acres as the area in need of topsoil redistribution at a depth of 1 foot, 3485 yd³s of topsoil will need to be stockpiled for reclamation. If all the potential areas of disturbance are disturbed (worst case), then 4453 yd³s of topsoil will need to be stockpiled.~~

~~As can be seen from the two charts,~~ The Applicant will stockpile more than enough topsoil and substitute topsoil to adequately reclaim any permitted disturbances, as a result of the facilities expansion and road relocation. The remaining topsoil material will be used in reclaiming pre-SMCRA disturbances (Exhibit 2.22-2), where topsoil was not salvaged. The Applicant will not remove topsoil for minor disturbances which occur at the site of small structures, such as power poles, signs, or fence lines; or that will not destroy the existing vegetation and will not cause erosion.

All material to be removed under R614-301-232 will be removed after the vegetative cover that would interfere with its salvage is cleared from the area to be disturbed, but before any drilling, blasting, mining, or other surface disturbance takes place.

Topsoil Storage Site - Topsoil removal was performed only in those areas affected

by the construction of the access road and landscape boulders/riprap stockpile. The top 17" of topsoil was segregated in those areas (see Section 2.31.4). Topsoil material was used in the construction of the berms, where it will be revegetated upon completion of the site.

2.33 Topsoil Substitute and Supplements

Selected overburden materials may be substituted for, or used as, a supplement to topsoil if the operator demonstrates to the Division that the resulting soil medium is equal to, or more suitable for, sustaining vegetation on non-prime farmland areas than the existing topsoil, and results in a soil medium that is the best available in the permit area to support revegetation.

Section 2.24 (Substitute Topsoil) addresses the substitute topsoils and their respective locations. As stated in section 2.24, the majority of the surface disturbance occurred prior to the passage of SMCRA. Exhibit 2.22-2 shows the extent of the pre-SMCRA disturbances. As such, soil salvage was not conducted as a part of normal operating procedures. Therefore, topsoil materials available for revegetation are limited.

Test plots constructed under the previous Soldier Canyon Mine permit will test the efficacy of the substitute materials (section 2.24). The Applicant will use the vegetation growth on the substitute topsoil stockpile, constructed of stream channel soils, to test the efficacy of that particular substitute material. The applicant has established test plots as mentioned in Section 2.24. The vegetation growth on the stockpiled stream channel soil will test the efficiency of that substitute material.

Imported substitute topsoil will not be required, as the best available soil resources from the site will be salvaged.

2.34 Topsoil Storage

Materials removed under R614-232.100, R614-301-232.2 and R614-301-232.300 will be segregated and stockpiled when it is impractical to redistribute such materials promptly on regraded areas. The stockpiled material will:

* Be selectively placed on a stable site within the present permit area

The permit application includes plans for redistribution of soils, use of soil nutrients and amendments and stabilization of soils.

2.42 Soil Redistribution

Topsoil will be replaced on graded areas in a manner and at a time that 1) achieves an approximate uniform, stable thickness consistent with the approved postmining land use, contours, and surface water drainage systems; 2) Prevents excess compaction of the materials; 3) Protects the material from wind and water erosion before and after seeding and planting.

Topsoil will be applied in lifts as thick as possible to decrease compaction potential. Replacement will occur along the contour, where safety factors permit, to minimize erosion and instability. Replacement will occur within 30 days prior to seeding.

Central Mine Facilities Area

The Applicant does not plan to redistribute the topsoil in any area until that area is backfilled, recontoured and scarified (1.5 ft.). Immediately after the preceding measures are completed in an area, that area will be staked on 100 ft centers to ensure a uniform distribution of topsoil, over the area to be resoiled. Upon completion of the redistribution, the soil will be randomly sampled to ensure that the appropriate depth has been attained and to obtain composite samples for analyses to determine the current requirements for soil nutrients and amendments. Exhibit ~~7.60-1~~ 760A shows the final reclaimed contours. Topsoil replacement depths presented in Section 5.42 of this application.

The central facilities sediment pond will be recontoured and revegetated after revegetation requirements have been met, and quality of the drainage entering the pond meets the applicable Federal and State water quality standards. Since the embankment of this structure is composed of topsoil, redistribution of the embankment material will be used to cover the sediment pond and achieve the proposed postmining contours. The depths of backfilling and topsoil replacement are shown on Exhibit ~~7.60-1~~ 760A and addressed in Section 5.42.

Sewage Lagoons

2.43 Soil Nutrients and Amendments

Seedbed materials will be sampled following gradings and prior to seeding to assess the success of grading and to determine fertilizer requirements. Fertilizer will be added to regraded areas as per recommendations resulting from sample analysis. The following specifications will be followed to collect seedbed material samples.

~~The laboratory selected to analyze samples will be contacted at least 30 days in advance of each sampling period to aid in coordinating sample analyses with the implementation of subsequent revegetation procedures.~~

Specific Procedures

Two samples, representing the 0-6 and 6-18 in. depths, will be taken at a rate of one sample per 5 ac of disturbed area for each type of disturbed site. Sites less than 5 ac in size will also be represented by one set of samples. Seedbed materials exhibiting surface characteristics (e.g. color, texture, parent material) or topsoil replacement depths significantly different from adjacent areas will be sampled as separate entities under the 5 ac rule. For each sample, the average slope and estimated coarse fragment content by volume will be estimated. Each sample will be analyzed by the laboratory for:

1) pH
2) texture
3) percent organic matter
4) NH_4-N (ppm) and NO_3-N (ppm)
5) phosphorus (ppm)
6) potassium (ppm)
7) electrical conductivity
8) sodium absorption ratio

Accompanying each set of samples will be a brief discussion of the area from which samples were collected. The discussion will include comments concerning:

1) plant species to be established
2) type of seedbed preparation techniques to be implemented
3) types of mulches to be applied
4) approximate final slope
5) any special problems or conditions
6) past and future land use considerations

CHAPTER 2

SOILS

LIST OF TABLES

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Chapter 2

SOILS (R614-301-200)

2.10 Introduction

This chapter presents soil resource data and soil mapping for the Soldier Canyon Mine. The information has been compiled from the previously approved soil sections for the Sage Point-Dugout Canyon and Soldier Canyon Mine, ACT/007/009 and ACT/007/018, respectively, as well as new soil survey information for the nonpermitted permit boundary expansion. Soil studies were conducted in accordance with guidelines issued by the Utah Division of Oil, Gas and Mining (DOGM) which were in effect at the time each study was conducted. All surveys fulfilled the requirements established by the Soil Conservation Service (SCS). However, developmental plans for future disturbances, unless exempted by the R645 rules, will meet the standards of the National Cooperative Soil Survey and analyzed by horizon according to Table 1 of the Division's "Guidelines" for topsoil.

Mapping and data from these surveys were combined onto one final base map and report for this application to identify the locations, characteristics and areal extent of endemic soil resources within the life of mine (LOM) area at the Order III level (Exhibit 2.22-1). Soil sampling information, collected for the Soldier Canyon Mine permit application, is presented on a site-specific basis with regard to existing or proposed disturbances.

Soil resources affected by the surface facilities expansion and county road relocation, and topsoil storage site were thoroughly evaluated by EarthFax Engineering, Inc., and the SCS. Their reports are presented in this chapter or referred to in the text. In areas not affected by any surface disturbance, only an Order III survey was conducted.

Although, references to a refuse disposal site and preparation plant may be made in the text, appendices, reports, plates, drawings or maps of this chapter and M&RP, these facilities will not be constructed. Many references have been removed, however removal of all references was not possible such as on Drawings 1.21-1, 3.7-1, 3.7-3, 3.8-1, 3.10-1, 3.10-2, 3.10-3, 3.10-4, 4.11-1, 5.26-2,6-22-7, 7.21-1 and 7-21-2A, etc.

The Applicant will present, in this chapter, a description of the permining soil resources as specified under R614-301-221. Topsoil and subsoil to be saved under R614-301-232 will be separately removed and segregated from other material.

After removal, topsoil will be immediately redistributed in accordance with R614-301-242, stockpiled pending redistribution under R614-301-234, or if demonstrated that an alternative procedure will provide equal or more protection for the topsoil, the Applicant will seek approval from the Division.

2.20 Environmental Description

Central Mine Facilities

The central mine facilities are located in Sections 18 and 7, Township 13 South, Range 12 East, S.L.B & M. The mining activities are conducted within 100 feet of the Soldier Creek Road and are within the Soldier Creek Stream buffer zone. The elevation is 6700 to 6850 MSL and the soil range type is mountain loam.

The slopes in this area range from 10% to >60%. Vegetation varies from a deciduous community along the stream channel to a mountain brush community. As shown on Exhibit (2.22-2), much of the soil resources in this area had been previously disturbed through coal mining and exploration activities, county and road development, and the installation of a gas pipeline.

Topsoil Storage Site

This site is located in Section 25, T13S, R11E, S.L.B & M. This site is located just west, within 100 feet of the Soldier Creek Road right-of-way and approximately 2.5 miles south of the central mine facilities (Exhibit 5.21-2). The site area is located on a small gentle sloped bench at an approximate elevation of 6200 MSL (Appendix 2-A). Vegetation in the site area consists of a sagebrush-grass community (Exhibit 3.7-3/Map A). The sagebrush-grass community has a cover of approximately 35 percent. Refer to Appendix 2-F for information pertaining to the expansion of the storage area.

2.21 Prime Farmland Investigation

Soil mapping was completed for the proposed LOM permit area and the resultant data forwarded to the SCS office in Salt Lake City, Utah. This information was

reviewed by SCS personnel and a negative determination was given with regard to the prime farmland status of the soils overlying the proposed LOM area. A copy of this letter is presented in Appendix 2-B.

In addition, the Soil Conservation Service indicated that a small area of irrigated Prime Farmland exists within the NE 1/4 of the NE 1/4 of Section 36, T13S, R11E. The attached map (Appendix 2-B) shows that the area is located south of the LOM area.

2.22 Soil Survey

A map (Exhibit 2.22-1) delineating the different soils at an Order III level was drawn showing the areal extent of the endemic soil resources within the life of mine (LOM). Supplemental field investigations were also conducted for the facilities expansion and topsoil storage site as required by the Division. These reports will supplement the existing soils report and supply baseline information for undisturbed areas that the Applicant is proposing to disturb.

With respect to the area encompassed by this proposed LOM permit, three seedbed material (topsoil, substitute topsoil and previously disturbed subgrade material) sampling efforts have been completed. Sixteen samples of soil and disturbed materials were collected and analyzed as a part of the original Soldier Canyon Mine permit document (ACT/007/018). The raw data results from the initial mine sampling program is shown in Table 2.22-1 with soil locations shown on Exhibits 3.7-2 and 5.21-1. These soils were analyzed at Utah State University's Soil Laboratory, an approved soils and agricultural laboratory.

With regard to Table 2.22-1 sample number 1 was taken from the existing soil stockpile. Sample 2 was collected from the sediment pond storage pad fill while sampled 3 and 4 were from undisturbed soils bordering the sediment pond. Samples 5, 6 and 11 were taken from the parking lot fill and samples 7, 8 and 9 were from the upper storage area. Sample 10 was collected from the crib wall. Samples 12, 13 and 14 were collected from the sewage lagoon site. Samples 15 and 16 were collected at the No. 2 fan site. These samples were analyzed for percent organic matter, saturation percentage, pH, electrical conductivity, sodium adsorption ratio, available water capacity, texture, percent coarse fragments (> 2 mm), moist consistency, and water erodability (K-factor).

All samples collected for the Soldier Canyon Mine proper were rated "good" in terms of saturation percentage, sodium adsorption ratio, texture, and water erodibility. Sample suitability for the percent organic matter and electrical conductivity parameters ranged from "good" to "fair" with the majority of samples in the "good" category for both parameters. The higher organic matter values for some of the disturbed seedbed materials were likely due to the inclusion of coal fines. The pH values of all samples collected were "fair" except for the crib wall sample which was rated "good". Similarly, available water capacity was rated "fair" for all samples but one which was rated "poor". The "poor" rating was from a soil sample taken from the fan site. The value was 4.8 which is slightly under the lowest possible "fair" (5.0) rating. Coarse fragment content values ranged from "poor" to "good". Three of the 16 samples taken were in the "poor" category. These samples were collected from the parking lot, upper storage area, and crib wall. The ratings for the moist consistency parameter ranged from "fair" to "good" with the majority of samples rated as "good". These sampling efforts indicate that potential revegetation problems linked to soil characteristics are limited. High coarse fragment content of certain soils associated with disturbed mine facility sites is the most obvious concern at the mine proper. This condition, however, is not wide-spread and can be mitigated through the proper application of revegetation techniques and the selection of species to be planted. The predominance of "fair" ratings for the pH and available water capacity parameters is also notable. These ratings are not considered to be detrimental in terms of limiting revegetation success. Native plant species adapted to these conditions can be used to overcome secondary pH and available water capacity limitations. The use of sulfur-coated urea fertilizer may aid in reducing pH values to somewhat lower levels.

Central Mine Facilities

During the permitting of the surface facilities expansion, county road relocation, culvert installation, and new portal development, additional soil investigations were conducted to further characterize the physical and chemical characteristics of the soils. Table 2.22-2 lists the location, date, identification number or field evaluation, and the report (Illustration) pertaining to each investigation.

Topsoil Storage Site

The initial field exploration program, conducted in May, 1990, consisted of a detailed inspection of the site to evaluate topographic relief, vegetation type and percent cover, surficial evidence of soil distribution and exploration of Old Test-Pits 1, 2, 3 & 4 (OTP 1-4) (Figure 1, App. 2-A) to provide a detailed log

of the soil profile for each series present and collection of representative samples from each series for laboratory analysis. A supplemental field investigation was conducted in April, 1991. During the supplemental investigation six stream bank sections, seven test pits and ten auger holes were installed, logged and samples. The additional soils investigations were conducted to further characterize the physical and chemical characteristics of the soils present in the bottom of the drainage area. These supplemental investigation includes Test-Pits 1-4, Auger Holes 1-10 and Stream Channel Sections 1-5.

Figure 1, presented in Appendix 2-A, delineates the soil map unit boundaries as mapped in the field. General soil unit descriptions are defined below.

Three soil mapping units were identified during the field investigation and subsequent report preparation. They are the Hernandez, the Gerst-Badland Complex, and the Haverdad.

Hernandez Soil

This area is represented by OTP #1.

Gerst-Badland Complex

OTP #2 and #4 are representative of this soil complex.

Haverdad Soil

The soils within the confines of the valley floor have been classified as the Haverdad Soil and is represented by OTP #3. In addition, TP 1-4, AH 1-10 and Stream Channel Cross-sections (SCC) 1-5 also represents the Haverdad soil unit.

Soil Description

This section presents the results of the soil baseline investigation

completed for the Soldier Canyon Mine LOM permit area. Factors important in the development of soils overlying the permit area are discussed. Descriptions are included with respect to the soil map units (Appendix 2-B) and soil series mapped within the permit boundary (Exhibit 2.22-1). The map unit descriptions describe the physiographic setting of the unit, soil characteristics, overlying vegetation communities, and related information. Soil series descriptions give a more detailed description of soil characteristics in terms of soil horizonation. A soil map unit legend is included (Table 2.22-3).

Soil productivity of map units within the proposed LOM boundary are listed. Laboratory data resulting from the collection and analysis of soils and disturbed seeded materials are also presented in this section. The characteristics of soils in the permit area are determined by the interaction of the following five principal soil factors.

Parent Material: The soils above the drainageways on the large, gently sloping pediment surfaces, steep sides of hills, and bottoms away from the streams have formed in colluvial material. This material is a weathering product of the Mancos Shale and Flagstaff Formation. These soils are generally gravelly, stony, and bouldery in the interbedded sandstone, and channery and flaggy where they develop over interbeded sandstone and shale. The soils in the drainages have formed in material from the same sandstone and shale but are finer and more sorted.

Climate: Two important climatic factors in soil formation are precipitation and temperature. No long-term data are available for the project area itself. Data are available for Price, Utah. The estimated annual average precipitation ranges from 8 to 18 in. The average annual soil temperature at a 20 in. depth is estimated to be more than 47°F south of the Book Cliffs and on lower slopes at higher elevations having high insolation. Both areas are mesic. On mountain toe-slopes with low insolation and at some higher slope positions , mean annual soil temperatures are estimated to be less than 47°F. These soils are in the frigid family. On north-facing mountain slopes and ridges above 7,500 ft, soil temperatures remain colder throughout the year. These soils are thus classified in the cryic family.

Relief or Topography: The permit area is in the Colorado Plateau physiographic province. The province is distinguished by approximately horizontal bedrock,

numerous canyons, and moderately high elevations. The topography of the area is gently sloping to steep with slopes ranging from one to over 80%.

Biota: Vegetation influences soil formation primarily through the addition of organic matter from leaves, stems, and roots. In the upper mountainous area, the dominant vegetation on north- east slopes consists of Douglas fir and ponderosa pine. Sagebrush, forb, and grass communities are on the south and west slopes. In the lower areas, pinyon-juniper communities are located in the drainageways. In highly alkali-affected areas, greasewood and shadscale predominate. Burrowing animals are important in mixing soil materials and their mounds and casts are conspicuous throughout the area. Grazing animals have also had an impact on the soils. The removal of vegetative matter tends to increase erosion and thus contribute to the thinness of the regolith and topsoil.

Time: Time is an essential element in soil formation. Entisols, such as Typic Torrifluvents, are located along drainageways and lack distinct horizons. These are young soils which have not been in place and been undisturbed long enough for distinct horizons to develop. In contrast, the Typic Natrargid is an example of a soil with well-differentiated horizons which imply greater age and more time for soil-forming processes to act.

Soil Map Unit Descriptions

The mapping unit descriptions, which describe the characteristics of the soils overlying the proposed LOM area are written in standard SCS format. For definitions of terms, refer to the Glossary (Appendix 2-B). Each map unit description discusses the kinds and proportions of soils within the unit, the location of the unit on the landscape, and the kinds of vegetation occurring on the soils. In addition, the descriptions identify edaphic characteristics related to soil use and management.

The map unit legend in Table 2.22-2 presents the symbol for each of the 23 soil mapping units which occur in the proposed LOM area. The symbols are those approved for publication by the SCS. Included in the map unit descriptions are the SCS Land Capability Classifications. The capability classes indicate the suitability of various soils for different kinds of crops. The classes are designated by Roman numerals I through VIII. The numerals indicate progressively

greater limitations and narrower choices for economic uses. The soils in the area were placed in three capability classes: VI, VII, and VIII. Class VI soils have severe limitations that generally make them unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife areas. Class VII and VIII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to range, woodland, or wildlife areas.

The small letter "e" added to the capability class denotes a subclass. It indicates that the main limiting factor is risk of erosion. Erosion is considered to be the main factor limiting use of the soils in the area. Another important risk factor to be considered is the soil factor ("s"). This symbol is used to denote shallow, droughty, or stony soils.

Soil Description

Surface Facilities Expansion and County Road Relocation

To satisfy the R614 regulations, for the Applicant to expand its surface facilities (coal handling and preparation facilities) and relocation of the county road, additional soil investigations were required. The Applicant contracted Earthfax Engineering, Inc. and had the SCS visit (Appendix 2-G) the proposed expansion and relocation areas to perform the needed soil investigations.

On November 11, 1988, soil samples were collected from test pits (1-1, 1-2, 2-1,2-2) as shown on Exhibit 2.22-2. Inspection of test pits (#3 and #4) conclusively proved that the soil in the area was previously disturbed by activities associated with the installation of a buried gas line. Therefore, it was not possible to identify or log any distinct soil profiles or horizons. The soil appeared to be well mixed from the surface down to bedrock (0.0' to 3.0'). Thus only the upper foot of soil was sampled and submitted to ChemTech on January 5, 1989 for analysis of the required physical and chemical parameters (Illustration 10.6.5-1). Inspection of test pits (1-1, 1-2 and 2-1, 2-2) show a definite break in the soil horizons with the appropriate soil samples submitted for analyses (Illustration 10.6.5-2 and 10.6.5-3).

The soils in the area of the portal expansion are a sandy loam to loam with up to 22% gravel and cobble fragments. Field notes for test pits #3 and #4 are shown on Illustration 10.6.5-4. The undisturbed soils (1-1, 1-2 and 2-1, 2-2) are a gravelly sandy loan with up to 20%-25% gravel in the A Horizon with a gravelly sandy loam with up to 20% cobbles in the B Horizon. Field notes for (1-1, 1-2 and 2-1, 2-2) are shown on Illustration 10.6.5-5 and 10.6.5-6. Soil samples 1-1, 1-2 and 2-1, 2-2 were taken when the Applicant had originally made plans to place the new portals southeast (Portal Gulch) of their present locations. Because of the geologic conditions of the coal seam in the Portal Gulch area, the Applicant was forced to relocate the portals.

Due to the decision to realign the County road, the Applicant had additional studies performed on the soils to be disturbed. On October 16, 1989, Carol Franks (Soil Scientist) for the SCS examined the topsoil material adjacent to the present topsoil stockpile. From her examination of the topsoil material, the Applicant should save the material down to the very stony layer (Illustration 10.6.3-2), since this material is similar to the topsoil already stockpiled. On May 23, 1991 Leland Sasser (Soil Scientist) for the SCS examined additional soils outside the disturbed area that are subject to be and may be disturbed as a result of the road relocation and surface facilities expansion. (Illustration 10.6.3-1).

As per discussions and agreements with Priscilla Burton of DOGM, a topsoil thickness survey was performed by Rhett Brooks on a small area to be disturbed by the road alignment located a short distance away from the above sampled areas. Because this area is located within the same soil mapping unit and is of similar material, only a thickness survey was needed and the results are shown in Illustration 10.2.12-1

Soil Descriptions

Many portions of the following soils descriptions were taken, in large measure, from the Soil Survey of Carbon Area, Utah (Soil Conservation Service, June 1988). Detailed soils descriptions are located in Appendix 2-B.

Gerst-Badland

This series consists of shallow, well drained, moderately permeable soils on the sides of mesas, benches, terraces and canyons and on mountain slopes and

hillslopes. These soils are formed in residuum and colluvium derived from shale and sandstone. The slope averages 30%-70%. Elevation ranges from 5,200 to 8,000 feet. Average annual precipitation ranges from 8 to 14 inches and average annual air temperature ranges from 45 to 50 degrees F. The soils are loamy, mixed (calcareous) mesic shallow Usitic Torriorthents.

The surface soils are light brownish gray to dark brown, moist, extremely stony loams. They have a weak medium subangular blocky structure and are slightly hard, friable and slightly plastic. Intermediate horizons are light brownish gray to grayish brown, moist Channery silt loams. Structure is massive and the soil is hard, friable, and plastic. Very fine roots are common. The subsoil contains 15% shale fragments and are strongly calcareous. Deeper horizons are partly weathered Mancos Shale with a paralithic contact depth at 18-20 inches.

Haverdad

The Haverdad soils are deep, well drained, moderately permeable soils on fan terraces and valley floors. These soils formed in stratified alluvium derived from sandstone and shale. Slopes average 1 to 8 percent. Elevation ranges from 5,500 to 6,900 feet above mean sea level, Average annual precipitation ranges from 8 to 14 inches, and average annual air temperature ranges from 45 to 49 degrees F. The soils are fine-loamy, mixed (calcareous) mesic Ustic Torrifluvents

The surface soils are typically light brownish gray to dark grayish brown, moist loams. Structure is weak platy to fine granular, hard, friable and plastic. The soil contains numerous pores and is moderately carbonaceous. The intermediate horizons are light yellowish brown to yellowish brown, moist loams. A weak subangular, blocky structure is typical. The soils are hard, friable and plastic. The soil is moderately calcareous and contains numerous pores. Deep horizons are pale brown to yellowish brown, moist loams. The structure is massive and very hard, friable, and plastic. Pores are common and the soil is moderately calcareous.

Hernandez

The Hernandez unit consists of very deep, well drained soils developed on fan terraces. These soils form in alluvium derived form sandstone and shale. Slopes are 1 to 8 percent. Elevation is 5,600 to 7,100 feet. Average annual

precipitation is 10 to 14 inches, and average annual air temperature is 45 to 49 degrees F. The soil is fine loamy, mixed, mesic Ustollic Calciorthids.

The surface soil is typically brown to dark brown, moist loams. The structure is weak fine granular, slightly hard, friable, and slightly plastic. It contains few very fine, common fine and few medium roots; many fine and few medium pores and is moderately calcareous. The intermediate horizons are brown to light brown, moist loams. These soil horizons exhibit a weak to moderate medium subangular blocky with few very fine, fine and medium roots. Also these horizons commonly have fine to medium pores and are moderately to strongly alkaline. The deep horizon is a moist, massive, hard, firm and plastic loam. It is strongly alkaline with few fine roots and common fine pores. Calcium Carbonate coats the faces of the peds.

Present and Potential Productivity

Table 2.22-4 depicts the potential productivities of soil mapping units occurring within the proposed LOM boundary. Potential values vary for map units between oven-dry and air-dry productivities were taken from SCS Soils 5 Soil Interpretation Records for the Carbon Soil Survey Area. Potential oven-dry productivities were extracted from the previously accepted Sage Point/Dugout Canyon Mine permit application.

The Gerst soil is in capability class VIIe nonirrigated and the Badland is in capability class VIIIe. The Haverdad loam unit is in capability class VIe, non irrigated. The Hernandez non-irrigated soil is in capability subclass VIe. Class VI soils have severe limitations that make them generally unsuitable for cultivation. Class VII soils have very severe limitations that make them unsuitable for cultivation. Class VIII soils have limitations that preclude their use for crop production. The capability subclass with a letter designation of "e" shows a significant limitation in use due to risk of erosion, unless, close-growing plant cover is used and maintained.

Under current and envisioned future management conditions, the productivity of the soil will not increase. The high salt contents, lack of available water supply, proximity of crucial-critical wildlife habitat are significant factors in limiting the future productivity and development of these soil resources.

Present productivity of selected vegetation communities within the LOM boundary, in terms of the herbaceous and shrub stratum components, can be found in Chapter 3 (Appendix 3-D).

2.23 Soil Characteristics

The soil survey for all future disturbances, unless exempted by the R645 rules, will meet the standards of the National Cooperative Soil Survey and analyzed by horizon according to Table 1 of the Division's "Guideline" for topsoil.

All soil surveys were conducted according to procedures approved by the Soil Survey Staff of the USDA and cooperating agencies which were in effect at the time each study was conducted. These studies were initiated by assembling all pertinent environmental data including edaphic, geologic, topographic, vegetative, and climatic information. Map scales and field sheet design were chosen to permit appropriate delineation of soil types.

To complete the Order III surveys conducted in 1979, 1980 and 1985, collected information was reviewed and analyzed to ascertain the probable location and extent of endemic soils as per SCS mapping. SCS field sheets were compared to aerial photographs and SCS mapping transferred to the photos. A check of SCS mapping was then completed in the field. SCS soil map unit boundaries were modified where necessary to reflect on-site environmental and edaphic conditions and to better reflect SCS map unit descriptions. Limited excavations were made to examine soil horizons and to assure mapping accuracy. During the mapping of Sections 5 and 6 in 1985, all map unit and soil series names resultant from previous mapping efforts were correlated with present SCS county and state terminology (Table 2.23-1).

To complete the Order II survey in 1979, reconnaissance was conducted by stereoscopic study of aerial contact prints accompanied by on-site observations. Geologic maps of the area were examined to determine general relationships of parent materials to soil types. Vegetation and relief were studied to determine their relationship to the soils. During the course of the fieldwork, holes were excavated to expose the soil horizon sequence. These excavations extended from the surface downward into the soil parent material. The soil horizons were

described in detail according to the methods and nomenclature of the National Cooperative Soil Survey.

Phases of soil series formed the basis for establishing mapping units on the site during the Order II survey. Series phase criteria included soil properties such as slope, surface texture, stoniness, internal drainage, and erosion potential. The soils map were designed to show the distribution of these various kinds of soils.

Different soil phases were assigned letter symbols as they were mapped in the study area. The Order III survey completed by the SCS was used as a basis for Order II mapping.

Comparisons during Order II mapping were made among the examined soil pedons and the mapping units established by the SCS. Because of the intricate physiography of much of the area, it was necessary to set up a number of mapping units called "soil complexes". A soil complex consists of areas where two or more soils are so intermingled or so very small in areal extent that they cannot be shown separately on the soil map. Some of the mapping units were complexes of soil and rock outcrops. Other complexes may contain badlands or rubbleland.

Field and laboratory data were used to classify the soils according to USDA standard soil taxonomy. Comparisons of field data, along with analytical data obtained in the laboratory, provided the basis for naming each soil series or family.

Soil and "substitute" soil samples were collected on the Soldier Canyon properties at the mine proper in 1984. Samples taken at the mine proper reflected primarily existing disturbed areas which would be disturbed under this permit and for which revegetation would be required. The following information summarizes the methodology used to collect these samples.

1) Topsoil Stockpile - Sample 1: Composite sample consisting of material taken from the top of the stockpile to a depth of 5.5 ft.

2) Sediment Pond Storage Pad Fill - Sample 2: Composite sample of fill material used to construct the sediment pond embankment and storage pad. The sample was taken to a depth of 4.5 ft.

3) Sediment Pond in Situ Soils - Samples 3 and 4: Sample 3 is a composite sample of the A and B soil horizons taken to a depth of 1.6 ft. Sample 4 consists of the C horizon material from a depth of 1.6 to 4.3 ft.

4) Parking Lot Pad - Samples 5, 6 and 11: Sample 5 was taken from a backhoe test pit northeast of the pad. The sample was a composite of material taken for 0 to 7.0 ft. in depth. Sample 6 was also taken from a backhoe pit on the southeast facing slope and consisted of composited materials from the 0 to 6.5 ft. depth. Sample 11 is a composite sample taken by auger to a depth of 5.0 ft. on the southwest portion of the pad.

5) Upper Storage Pad - Samples 7, 8 and 9: Sample 7, a composite sample, was collected from a fresh channel cut into the exposed south slopes of the pad. Composited sample 8 was collected from a 4.5 ft deep backhoe test pit in the pad. Sample 9 was composited from the outslope at the pad where a 4.0 ft hole was excavated and sampled.

6) Fan Site - Sample 15 and 16: These two samples were taken from exposed soil profiles along the streambank near this site. Sample 15 was collected from an east-facing slope and represents the 0.5 to 5.5 ft depth interval. Sample 16 was collected from a north-east exposure and represents the 0.5 to 6.0 ft depth.

7) Sewage Lagoon - Samples 12, 13 and 14: Sample 12 is a composite sample taken from undisturbed soil at the boundary of the disturbed area and represents soil used to construct the embankments. This sample was taken from the 0 to 5.5 ft depth. Sample 13 is from the northern portion of the embankment and is a composite for the 0 to 5.5 ft interval. Sample 14, collected to a depth of 5.5 ft, is a composite sample from the embankment opposite the southernmost sewage cell.

8) Crib Wall - Sample 10: Crib wall material was sampled to a depth of 2.5 ft and was composited for analysis. At the time of sampling, material at deeper depths was frozen and impenetrable.

These mapping and sampling data were then synthesized to complete this report. Soil map unit boundaries were transferred from soil maps prepared for the previous two permit applications as well as the 1985 field survey sheets and drawn on Exhibit 2.22-1. A list was made of map units and series which occur within the LOM boundary. The Sage Point-Dugout and Soldier Canyon Mine permit applications were then culled for all material relevant to identified mapping units and soil series. Mapping has been completed at a scale of 1:12,000. Larger scale mapping was not considered appropriate due to the inherent accuracy which could be obtained from an Order III level of mapping and the fact that this scale of mapping was completed for the previously accepted Sage Point-Dugout Canyon and Soldier Canyon mines.

Contributors

In 1979, Mr. A.R. Southard and Mr. Richard Lawton conducted a soil survey for the proposed Sage Point-Dugout Canyon Mine. This survey was conducted at both the Order II and Order III survey levels. The Order II survey was completed for all areas of potential disturbance. The Order III survey served to describe the location, properties, and characteristics of soils overlying areas within the proposed permit boundary which would not be disturbed by mining operations. This information was subsequently put into permit application form (ACT/007/009) by Environmental Research and Technology, Inc. of Fort Collins, Colorado in 1980.

In 1980, California Portland Cement Company prepared the soil section of their permit for the proposed Soldier Canyon Mine (ACT/007/018). Preparation was completed with the help of the SCS in Price, Utah, the Utah State Soil Laboratory, and Mr. Robert Thompson, a private consultant.

Soils are mapped at the Order III level on the permit area. An Order II survey was not required for disturbed areas since all areas to be disturbed during the proposed mining had been affected by operations conducted prior to the passage of current mining laws and regulations. Soil reports were prepared by Ford, Bacon, and Davis, Inc. and by EarthFax Engineering, Inc. to supplement information contained in Section 8.0 of the original permit application.

In 1985, Cedar Creek Associates, Inc., was retained by the Applicant to conduct a soil survey on two sections of land adjacent to the Sage Point-Dugout Canyon and Soldier Canyon mines. These were Sections 5 and 6, T135 and R12E, SLM. This survey (as well as the Soldier Canyon Mine survey) relied exclusively on existing information. These areas had previously been surveyed by the SCS at an Order III level. (Soil mapping and map unit descriptions have been completed and approved for this area but are as yet unpublished.) Because no surface disturbance is scheduled to occur in Sections 5 and 6, an Order III soil survey was deemed sufficient to characterize the soil resource. Cedar Creek was also retained to integrate the soil information from the Sage Point-Dugout Canyon Mine and Soldier Canyon Mine surveys, as well as the new soil resource information, into this permit application.

New soil resource information for SC3's surface facilities expansion is provided to supplement the existing soils information for these areas. A 1st Order Soil Survey was conducted on those areas to be disturbed.

Soil surveys were performed by the SCS on 10/16/89 and 5/23/91, to identify any soil complexes within the soil mapping units. These investigations were required by the Division to adequately describe the soils that will be disturbed or potentially disturbed, as a result of, the surface facilities expansion and county road relocation. Illustrations 10.6.3-1 and 10.6.3-2 provide SCS's findings.

For the topsoil storage site, EarthFax Engineering, Inc. was contracted to perform the necessary field investigations. All field investigations were conducted and test-pits were logged in accordance with USDA Soil Conservation Service procedures as defined in the National Soils Handbook and the Soil Survey Manual. The soils were mapped to the phase of the series. Individual mapping unit boundaries were delineated in the field. Thus, allowing the area to be mapped under a "1st Order Soil Survey". The Gerst-Badland is a soil complex which cannot be separated into individual mapping units because of the intimately mixed nature of the two soil units.

2.24 Substitute Topsoil

Many areas requiring revegetation following this permit term, at the surface facilities, were disturbed prior to the passage of SMCRA (Exhibit 2.22-2). As such, soil salvage was not conducted as a part of normal operating procedures. Therefore, topsoil materials available for revegetation are limited. Several disturbed areas will receive substitute topsoil composed primarily of fine-grained fill materials as a seedbed covering. The use of these materials for this purpose was considered acceptable under the previously granted Soldier Canyon Mine permit ACT/007/018. Sites to receive a covering of substitute topsoil include the loadout and storage areas, crib wall, highwall, and upper storage site. The No. 2 fan site disturbances will be revegetated using existing, in-place disturbed materials along with the soil salvaged during its construction and placed south of the sediment pond.

The results of laboratory analysis conducted on samples taken from substitute materials indicate an overall "good" and "fair" material suitability for revegetation (Table 2.24-1). Values for the parameters: saturation percentage, sodium adsorption ration, texture, and wind erodibility (K-factor) are rated as "good" for all substitute material samples collected. Values for pH were "fair" for all but the sample taken at the crib wall which was rated "good". Samples were given a "good" rating in terms of organic matter percentage. Electrical conductivities of samples were "good" to "fair". The three samples rates as "fair" had values of 4.5 to 5.2 indicative of very slight salt accumulations. Available water capacity was rated as "fair" for all disturbed material samples. Moist consistency ratings were "good" or "fair" for all samples collected. The majority of "fair" ratings were indicative of materials overlying the parking lost and upper storage areas. Coarse fragment contents ranged from "good" to "poor". Very high contents were found in one of two samples taken at both the parking lost and upper storage areas. A similar condition was found for the sample taken at the crib wall. The lowest coarse fragment contents were found in samples taken at the No. 2 fan site.

Test plots constructed to test the efficacy of substitute materials will continue to be evaluated as a part of this permit application. This program was initiated under the previous Soldier Canyon Mine permit. Vegetation Field Trials/Test Plots Conditions were reported in Soldier Canyon Mine's Annual Reports beginning

in 1985 through 1992. Other vegetation information is included in the 1994 thru 1996 annual reports.

The test plots reflect representative soils types plus the approved seed mix and the recommended types and application rates for both fertilizer and mulch.

One test plot is located by the sewage lagoons on the loam soils which are present in the area. The second test plot area is located adjacent to the No. 2 fan installation, approximately 1200 ft north of the office and warehouse. A third test plot currently exists on the topsoil stockpile, located downstream of the sediment pond. The sandy loam textured topsoil was seeded and covered at the suggested mulch rate (1-2 t/ac) with straw which was tacked down using anchored jute netting.

Much of the area requiring revegetation following the surface facilities expansion and county road relocation, were previously disturbed by early coal exploration activities and installation of a natural gas pipeline. Of the above mentioned mine-related activities, the county road relocation project was performed on mostly undisturbed soils. These soils were salvaged and protected as required by the regulations. The installation of the stream culvert extension produced approximately 4800 yd^3s of soil material which could be used as substitute topsoil. These soils were sorted to ensure that the substitute topsoil contains approximately 10% rock fragments of the 10-12 inch or greater size. By sorting this material, approximately 3794 yd^3s will be substitute topsoil and the boulders larger than 10-12 inches will be stored as landscape boulders/riprap. The topsoil and landscape boulders/riprap are stored at the topsoil storage area. Two composite samples (#1 and #2) were taken and sent to Intermountain Labs for analysis. The results of laboratory analysis conducted on the two composite samples taken from the excavated stream channel soils indicate an overall "good" to "fair" material suitability for revegetation (Table 2.24-2).

Vegetation growth on the substitute topsoil pile, constructed from the stream channel soils, will test the efficiency of the substitute material.

The soils designated as substitute topsoil from the portal expansion, yard expansion and initial stream culvert were used in backfilling the initial stream

by-pass culvert, thereby, minimizing its use as potential topsoil. The placement of the soils as backfill minimizes their potential for substitute topsoil because of excessive compaction and degradation of the material. However, upon further sampling and analysis during reclamation, these soils may be determined suitable for use as substitute topsoils.

The backfill material does not contain any of the soils from the areas where soil samples 1-1, 1-2 and 2-1, 2-2 were taken. Therefore, the extreme values for Boron reported in the analysis samples 1-1 and 1-2 do not pertain to the backfill material. However, the Applicant, prior to placement of the portal soils, yard expansion soils, and initial stream culvert soils at the top of the backfill, for use as subsoils or substitute topsoil, will have the backfill material analyzed.

The culvert backfill, upper storage yard, crib wall, parking lot, sedimentation pond and #2 Fan soils, will be analyzed prior to the time of reclamation to determine the best available material to cover the pre-SMCRA disturbances. Each storage location will have a minimum of 3 depth segregated samples and will be tested for total nitrate nitrogen, phosphorus, potassium, total petroleum hydrocarbons, SAR, pH, electrical conductivity, % rock fragments, organic carbon, boron and selenium will be performed at that time. The depth segregation will be in foot intervals down to the proposed depth of recovery. Organic matter such as composted manure, digested sewage sludge, composted sawmill waste or other available material will be incorporated into the substitute topsoil upon reclamation to inject microbial activity into the rhizosphere.

To determine acid/toxic properties of the graded fill (R645-301-731.311) the following procedure will be implemented during final reclamation:

> After removal and safe storage of substitute topsoil, and following grading of the fill, random sampling will be conducted at a frequency of 1 sample/2.5 acres prior to applying substitute topsoil or topsoil cover material. Composite samples from 0 - 4' will be tested according to Table 6 of the Division Guidelines. Table 6 covers most of the acidic/toxic parameters that the Division will evaluate during final reclamation. However, in areas where surface activities included a repair shop and fuel storage the list of parameters would also include Gas and Diesel/Oil and Grease Total Petroleum Hydrocarbons (USEPA

methods 8015 modified and 418.1 or 413.1) and BTEX (N), that is benzene, toluenem, ethylene, xylene and napthalene (USEPA method 8020 or 602). Parameters found to be in exceedence of the Division guidelines for Overburden will be buried deeper into the fill.

Topsoil Pile Downstream of Sediment Pond - Approximately 310 yd^3 of topsoil, the upper 6 in., was stripped prior to the installation of the fan and stockpiled on the southern portion of the sediment pond area. The topsoil stockpile is approximately 50 ftx30 ft and 6 ft deep. The soils material in the topsoil stockpile has a good suitability rating for reclamation in all parameters except for pH. The pH of 8.1 has fair suitability. This topsoil is well suited to providing a plant growth media for vegetative growth. (See Table 2.24-1, TP#1).

Central Mine Facilities Sedimentation Pond - The sediment pond area has two additional sources of topsoil and/or subsoil other than the topsoil stockpile. One thousand-eight hundred and sixty two cubic yards of material are available from soil materials, hauled to the sediment pond area and used to construct portions of the dike and storage pad. This material came from the development of the mine facilities and primarily contains soils materials with some overburden. The overburden materials, about 600 yd^3, will be separated and used for backfill, the remaining 1,200 yd^3 is available for use as substitute topsoil. Sample 2 (Table 2.24-1) is representative of this soil which is considered to have good suitability ratings except for the following parameters which were rated as fair: organic matter, pH and the available water capacity.

The other source of soil at the central facilities sediment pond is the relatively undisturbed, in situ soil. Three thousand, three hundred and twenty-eight cubic yards of this material is available. Of this 1,238 yd^3 is available from a mixed A-B horizon 1.6 feet deep. The remaining 2,090 yd^3 are available from C horizon, 1.6 to 4.3 ft in depth. The mixed A-B horizon (Table 2.24-1, Sample 3) has good suitability ratings for all parameters except pH and AWC. The pH of 8.3 has a fair suitability. The available water holding capacity of 5.9% has a fair AWC although the AWC is sufficiently adequate to sustain the healthy vegetation which exists at the site. The C soil horizon (Table 2.24-1, Sample 4) has good suitability in all parameters except for the percentage of organic matter (OM), pH and the available water capacity, all of which have fair suitability ratings.

Parking Lot - Reclamation plans call for removing the nearly 10 ft of fill material from the parking lost pad. From the 0.62 ac pad, 9,800 yd^3 of backfill and/or substitute topsoil are available. Based on observations during the test pit logging and sampling, 40% of the materials (3,920 yd^3) are available as substitute topsoil. The fine-grained fraction of the parking lot pad fill material which will be used as a plant growth medium is represented by samples 5, 6 and 11 (Table 2.24-1). The OM ranges from 3.65 to 14.3 and has good suitability for reclamation. The saturation percentage values range from 27.1 to 33.8 and have a fair suitability for reclamation. The electrical conductivity values range from 1.0 to 3.4 and 4.5. The first two values are rated as good and the latter as fair, being slightly saline. No mitigation is planned for the slightly saline soil. The SAR values range from 0.5 to 1.6 and have a good suitability rating. The AWC values are rated as fair and range from 6.1 to 7.7%.

The texture has a good suitability rating for reclamation, although the values for the percent greater than 2 mm ranges from 24.6 to 33.0 and 53.5, with the first two values being rated as fair and the third rated as poor. It is believed that acceptable stands of vegetation will still be produced.

The permeability rate for all three sample areas is 2.0 to 6.0 in/hr and all are rated as having good reclamation suitability.

Upper Storage Area - The upper storage area is represented by samples 7, 8 and 9 (Table 2.24-1). This material is primarily colluvial soils which were cut to create a storage area. Based on the Ford, Bacon & Davis study, approximately 5300 yd^3 of backfill and/or substitute topsoil are available. Based on the test pit logging and sampling, 60% (3180 yd^3) is fine grained and available as substitute topsoil. This soil has good suitability for use as a plant growth medium as shown by the following parameters: organic matter, saturation percentage, SAR, texture, and permeability. The pH values of 8.1 to 8.2 are considered fair. The EC values range from 0.6 to 2.5 and 5.2 mmhos/cm. The latter value of 5.2 is rated as fair, being slightly saline. No mitigation is planned for the slightly saline soil. The test plot established behind the crib wall was removed pursuant to 30 CFR 77.1103(d) and approved by DOGM on January 8, 1986.

The AWC values in the upper storage area are considered fair. The coarse fraction (percent greater than 2 mm) values range from 21.2 to 24.7 and 39.6. The first two values are considered fair and the later poor for reclamation suitability.

The moist consistency characteristics (MC) range from firm to friable, with a firm MC having fair suitability and a friable MC having good suitability for reclamation.

Crib Wall - The soils of the crib wall area, represented by sample 10 (Table 2.24-1), have a good suitability rating for organic matter, saturation percentage, pH, SAR, texture and permeability. The electrical conductivity value of 5.0 mmhos/cm has a fair suitability. Approximately, 3700 yd^3 of backfill and/or substitute topsoil are available. Based on the sampling program, 50% (1850 yd^3) is fine grained and available as substitute topsoil. No mitigation will be made for the slightly saline soil. The 41.1% coarse fraction will be mixed with other soils to reduce the overall coarse fraction percentage. The test plot established in this area was removed pursuant to 30 CFR 77.1103 and approved by DOGM on January 8, 1986.

The firm moist consistency has a fair suitability.

Sewage Lagoons - The soils used to construct the sewage lagoons embankment will also be used for reclamation. The disturbed area associated with the sewage lagoons will be reclaimed by redistributing the embankment materials, with the area being returned to its original contours. The soils are represented by Samples 12-14 (Table 2.24-1). The soils have a good suitability for reclamation for the following parameters: saturation percentage, electrical conductivity, SAR, texture, coarse fraction, moist consistency and permeability. The percent organic matter ranges form 0.74 to 0.76 and 1.41, and is considered to have fair suitability. The pH ranges from 8.2 to 8.3 and is considered fair. The AWC for the sewage lagoons soils range from 7.8 to 8.1% and has fair reclamation suitability.

Fan Site - The fan site will be reclaimed with soil from the topsoil stockpile. The suitability of this material has previously been discussed.

However, it is important to discuss the partially disturbed subsoil, at the fan site, which will be used in reclamation. The fan site subsoils are over 5 ft in depth and have good suitability in the following parameters: saturation percentage, electrical conductivity, SAR, texture, percent coarse fragments greater than 2 mm, moist consistency and permeability. Being a subsoil, the percent organic matter ranges from 1.00 to 1.41 which is considered fair. The pH, values 8.0 and 8.1, is considered fair.

The AWC values of 4.8 and 5.0 are considered poor and fair, respectively. The mulch which will be applied will increase infiltration and decrease evaporation and soil temperature through shading.

Central Mine Facilities Stream Channel - Approximately 4800 yd^3s of material was excavated during the installation of the stream culvert extension. This material was analyzed for its suitability for use as substituted topsoil. The lab results (Table 2.24-2) show the material to have good suitability ratings for all parameters, except for EC, AWC and % rock fragments. The EC and AWC have fair ratings. The % rock fragments were unacceptable, unless, sorting of rocks and boulders larger than 10-12 inches or greater size was performed. After sorting of the rocks, 3794 yd^3 of material was stockpiled as substitute topsoil.

Stream Culvert Backfill - As stated previously in this section, the use of soil material as backfill minimizes its potential for use as substitute topsoil.

Prior to placement and use of this material as subsoil or substitute topsoil, the material will be analyzed as previously stated in this section.

Refer to Section 2.32 for topsoil and subsoil yardage volumes and Section 5.42.20 for soils at the central facilities area to be salvaged during reclamation activities.

The material identified as suitable substitute topsoil will be removed and stockpiled away from active sites, until all backfilling and grading procedures are completed. This will entail segregating the more coarse, rockier material during backfilling, and placement on the bottom of the fill with the finer grained materials being salvaged and stockpiled until they can be distributed on the surface.

Topsoil Storage Site - All of the horizons of the Hernandez soil encountered within the 4.5 acre parcel area is suitable for use in reclamation.

The soils contain no appreciable amounts of gravel that would preclude them from reclamation.

1. Using Table 6 from the "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" prepared by the Utah Division of Oil Gas and Mining (UDOGM) in 1988 the soils are suitable for Vegetative Root Zones. The pH values range from 7.42 to 8.27 which classifies as good, the Electrical conductivity ranges from 0.135 to 0.163 mmhos which classifies as good. Sodium Absorption Ratios (SAR) range from 1.32 to 6.78. The acceptable SAR range for vegetative root zones is 0-4 for "Good" and 5-8 for "Fair". All horizons sampled with the exception of the 2 to 12" horizon fall within the good category. The 2" to 12" zone falls within the fair category which has limits of 2-8. Saturation capacity ranges from 27.9 to 39.5%, well within the prescribed limits of 25-80%. Gradation analyses indicate that the percent rock is less than the uppermost limit of 15 for 3 inch rock at all depths. Both Selenium and Boron are less than the prescribed limits of 0.1 and 5.0 ppm respectively. Table 2.24-3 shows the laboratory analysis results for Haverdad Loam soil adjacent to the topsoil storage area. The analysis information pertains to the Waste Rock Disposal Area which was not constructed. Refer to Appendix 2-D for copies of the the Haverdad Loam soil analyses. For additional information pertaining to soils associated with the "topsoil storage area" refer to Appendix 2-F and UDOGM Technical Analysis dated 3/29/91, ACT/007/018/91-1, Folder #2, Page 4, R614-301-22-300-Soil Description.

2.30 Operation Plan

2.31.1 Methods for Removing and Storing Topsoil, Substitute Topsoil and Landscape Boulders/rip rap

The following is a list of equipment to be used for removal of vegetation, boulders and topsoil and for loading the topsoil, substitute topsoil and landscape boulders/riprap.

1. Track Hydraulic Excavator
2. 966 Wheel Loader
3. D8 Dozer
4. 953 Track Loader
5. 12 yd^3 Dump Trucks
6. Belly Dumps

The safest and most efficient means of performing this operation will be used to ensure the safety of the equipment operators. Topsoil will be loaded into the dump trucks and hauled to the Applicant's topsoil storage site. Substitute topsoil will be sorted and hauled to the topsoil site and placed in its designated location at the topsoil site. Landscape boulders/riprap will also be hauled and placed in its designated location at the topsoil storage site.

2.31.2

The suitability of topsoil substitutes is described in section 2.24 of this application

2.31.3

Testing plan for evaluating the results of topsoil handling and reclamation procedures related to revegetation are as described in section 2.41 of this application. Sampling techniques are described in detail in this section. Soil nutrients and amendments will be added based on these tests.

2.31.4

The Applicant has an approved topsoil storage site to accommodate the storage of topsoil, substitute topsoil and landscape boulders/riprap associated with the surface facilities expansion and road relocation. The topsoil storage area was expanded to 8.6 acres to allow storage of growth medium from the Dugout Canyon Mine, of the 8.6 acres, 7.8 acres are disturbed. Approximately 2.3 acres of the storage site is being used for the storage of topsoil, substitute topsoil and landscape boulders/riprap for the Soldier Canyon Mine, an additional 5.5 acres is being used to store growth medium and landscape boulders/riprap from the Dugout Canyon Mine.

Additional information pertaining to the topsoil storage site is located in Appendices 2-E and 2-F. Quantities of growth medium available for use during reclamation of the Soldier Canyon mine site are located in Sections 2.24 and 2.32.

Presently the topsoil storage site is arranged as shown on Exhibit 5.21-2. The area designated as topsoil/substitute topsoil storage will not be stripped of topsoil, but will be cleared of any vegetative cover prior to placement of other topsoil. The area designated as landscape boulders/riprap storage will be stripped of topsoil to a depth of 17 inches prior to placement of boulders. Vegetation that is removed will be burned, buried or hauled off to the nearest landfill for disposal.

Topsoil and substitute topsoil will be placed on a stable gradually sloping site with enough compactive effort applied during placement to maintain competence of the embankment. Any further placement of topsoil, after the initial piles are revegetated and stabilized, will necessitate the formation of new topsoil piles to eliminate disturbance to the established piles. Vegetation will be established to limit erosion. The topsoil/substitute topsoil will be protected from excessive erosion and instability by the following means:

* Placed on a stable site with proper identification signs
* Construction of runoff control and diversion measures around the site
* Completing necessary annual <u>interim</u> reclamation measures to ensure that an adequate stand of vegetation cover is maintained.
* Not be moved until required for redistribution unless approved by the Division.

Landscape boulders/riprap will be placed on a 0.30 acre parcel of the topsoil site. Prior to any boulder placement, the 0.30 acre parcel will be stripped of topsoil to a depth of 17 inches. The total yardage of topsoil to be removed will be approximately 590 yd^3s. The topsoil to be removed will be placed as shown on Exhibit 5.21-2. After topsoil removal, approximately 1675 yd^3, of landscape boulders/riprap will be hauled from the mine site and placed until reclamation.

Prior to the establishment of the topsoil storage site, only one other site at the central mine facilities accommodated the storage of topsoil; the central mine facilities topsoil storage pile. This topsoil stockpile is located on the

southeast portion of the sediment pond area and is adequately protected from runoff, water and wind erosion and instability. The stockpile was placed on the insitu and fill soils downstream of the incised sediment pond. The west portion of the pile butts directly against the pre-existing hillslope. The northern most portion of the stockpile has a flat top with a 6 in. protective gravel cover. (This portion of the stockpile along with the sediment pond embankment soils were incorporated into a small storage yard which is covered with gravel and enclosed by a wire mesh fence). Liquids or materials which might provide a source of toxic or hazardous materials are restricted from the area. The exposed southeast facing slope of the topsoil stockpile has moderate slopes 1 V:2.5 H, and is well vegetated. The exposed face has mulch tacked down by anchored jute netting. The topsoil stockpile has approximately 85% vegetative cover with the remainder of the area being covered by the mulch and jute netting.

The area is protected from runoff by the sediment pond and road diversions. Protection from water and wind erosion is provided by the 6 in. gravel cap on top and the well vegetated southeast facing slopes. The soil was emplaced on a stable foundation utilizing acceptable engineering practices to achieve the appropriate level of compaction to insure slope stability.

The area is well marked and identified as a topsoil stockpile. The protection measures previously mentioned ensure the long term stability and protection of these topsoil resources.

Plans for the removal and sequence of removal are contained in Section 5.28 of this application. A seed mix made up of species similar to those within the vegetation reference will be used to establish vegetation on the stockpiled topsoil. The Interim(Temporary) Seed Mixture (1991) was designated for use on the topsoil/substitute stockpiles (Technical Analysis 3/29/91, ACT/007/018/91-1, Folder #2, Page 11, R614.301-353 - Revegetation). The seed mixture included Intermediate wheatgrass, Slender wheatgrass, Thickspike wheatgrass, Western wheatgrass, yellow sweet clover and alfalfa. Refer to Soldier Canyon Mine's annual reports for information pertaining to vegetation studies.

2.32 Topsoil and Subsoil Removal

Central Mine Facilities

As a result of soil thickness surveys and SCS's recommendation, the Applicant will remove the material down to the very stoney layer. Therefore, where topsoil is less than six inches thick, it and the unconsolidated material immediately below will be treated as topsoil.

The stripping depths and quantity of topsoil to be removed prior to any surface disturbances associated with the facilities expansion and road relocation was determined by EarthFax Engineering (Illustration 10.2.12-1, Appendix 10). Three areas of potential disturbance (Area 1, Area 2, Area 3) that may arise, as a result of sight-fitting the facilities were also evaluated for their topsoil recovery potential and are within our proposed limits of disturbance.

A summary of the topsoil and substitute topsoil yardage previously salvaged, to be salvaged from the central facilities area are shown below.

The salvaged soils have been placed at the Applicant's Topsoil Storage Site (Exhibit 5.21-2). Cross-sections used in determining volumes for each stockpiles are shown on Figures 2 and 3 in Appendix 2E. Soils salvaged (620 yd^3) from the proposed #3 Fan project are also shown.

The Applicant will stockpile more than enough topsoil and substitute topsoil to adequately reclaim any permitted disturbances, as a result of the facilities expansion and road relocation. The remaining topsoil material will be used in reclaiming pre-SMCRA disturbances (Exhibit 2.22-2), where topsoil was not salvaged. The Applicant will not remove topsoil for minor disturbances which occur at the site of small structures, such as power poles, signs, or fence lines; or that will not destroy the existing vegetation and will not cause erosion.

All material to be removed under R614-301-232 will be removed after the vegetative cover that would interfere with its salvage is cleared from the area to be disturbed, but before any drilling, blasting, mining, or other surface disturbance takes place.

AREA STORED	TOPSOIL (yd^3)	SUBSTITUTE TOPSOIL (yd^3)	ROCK/RIPRAP (yd^3)
Topsoil Storage Site "As Built" (Appendix 2-E)			
Landscape Boulders			1,675
Substitute Topsoil		3,794	
Topsoil	2,970		
Topsoil - Soil Removed from beneath landscape boulders/riprap	590		
Substitute Topsoil - No. 3 Fan Exploration Road		620	
Soils in place at Central Facilities Area			
Topsoil at Sediment Pond below REI Fenced Area	310		
Substitute Topsoil Under Parking Area		3,920	
Substitute Topsoil in Sediment Pond Embankment		4,500	
Sub-Totals	3,870	12,834	1,675
TOTAL Topsoil/Substitute Topsoil	16,704		1,675

Topsoil Storage Site - Topsoil removal was performed only in those areas affectedby the construction of the access road and landscape boulders/riprap stockpile. The top 17" of topsoil was segregated in those areas (see Section 2.31.4). Topsoil material was used in the construction of the berms, where it will be revegetated upon completion of the site.

2.33 Topsoil Substitute and Supplements

Selected overburden materials may be substituted for, or used as, a supplement to topsoil if the operator demonstrates to the Division that the resulting soil medium is equal to, or more suitable for, sustaining vegetation on non-prime farmland areas than the existing topsoil, and results in a soil medium that is the best available in the permit area to support revegetation.

Section 2.24 (Substitute Topsoil) addresses the substitute topsoils and their respective locations. As stated in section 2.24, the majority of the surface disturbance occurred prior to the passage of SMCRA. Exhibit 2.22-2 shows the extent of the pre-SMCRA disturbances. As such, soil salvage was not conducted as a part of normal operating procedures. Therefore, topsoil materials available for revegetation are limited.

Test plots constructed under the previous Soldier Canyon Mine permit will test the efficacy of the substitute materials (section 2.24). The Applicant will use the vegetation growth on the substitute topsoil stockpile, constructed of stream channel soils, to test the efficacy of that particular substitute material.
The applicant has established test plots as mentioned in Section 2.24. The vegetation growth on the stockpiled stream channel soil will test the efficiency of that substitute material.

Imported substitute topsoil will not be required, as the best available soil resources from the site will be salvaged.

2.34 Topsoil Storage

Materials removed under R614-232.100, R614-301-232.2 and R614-301-232.300 will be segregated and stockpiled when it is impractical to redistribute such materials promptly on regraded areas. The stockpiled material will:

* Be selectively placed on a stable site within the present permit area
* Be protected from contaminants and any unnecessary compaction that would interfere with revegetation.
* Be protected from wind and water erosion through prompt establishment and maintenance of an effective, quick growing vegetative cover or through other measures approved by the Division.
* Not be moved until required for redistribution unless approved by the Division.

The Applicant's permitted Topsoil Storage Site (Exhibit 5.21-2) was constructed according to the R614 coal mining regulations. This approved site allows for the stockpiling of soil material and landscape boulders/riprap to prevent any damage to the quality or quantity of those materials. Figures 2 and 3 in Appendix 2E also show stockpile quantities, locations and cross-sections. Soils salvaged (620 yd^3) during #3 Fan exploration project are also shown.

The stockpiling of materials at the topsoil storage site will not permanently diminish the capability of the topsoil of the host site. The stockpiles will have approximately 2h:1v outslopes and surrounded by soil berms. Placement of the stockpiles will take place after the vegetation is removed or incorporated into the salvaged topsoil from the host site (topsoil storage site). Topsoil from the host site will be salvaged to a depth of 17" and stockpiled to prevent any potential for contamination by the material to be stockpiled. Those areas where the central mine topsoil and substitute topsoil were placed did not require stripping prior to their placement. This activity was approved by the Division during the initial permitting of the site.

Any further placement of soil stockpiles, after the initial piles are revegetated and stabilized, will necessitate the formation of new topsoil or subsoil piles to eliminate disturbance to the established piles. Vegetation will be established to limit erosion.

Runoff control for the topsoil storage site is presented in Section 7.32 of this application.

2.40 Reclamation Plan

2.41 General Requirements

The permit application includes plans for redistribution of soils, use of soil nutrients and amendments and stabilization of soils.

2.42 Soil Redistribution

Topsoil will be replaced on graded areas in a manner and at a time that 1) achieves an approximate uniform, stable thickness consistent with the approved postmining land use, contours, and surface water drainage systems; 2) Prevents excess compaction of the materials; 3) Protects the material from wind and water erosion before and after seeding and planting.

Topsoil will be applied in lifts as thick as possible to decrease compaction potential. Replacement will occur along the contour, where safety factors permit, to minimize erosion and instability. Replacement will occur within 30 days prior to seeding.

Central Mine Facilities Area

The Applicant does not plan to redistribute the topsoil in any area until that area is backfilled, recontoured and scarified (1.5 ft.). Immediately after the preceding measures are completed in an area, that area will be staked on 100 ft centers to ensure a uniform distribution of topsoil, over the area to be resoiled. Upon completion of the redistribution, the soil will be randomly sampled to ensure that the appropriate depth has been attained and to obtain composite samples for analyses to determine the current requirements for soil nutrients and amendments. Exhibit 760A shows the final reclaimed contours. Topsoil replacement depths presented in Section 5.42 of this application.

The central facilities sediment pond will be recontoured and revegetated after revegetation requirements have been met, and quality of the drainage entering the pond meets the applicable Federal and State water quality standards. Since the embankment of this structure is composed of topsoil, redistribution of the embankment material will be used to cover the sediment pond and achieve the

proposed postmining contours. The depths of backfilling and topsoil replacement are shown on Exhibit 760A and addressed in Section 5.42.

Sewage Lagoons

The soils used to construct the sewage lagoons embankment will also be used for reclamation. The disturbed area associated with the sewage lagoons will be reclaimed by removing all structures and by redistributing the embankment materials into the lagoon to achieve the propose final contours (Exhibit 5.42-2.) and complete the resoiling process.

Topsoil Storage Site

1. Soil Stockpiles and Landscape Boulders/Riprap Stockpile

   Upon reclamation, the soil stockpiles will be taken to their respective sites and redisturbed. A dozer with a ripper bar will scarify the compacted areas, to a depth of 2 feet to produce proper seedbed conditions. Thereafter, the topsoil storage area will be graded to the proposed final contours (Exhibit 5.42-3), disced and reseeded according to revegetation plan.

2. Containment Berm and Overland Flow Structures

   The containment berm will be recontoured and revegetated after the soil stockpiles have been removed. Exhibits 5.42-3 shows the final contours to be achieved following reclamation. Topsoil and subsoil used in the construction of the embankment will be used as backfill material to achieve final grading. The overland flow structures (berms, and culverts) will also be removed at this time. The Applicant will use a method of removal that will minimize area disturbance. The backfill material will come from the berms and once graded, the area will be revegetated.

3. Access Road

   Immediately after the access road is no longer needed for operations, reclamation, or environmental monitoring, it will be restored. The gravel road surface and subgrade material will be removed and used as backfill at the mine site or at the proposed waste rock site. The topsoil off the outslopes will be removed and temporarily stockpiled in an area at the road construction beginning. The compacted roadway will

then be scarified to a minimum of two feet to ensure adequate bonding between soils. The topsoil material from the temporary stockpile will then be evenly spread over the area, disced and seeded.

2.43 Soil Nutrients and Amendments

Seedbed materials will be sampled following gradings and prior to seeding to assess the success of grading and to determine fertilizer requirements. Fertilizer will be added to regraded areas as per recommendations resulting from sample analysis. The following specifications will be followed to collect seedbed material samples.

Specific Procedures

Two samples, representing the 0-6 and 6-18 in. depths, will be taken at a rate of one sample per 5 ac of disturbed area for each type of disturbed site. Sites less than 5 ac in size will also be represented by one set of samples. Seedbed materials exhibiting surface characteristics (e.g. color, texture, parent material) or topsoil replacement depths significantly different from adjacent areas will be sampled as separate entities under the 5 ac rule. For each sample, the average slope and estimated coarse fragment content by volume will be estimated. Each sample will be analyzed by the laboratory for:

1) pH
2) texture
3) percent organic matter
4) NH_4-N (ppm) and NO_3-N (ppm)
5) phosphorus (ppm)
6) potassium (ppm)
7) electrical conductivity
8) sodium absorption ratio

Accompanying each set of samples will be a brief discussion of the area from which samples were collected. The discussion will include comments concerning:

1) plant species to be established
2) type of seedbed preparation techniques to be implemented
3) types of mulches to be applied
4) approximate final slope
5) any special problems or conditions

Disrupt the approved postmining land use or the reestablishment of the vegetative cover; Cause or contribute to a violation of water quality standards for receiving streams will be filled, regraded, or otherwise stabilized, topsoil will be replaced and the areas will be reseeded or replanted.

2.50 Performance Standards

All topsoil, subsoil and topsoil substitutes or supplements will be removed, maintained and redistributed according to the plan given under R614-301-230 and R614-301-240.

2.52

All stockpiled topsoil, subsoil and topsoil substitutes or supplements will be located, maintained and redistributed according to plans given under R614-301-230 and R614-301-240.

6) past and future land use considerations

Topsoil Storage Site

The nutrient levels for the soils are presented in Table 4. For the soils encountered to the proposed level of disturbance (17") the nutrients are quite similar and within acceptable ranges. As described previously, the percent organic matter had not been determined at the time this report was prepared.

The Nitrate-nitrogen levels range from 101 to 510 ppm which is considered low. Consequently 40 pounds per acre of Nitrogen will be added to the soil. This will be accomplished by using 88 pounds per acre of sulfur coated urea 45-0-0, a slow release fertilizer.

Phosphorus levels range from 0.22 to 2.74 ppm. These levels are also considered low for ideal plant development. Therefore, 30 pounds per acre of phosphorous will be added using 65 pounds per acre of treble superphosphate, 0-46,0.

Potassium levels range from 4.5 to 62 ppm. These levels are within acceptable limits. Mixing of the soils during placement will result in uniform distribution of potassium throughout the soil profile.

Fertilizer will be applied in the fall of the year when reclamation is occurring. Fertilizer will be applied by broadcasting, drilling or hydroseeding.

2.44 Soil Stabilization

All exposed surface areas will be protected and stabilized to effectively control erosion and air pollution attendant to erosion.

Suitable mulch and other soil stabilizing practices will be used on all areas that have been regraded and covered by topsoil or substitute topsoil. Section 3.41 of this document will fully address the methods by which the Operator will use to stabilize redistributed soils.

Rills and gullies, which form in areas that have been regraded and topsoiled and which either:

TABLE 2.22-1

SOIL LABORATORY ANALYSIS RESULTS - MINE AREA PROPER

Sample	% OM		SP		pH		EC mmhos/cm		SAR		AWC %		Texture [b]		> 2 mm %		MC [c]		K [d] in/hr	
1	2.22	G[a]	31.0	G[a]	8.1	F[a]	1.1	G[a]	3.7	G[a]	8.4	F[a]	SL	G[a]	2.6	G[a]	Fr	G[a]	.6-2.0	G[a]
2	1.28	F	32.7	G	7.9	F	3.1	G	.8	G	7.1	F	L	G	8.2	G	Fr	G	.6-2.0	G
3	1.52	G	28.4	G	8.3	F	.5	G	.4	G	5.9	F	SL	G	11.2	G	Fr	G	2.0-6.0	G
4	.72	F	27.0	G	8.3	F	.4	G	.5	G	8.2	F	SL	G	.4	G	Fr	G	2.0-6.0	G
5	4.17	G	29.7	G	7.9	F	4.5	F	.5	G	6.9	F	SL	G	33.0	F	Fi	F	2.0-6.0	G
6	14.3	G	33.4	G	8.0	F	1.0	G	.8	G	7.7	F	L	G	53.5	P	Fi	F	2.0 6.0	G
7	1.52	G	27.1	G	8.2	F	.6	G	.4	G	5.9	F	SL	G	39.6	P	Fi	F	2.0-6.0	G
8	2.21	G	30.2	G	8.1	F	2.5	G	1.0	G	7.3	F	SL	G	21.2	F	Fi	F	2.0-6.0	G
9	2.27	G	28.2	G	8.1	F	5.2	F	1.1	G	6.8	F	L	G	24.7	F	Fr	G	2.0-6.0	G
10	3.14	G	27.4	G	7.8	G	5.0	F	.9	G	6.1	F	SL	G	41.1	P	Fi	F	2.0-6.0	G
11	3.65	G	33.8	G	8.2	F	3.4	G	1.6	G	7.6	F	L	G	24.6	F	Fr	G	2.0-6.0	G
12	1.41	F	34.3	G	8.2	F	.6	G	.3	G	7.8	F	L	G	10.4	G	Fr	G	.6-2.0	G
13	.74	F	35.1	G	8.3	F	1.8	G	3.8	G	8.1	F	L	G	3.4	G	Fr	G	.6-2.0	G
14	.76	F	33.9	G	8.3	F	1.8	G	3.3	G	7.8	F	L	G	14.2	G	Fr	G	.6-2.0	G
15	1.00	F	26.2	G	8.1	F	.5	G	.4	G	4.8	P	SL	G	8.5	G	Fr	G	2.0-6.0	G
16	1.41	F	31.5	G	8.0	F	2.6	G	2.1	G	5.0	F	SL	G	2.4	G	Fr	G	2.0 6.0	G

a = Suitability: G = Good, F = Fair, P = Poor
b = Texture: SL = Sandy Loam, L = Loam
c = Moist Consistency: Fr = Friable, Fi = Firm
d = K = Permeability in inches per hour

(From: Ford, Bacon & Davis, Inc. 1984 Soil Suitability Analysis for Soldier Creek Coal Company's Soldier Canyon Mine, prepared for Soldier Creek Coal Company)

Analyses performed by Utah State University's Soil Laboratory, an approved soils and agricultural laboratory.

5/5/92

TABLE 2.22-2

LOCATION	DATE SAMPLED	SAMPLE I.D.	ILLUSTRATION APPENDIX 10
Disturbed Soil (Pipeline)	11/11/88 and submitted for analyses on 1/5/89	#3	10.6.5-1 and 10.6.5-4
Slope below pipeline	11/11/88 and submitted for analyses on 1/5/89	#4	10.6.5-1 and 10.6.5-4
Undisturbed Soils	11/11/88 and submitted for analyses on 1/5/89	1-1, 1-2 & 2-1 2-2	10.6.5-2 10.6.5-3 and 10.6.5-5 and 10.6.5-6
Exploration Cut	5/8/89	Overburd. comp. Underburd.comp.	10.2.6-2
Yard Expansion	5/11/89	#1 (0-6") #1 (0-12")	10.2.14-2
Exploration Cut	9/30/89	Overburden Underburden	10.2.6-2
Soil below topsoil pile	10/16/89 5/23/91	SCS Field Evaluation	10.6.3-2 and 10.6.3-1
Soil Thickness Survey (steam bank/ridge)	12/10/90 5/23/91	15 auger holes to determine topsoil depth	10.2.12-1 (revised 5/1/91) and 10.6.3-1
Stream Channel	2/26/91	#1, #2 Composites	10.2.14-1
Portal Development	2/26/91	#3 Composite	10.2.6-1
Soil below and adjacent to topsoil pile	5/1/91 5/23/91	9 auger holes to determine topsoil depth	10.2.12-1 and 10.6.3-1
Potent. areas of disturbance Area 1 Area 2 Area 3	5/1/91 5/23/91	14 auger holes to determine topsoil depth and SCS field evaluation	10.2.12-1 and 10.6.3-1
#3 Fan Site (proposed)	10/15/91	SCS Field Evaluation	10.6.3-3

TABLE 2.22-3

SOIL MAP UNIT LEGEND

MAP UNIT SYMBOL*	MAP UNIT NAME
6	Beje-Comodore complex
7	Beje-Trag complex
13	Cabba family-Guben-Rock outcrop complex
17	Chipeta-Badland complex
20	Comodore-Datino Variant complex
21	Croydon loam, 8 to 30 % slopes
27	Doney family-Podo complex
35	Gerst-Badland-Stormitt complex
37	Gerst-Strych-Badland complex, 50 to 70 % slopes
47	Guben-Rock outcrop complex
48	Haverdad loam, 1 to 8% slopes
50	Haverdad loam, moist, 1 to 5% slopes
53	Hernandez family, moist, 1 to 6% slopes
62	Midfork family-Comodore complex
63	Midfork family, Podo association
71	Pathead extremely bouldery fine sandy loam, 40 to 70% slopes
72	Pathead-Curecanti family association
75	Perma family, 15 to 40% slopes
76	Perma family-Datino complex
84	Podo-Rock outcrop complex
88	Rabbitex family-Datino variant complex
96	Rock outcrop-Rubbleland-Travessilla complex
97	Rottulee family-Trag complex
100	Senchert loam, 3 to 15% slopes
101	Senchert loam, 30 to 50% slopes
103	Senchert-Toze family complex
113	Strych very stony loam, 3 to 15% slopes

* Descriptions of these mapping units are found in soil survey of Carbon Area, Utah, a publication of the National Cooperative Soil Survey, Issued in June 1988.

TABLE 2.22-4

POTENTIAL SOIL PRODUCTIVITIES

MAP UNIT NUMBER	MAP UNIT NAME	LBS/ACRE OVEN DRY WEIGHT	LBS/ACRE AIR DRY WEIGHT
6	Beje-Comodore complex	244	--
7	Beje-Trag complex	-	1,200-1,500
13	Cabba family - Guben - Rock outcrop complex	-	500 or less
20	Comodore - Datino variant complex	319	--
27	Doney family - Podo complex	-	1,000-1,200
35	Gerst-Badland-Stormitt complex	-	--
37	Gerst-Strych-Badland complex, 50 to 70% slopes	29	--
47	Gieben-Rock outcrop complex	-	275 or less
48	Haverdad loam, 1 to 8% slopes	801	--
50	Haverdad loam, moist, 1 to 5% slopes	801 or less	--
53	Hernandez family, moist, 1 to 6% slopes	-	800-1,100
62	Midfork family-Comodore complex	-	75
71	Pathead extremely bouldery fine sandy loam, 40 to 70% slopes	-	800
75	Perma family, 14 to 40% slopes	-	1,200
76	Perma family-Datino complex	-	275-1,000
84	Podo-Rock outcrop complex	-	500 or less
88	Rabbitex family-Datino variant complex	-	500-1,200
96	Rock outcrop-Rubbleland-Travessilla complex	-	500 or less
97	Rottulee family-Trag complex	-	1,000-1,500
100	Senchert loam, 3 to 15% slopes	-	1,500
101	Senchert loam, 30 to 50% slopes	-	1,500
103	Senchert-Toze family complex	-	100
113	Strych very stoney loam, 3 to 15% slopes	530	--

TABLE 2.23-1
MAP UNIT NAME AND SYMBOL CORRELATION

PREVIOUS FIELD MAP UNIT SYMBOL	REPORT SYMBOL	MAP UNIT FIELD MAP UNIT NAME	APPROVED MAP UNIT NAME
Dh G2	20	Comodore - Datino complex, 40 to 60% slopes; eroded	Comodore - Datino Variant Complex
FUG	27	FB-FD complex, 40 to 70% slopes	Doney family - Podo complex
LDG2	35	Lockerby-Cragola complex, low rainfall, 8 to 60% slopes, eroded	Gerst-Badland-Stormitt complex
HaC	48	Haverson loam, 3 to 8% slopes	Haverdad loam, 1 to 8% slopes
HbC	50	Haverson loam, high rainfall, 1 to 5%	Haverdad loam, moist, 1 to 5% slopes
HbD2	50	Haverson fine sandy loam, high rainfall 5 to 15% slopes, eroded	Haverdad loam, moist, 1 to 5% slopes
ABC	53	Harvey very fine sandy loam, high rainfall, 1 to 6% slopes	Hernandez family, moist, 1 to 6% slopes
HUG	62	Midfork-Elwood complex, 50 to 70% slopes	Midfork family - Comodore complex
IeC	113	Ildefonso very stony loam, 3 to 8% slopes	Strych very stony loam, 3 to 15%
IeE	113	Ildefonso very stony loam, 8 to 30% slopes	Strych very stony loam, 3 to 15% slopes
IcE2	113	Ildefonso very stony loam, 8 to 30% slopes, eroded	Strych very stony loam, 3 to 15% slopes
IkD	7	IK-silt loam, 3 to 15% slopes	Beje - Trag complex
IvE	7	Beenom-Pino complex, 3-30% slopes	Beje - Trag complex
JTG	71	IJ complex Repp-Doney complex, 40 to 70% slopes	Pathead extremely bouldery fine sandy loam, 40 to 70% slopes
KxH	84	Podo-Rock outcrop complex, 50 to 80% slopes	Podo-Rock outcrop complex
LSG	97	LM-LP complex, 30 to 60% slopes	Rottulee family - Trag complex
LzH2	84	Lithic, Ustorthents-Rocks outcrop-Rubble-slopes, land complex, 70 to 90% eroded	Podo-Rock outcrop complex
MTH	13	Cabba-Guben-Rock outcrop complex, 40 to 75% slopes	Cabba family-Guben rock outcrop complex
Nj62	37	Shingle-Ildefonso-Badland complex, 50 to 70% slopes, eroded	Gerst-Strych-Badland complex, 50 to 70% slopes

TABLE 2.23-1 (cont.)
MAP UNIT NAME AND SYMBOL CORRELATION

PREVIOUS FIELD MAP UNIT SYMBOL	REPORT SYMBOL	MAP UNIT FIELD MAP UNIT NAME	APPROVED MAP UNIT NAME
OJF	88	OK-PP complex, 15 to 50%	Rabbitex family-Datino Variant complex
OpF	103	Benteen-Decross Variant complex, 15 to 40% slopes; Of - Decross complex 15 to 40% slopes	Senchert-Toze family complex
PLF	75	PP very stony fine sandy loam, 15 to 40% slopes	Perma family, 15 to 40% slopes
PSH	76	PP complex, 55 to 80% slopes	Perma family-Datino complex
RfD	100	RF loam, 3 to 15% slopes	Senchert loam, 3 to 15% slopes
RfF	101	RF loam, 30 to 15% slopes	Senchert loam, 30 to 50% slopes
RsH2 Tavessilla	96	Rock outcrop - Rubbleland - DL complex, 60 to 80% slopes, eroded; Rock outcrop - Rubbleland - Podo Variant complex, 60 to 80% slopes, eroded	Rock outcrop - Rubbleland-complex
RWG Travessilla	96	Rock outcrop-Rubbleland-Sunup complex, 60 to 70% slopes	Rock outcrop-Rubbleland-complex
SgG2	6	Beenom - Comodore complex, 30 to 50% slopes	Beje - Comodore complex
VoH	47	Peso - Rock outcrop complex, 50 to 80% slopes; VD-MG complex, 50 to 80% slopes	Guben- Rock outcrop complex

TABLE 2.24-1

SOIL LABORATORY ANALYSIS RESULTS - MINE AREA PROPER

Sample	% OM		SP		pH		EC mmhos/cm		SAR		AWC %		Texture [b]		> 2 mm %		MC [c]		K [d] in/hr	
1	2.22	G [a]	31.0	G [a]	8.1	F [a]	1.1	G [a]	3.7	G [a]	8.4	F [a]	SL	G [a]	2.6	G [a]	Fr	G [a]	.6-2.0	G [a]
2	1.28	F	32.7	G	7.9	F	3.1	G	.8	G	7.1	F	L	G	8.2	G	Fr	G	.6-2.0	G
3	1.52	G	28.4	G	8.3	F	.5	G	.4	G	5.9	F	SL	G	11.2	G	Fr	G	2.0-6.0	G
4	.72	F	27.0	G	8.3	F	.4	G	.5	G	8.2	F	SL	G	.4	G	Fr	G	2.0-6.0	G
5	4.17	G	29.7	G	7.9	F	4.5	F	.5	G	6.9	F	SL	G	33.0	F	Fi	F	2.0-6.0	G
6	14.3	G	33.4	G	8.0	F	1.0	G	.8	G	7.7	F	L	G	53.5	P	Fi	F	2.0-6.0	G
7	1.52	G	27.1	G	8.2	F	.6	G	.4	G	5.9	F	SL	G	39.6	P	Fi	F	2.0-6.0	G
8	2.21	G	30.2	G	8.1	F	2.5	G	1.0	G	7.3	F	SL	G	21.2	F	Fi	F	2.0-6.0	G
9	2.27	G	28.2	G	8.1	F	5.2	F	1.1	G	6.8	F	L	G	24.7	F	Fr	G	2.0-6.0	G
10	3.14	G	27.4	G	7.8	G	5.0	F	.9	G	6.1	F	SL	G	41.1	P	Fi	F	2.0-6.0	G
11	3.65	G	33.8	G	8.2	F	3.4	G	1.6	G	7.6	F	L	G	24.6	F	Fr	G	2.0-6.0	G
12	1.41	F	34.3	G	8.2	F	.6	G	.3	G	7.8	F	L	G	10.4	G	Fr	G	.6-2.0	G
13	.74	F	35.1	G	8.3	F	1.8	G	3.8	G	8.1	F	L	G	3.4	G	Fr	G	.6-2.0	G
14	.76	F	33.9	G	8.3	F	1.8	G	3.3	G	7.8	F	L	G	14.2	G	Fr	G	.6-2.0	G
15	1.00	F	26.2	G	8.1	F	.5	G	.4	G	4.8	P	SL	G	8.5	G	Fr	G	2.0-6.0	G
16	1.41	F	31.5	G	8.0	F	2.6	G	2.1	G	5.0	F	SL	G	2.4	G	Fr	G	2.0-6.0	G

a = Suitability: G = Good, F = Fair, P - Poor

b = Texture: SL = Sandy Loam, L - Loam

c = Moist Consistency: Fr = Friable, Fi = Firm

d = K = Permeability in inches per hour

(Analyses performed by Utah State University's Soil Laboratory, an approved soils and agricultural laboratory.)

Ford, Bacon & Davis, Inc. 1984 Soil Suitability Analysis for Soldier Creek Coal Company's Soldier Canyon Mine, prepared for Soldier Creek Coal Company.

Table 2.24-2

Soil Laboratories Analysis Result - Stream Channel

Sample	% OM		Saturation %		pH		EC		SAR		AWC		Texture		SC		Boron		Acid Base Potential		Rock Frag %	
1	0.1		26.4	G	7.7	G	3.95	F	2.30	G	0.10	F	SL	G	0.03	G	0.72	G	153	G	522	P
2	1.3		29.5	G	7.7	G	3.69	F	1.65	G	0.10	F	SL	G	0.03	G	0.69	G	121	G	527	P

TABLE 2.24-3

SOIL AND LABORATORY ANALYSIS RESULTS

TEST-PIT	DEPTH	pH	ECe	SAR	OM	AWC	SP	% ROCK	SEL	BORON	TEXTURE
1	0-2"	7.42	0.135	1.32	1.42	0.199	30.1	5.6	0.068	<1	SM-ML
	2"-12"	7.89	0.102	6.78	1.25	0.208	39.5	14.6	0.059	<1	SM-ML
	12"-30"	7.96	0.106	1.84	0.98	0.476	31.1	1.8	0.082	<1	SM-ML
	30"-54"	8.24	0.153	1.98	0.84	0.376	27.9	2.2	0.044	<1	SM-ML
	54"-72"	8.27	0.163	3.51	0.60	0.397	29.8	1.0	0.038	<1	SM-ML

==========

ECe Electrical Conductivity in mmhos/cm^3
SAR Sodium Adsorption Ratio
OM Percent Organic Matter
AWC Available Water Capacity in/in
SP Saturation Capacity in percent
Rock % Percent retained in #4 Screen
SEL Selenium as Se, ppm
BORON Boron as B ppm
TEXTURE Soil Texture - ML=Silt, SM=Silty Sand

TABLE 2.42-1
CURRENT SOIL NUTRIENT LEVEL

SOIL	DEPTH (in)	OM (%)	N (%)	P (ppm)	K (ppm)
Hernandez	0-2.0"	1.42	0.0510	2.74	29.0
Hernandez	2.0"-12.0"	1.25	0.0333	1.00	62.0
Hernandez	12.0"-30.0"	0.98	0.0193	0.29	5.5
Hernandez	30.0"-54.0"	0.84	0.0101	0.22	4.5
Hernandez	54.0"-72.0"	0.60	0.0133	0.51	38.0

Appendix 2-G

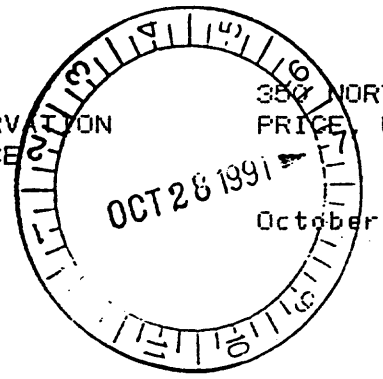
SCS Information

received 11-20-91 during inspection

UNITED STATES
DEPARTMENT
AGRICULTURE

SOIL
CONSERVATION
SERVICE

350 NORTH 400 EAST
PRICE, UTAH 84501



October 25, 1991

Johnny Pappas
Soldier Creek Coal Co.
P.O. Box #1
Price, Utah 84501

Dear Mr. Pappas:

On October 15, 1991, I examined the soils on the proposed site, above the present road, as outlined on the enclosed map. I made an examination of the site and then made two complete soil descriptions of the major soil found on the site. The enclosed map indicates that the area is the Guben soil on 15 to 35 percent slopes, it occurs along the toe slope at the base of the steep mountainside which is Travessilla, Rock outcrop and Rubbleland. The purposed road, as indicated on the map appears to cut across one small area of the steeper slopes, with shallower soils where a convex side ridge extends lower on the slope.

The area mapped Guben, very stoney sandy loam, is about 80 percent Guben soils with most being very stoney or very bouldery, about 10 percent is a soil similar to Guben but has less than 35 percent rock fragments in the profile. There is also about 5 to 10 percent of the area that is moderately deep to bedrock and about 5 percent of the other unnamed inclusions. Within this unit there is an area which was disturbed 15 or more years ago. It has only 0 to 2 inches of the surface horizon remaining. The rest of this area has 7 to 15 inches of surface or A horizon, with most having 7 to 10 inches, except in the concave positions and lowest toe slopes. The upper slopes are Travessilla, Rock outcrop and Rubbleland with some inclusions of a moderately deep to deep soils similar to Guben with a thinner surface layer.

Sincerely,

Leland D Sasser

Leland Sasser
Soil Scientist

Enclosures

SITE A
APPROXIMATE AREA OF INTEREST
E.2,251,000
Travessilla Rock outcrop-Rubble land
Gaben Vet Stony - Sandy loam
EXPLORATION ROAD
PROPOSED
7025
7000
6975
6950
6925
6900
6875
6850
6825
6800
6775
6750
6725
X6790
2

Soil type Gullied — File No.

Area Soldier Creek, Carbon Co. — Date 10/15/1991 — Stop No. 1

Classification Lo-SK mixed, Typic Calciborroll

Location

N. veg. (or crop) Oak Brush, Juniper, Pinon Pine, Sagebrush — Climate Arid 8-20" ppt

Parent material Colluvium & Alluvium from Sandstone & limestone

Physiography Toeslope

Relief SL concave	Drainage Well	Salt or alkali
Elevation 6765'	Gr. water —	Stoniness V very SL stony
Slope 28%	Moisture moist	
Aspect East	Root distrib. Throughout	% Clay* ≈ 23%
Erosion Slight	% Coarse fragments*	% Coarser than V.F.S.*

Permeability Moderate

Additional notes (1) Surface 2" is recent alluvium from upslope slightly lighter in color & Texture

8-15% Surface This area 15-20% slope SL. Concave areas

15-35% slope

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock	% Clay		
A	(1) 0-15"	10YR5/2	10YR3/2	Vbl L	1 Thin Pl & 1m sbk	sh	fr	ss/p	es	ai	10% 1cm 10% 5cm 10% 10cm	21%		
Bw	15-31"	10YR5/4	10YR4/4	Vgr L	2m sbk	slh	fr	ss/p	es	CW	35% 3cm 5% 10cm	23%		
BK1	31-50"		10YR4/3	Vgr L	1m sbk	sh	fr	ss/p	es	GW	25% 1cm 20% 5cm 10% 10cm	23%		
BK2	50-70"		10YR5/3	Vgr L	1m sbk	sh	fr	ss/p	es	—	30% 1cm 20% 5cm 10% 10cm	22%		

Soil type Guben | File No.

Area Soldier Creek, Carbon Co. | Date 10/15/1991 | Stop No. 2

Classification L-sk, mixed, Typic Calciborall

Location

N. veg. (or crop) less Oak more sagebrush | Climate frigid

Parent material Alluvium & Colluvium from Sandstone, limestone & shale

Physiography Toeslope

Relief Convex | Drainage Well | Salt or alkali

Elevation 6802' | Gr. water | Stoniness Very St[illegible]

Slope 18% | Moisture dry

Aspect S East | Root distrib. Throughout | % Clay* ≈ 15-18%

Erosion Moderate | % Coarse fragments* Many 53-70% | % Coarser than V.F.S.*

Permeability Moderately Rapid

Additional notes * Rocks Coated with $CaCO_3$

About 5-10% of Area on Toeslope Non Sk [illegible] Fi-l, mixed

Note # 4 | Note # 3

Ux Stopo A 0-4" VStSL es lo-sk | [illegible] 60% SiStC | + Shallow Trave[illegible]

BW 4-9" VStSL es | | A 0-4" VStSL

BK 9-21" VStSK ev | | C 4-11" Cob SL

| | R 11" Sand[illegible]

7-9" Surface 70% of Area

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Frag.	% Clay		
A	0-7"	10YR5/3	10YR3/3	VSt SL	1fgr	sh	vfr	ss/ps	e	aw	15% St, 5% Bldr, 10% Grav, aver	15%		
Bw	7-16"	10YR6/4	10YR4/4	Xgr SL	1m sbk	sh	fr	ss/ps	es-	cw	30% gr, 10% cob, 5% St	18%		
Bk	16-72	10YR7/3	10YR5/4	ex Stony	1f sbk	sh	vfr	ss/ps	ev	—	10% St, 20% cob, 30% gr	14%		

reviewed to assess the need for drought-tolerance in species selected. The vegetation report was evaluated to determine seed mixture constituents in light of production, cover, and diversity requirements. The soils report was reviewed to assess potential seedbed quality, among other things, and select species adapted to these assumed physical and chemical conditions. Plant species appropriate for enhancing wildlife habitat were selected on the basis of known wildlife needs and requirements. In addition, the operations plan was reviewed to determine the need for species with quick establishment, rapid spreading, and high erosion control potentials. The exact schedule will be determined during the revegetation year.

One temporary and five permanent seed mixtures are listed (Appendix 3-E). The "Intermediate" mixture will be used on those sites which are to be temporarily reclaimed, such as: topsoil storage areas, temporary road locations and unused disturbances associated with the Soldier Canyon Mine facilities that will be totally reclaimed at the conclusion of operations. Permanent mixtures will be seeded following seedbed preparations . All grass and forb seed rates are given in lbs/ac pure live seed (PLS) for seeding. ~~When the grass and forbs seeds are to be broadcast, the rates will be doubled. Rates for shrub species are given in lbs/ac PLS for broadcasting.~~ All seeds will be ~~broadcast and/or~~ incorporated with a small amount of mulch and applied by hydroseeding equipment. Hydroseeding will be accomplished in two applications, the first being the application of the seed to the soil and the second an application of mulch and tackifier on top of the seed.

3.41.22-24 Revegetation Methodology

All operations, where possible, will be conducted along the contour. No irrigation is planned for use in the permit area. The area will be graded to final contours, and then ripped to relieve compaction (see Exhibit 7.60). Ripping will be completed to a maximum depth of 2 feet, where possible. Final ripping depths will be determined by the materials being ripped, to prevent incorporation of less desirable soil/rock into more productive materials.

Following ripping, stockpiled soil will be applied to the ripped surface and left in a extreme roughened state. Prior to seeding, one ton per acre of certified noxious weed free hay will be incorporated by gouging into the soils. Except as noted all areas will be seeded the same.

Soil samples will be collected and sent to the laboratory for analysis to determine if amendments are necessary(see Section 2.43). If required, nutrients will be applied in a single application. The area will be ~~broadcast~~ fertilized with the recommended fertilizer using a hand held "cyclone-type" seeder in smaller areas, or with a rotary implement in larger areas. Where possible, a ripper equipped tractor or other appropriate equipment will be used to incorporate the fertilizer into the soil. Such as traversing a dozer perpendicular to the slope contour to incorporate the nutrients.

Mulching Techniques. Following seeding, the disturbed areas will be mulched with an organic mulching material. Organic mulch will be applied at the rate of one ton per acre and anchored with a tackifier.

Irrigation, Pest and Disease Control. No irrigation is planned and pesticides will not be used unless previously approved by the Division.

Revegetation Methodology - Topsoil Storage Site/Sewage Lagoons Area

Methodologies used to revegetate these disturbed areas will parallel those used to revegetate the central mine facilities area.

As shown in Exhibit 5.42-3 the proposed final slopes of the topsoil stockpile area and sewage lagoons are ≤3:1 or 4:1 (Exhibit 5.42-2). There is no topsoil stockpile at the sewage lagoons because the topsoil was utilized in the embankments.

Revegetation Methodology - Riparian Area

The riparian zone to be reclaimed on the mine site exists at the central mine facilities area and covers approximately 2.4 ac. The area will be graded, resoiled, sampled, fertilized (as required), seeded and mulched. The seed mixture to be planted is listed under Sec. 3.41.21. In addition, willow (Salix) and cottonwood (Populus) seedlings will be planted. Figure 3.41-1 depicts typical seedling planting plan layout.

At planting sites, a circular area will be cleared of inhibiting debris. The receiving hole will then be dug with the width of the hole at least three times the width of the root mass and deep enough so the stem with ~~bottom of the~~ roots will be placed directly on the bottom of the hole ~~on undisturbed soil and the~~ so the root collar ~~will be at or above the~~ is level ~~of~~ with the surrounding ground ~~soil~~. The seedling will then be place in the hole ~~onto undisturbed soil~~ with its stem vertical. Root systems for bare-root trees will be spread on the flat bottom of the hole or over a shallow mound constructed in the bottom of the hole. The hole will be backfilled with loose excavated native soil, packing the soil occasionally to remove air pockets. The seedling will be watered well immediately after backfilling. Additional soil will be placed if settling occurred, once placed the wet soil will not be packed. A bed of coarse organic mulch will be spread around the tree base following planting to assist in the retention of moisture. The mulch will be kept a couple of inches away from the base of the tree (Kuhns & Rupp, 2000).

3.41.25 Reference Areas

Three reference areas (Exhibits 3.7-2 and 3.7-3/Map A), established in undisturbed near-natural conditions, and adjacent to existing or future mine operations are described in Appendices 3-A and 3-B of this application.

Revegetation and Stabilization Success Determination

As identified within the revegetation plan, the Applicant will stabilize and revegetate sites disturbed by mine related activities. Rangeland is the primary intended postmining land use with wildlife habitat as a secondary land use. The Applicant will plant species of the same seasonal variety as those existing in pre-mine vegetation types in support of these postmining land uses. However, because dense stands of shrubs such as those growing on the pre-mining lands are not always optimally beneficial to wildlife (due to the phenomenon of edge effect), the Applicant may reduce stocking rates at the time of reclamation to reflect a more beneficial density and spatial distribution. The reduced

stocking rate would only be implemented if prior approval was granted by the regulatory authority. Such approval, would require that an alternate shrub density standard be developed based on the best technology available at the time of reclamation.

In accordance with DOGM's requirements, the Applicant will request initial bond release (60% of the bond) following successful completion of backfilling, regrading, topsoil replacement and drainage control of a particular bonded area. Release of an additional 25% of the bond (interim release) will be requested at the end of the 10 year responsibility period when bonded lands exhibit successful revegetation as proven by statistical testing between revegetated areas and approved reference areas. The last 15% of the bond will be requested when the Applicant has successfully completed all mining activities in the permitted area in accordance with the approved reclamation plan.

With respect to interim bond release, the Applicant will begin the bond release responsibility period when topsoil redistribution and seeding, mulching, etc. has been completed. During this period of responsibility, activities pursuant to R645-301-244.300 and those Division approved husbandry practices will be performed without reinitiating the bond responsibility period. Any husbandry practices must be approved as an amendment to the Utah Coal Regulatory Program.

To effect interim bond release at the end of the 10 year responsibility period, the Applicant will measure required vegetation variables (ground cover, herbaceous productivity, and woody plant density) once per year in each bonded revegetated area and corresponding reference area during each of the last 2 years of the period. Measurements will occur during the same time of the year. Productivity sampling will involve use of a simple random technique whereby 1 to 2 m^2 plots (rectangular in shape) will be clipped by life form for all current annual production. Sample parameters determined for these variables will be used to test the success of revegetation during each of these years and will prove establishment of: 1) adequate cover, 2) suitable productivity, 3) reasonable density and 4) adequate species composition. (See Monitoring of Reclaimed Areas Prior to Bond Release for additional revegetation monitoring information)

The estimated parameters for the variables of ground cover, herbaceous productivity and woody plant density will be obtained in a statistically adequate manner from both revegetated areas and corresponding reference areas. In accordance with R645-301-356.231, the Division has specified that the standards identified in the plan of 2506, 3479 and 3051 woody stems per acre for the mountain brush, deciduous streambank, and sagebrush-grass-juniper reference areas respectively will be used. These parameters will then be used to complete a statistical t-test of the sample means to determine equivalency between revegetated areas and reference areas.

Parameters to be used in this test are:

* estimated mean (x) ground cover, current annual herbaceous production, and woody plant density for each postmining revegetated type and corresponding reference area; and

* variance of the estimated mean (s^2) for ground cover,

appropriate for enhancing wildlife habitat were selected on the basis of known wildlife needs and requirements. In addition, the operations plan was reviewed to determine the need for species with quick establishment, rapid spreading, and high erosion control potentials. The exact schedule will be determined during the revegetation year.

One temporary and five permanent seed mixtures are listed (Appendix 3-E). The "Intermediate" mixture will be used on those sites which are to be temporarily reclaimed, such as: topsoil storage areas, temporary road locations and unused disturbances associated with the Soldier Canyon Mine facilities that will be totally reclaimed at the conclusion of operations. Permanent mixtures will be seeded following seedbed preparations. All grass and forb seed rates are given in lbs/ac pure live seed (PLS) for seeding. All seeds will be incorporated with a small amount of mulch and applied by hydroseeding equipment. Hydroseeding will be accomplished in two applications, the first being the application of the seed to the soil and the second an application of mulch and tackifier on top of the seed.

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incorporate the nutrients.

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Irrigation, Pest and Disease Control. No irrigation is planned and pesticides will not be used unless previously approved by the Division.

Revegetation Methodology - Topsoil Storage Site/Sewage Lagoons Area

Methodologies used to revegetate these disturbed areas will parallel those used to revegetate the central mine facilities area.

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Revegetation Methodology - Riparian Area

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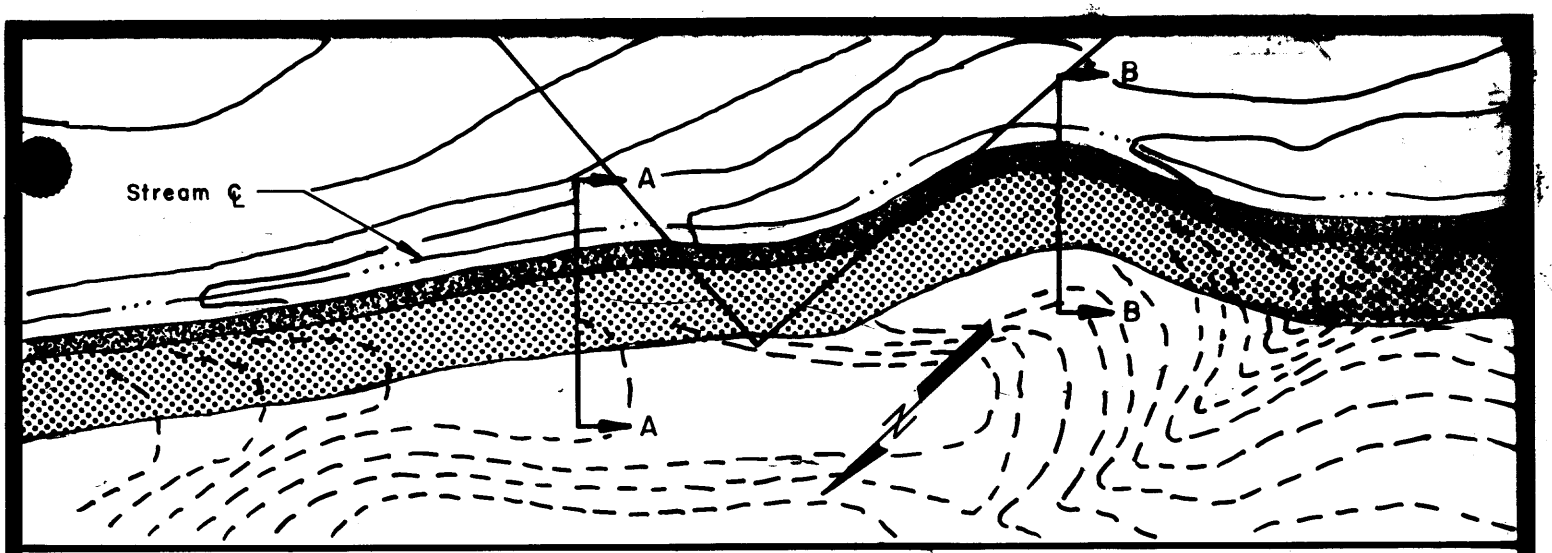
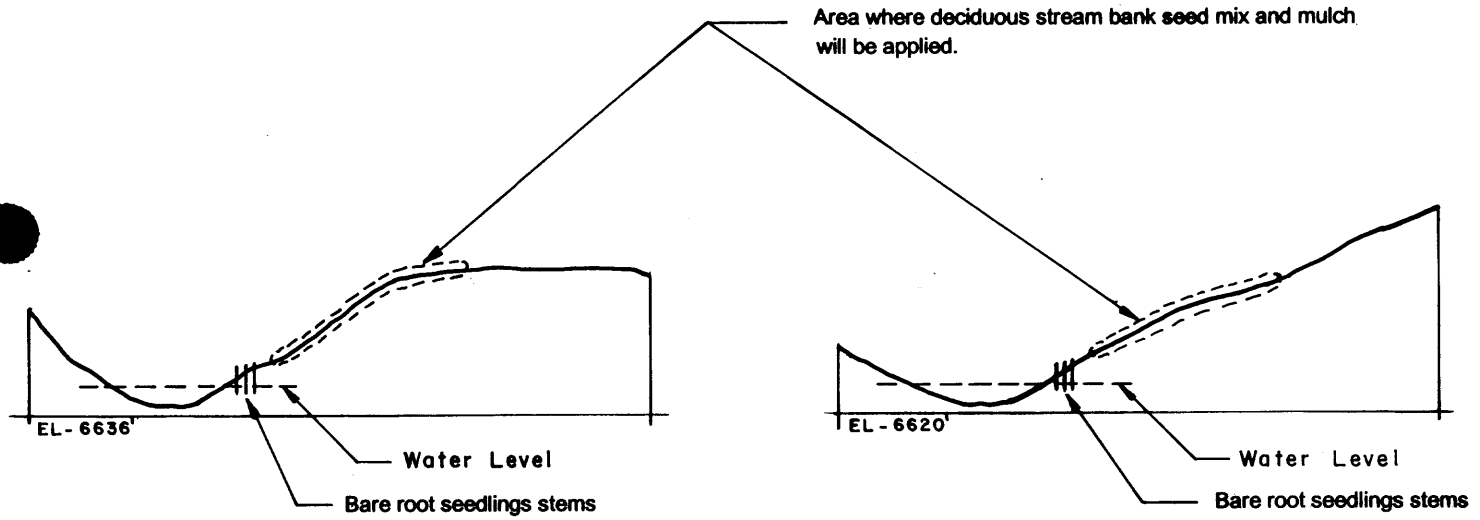


5' zone for planting of bare root seedlings, deciduous stream bank seed mix and mulch.

20' zone for deciduous stream bank seed mix and mulch.



SECTION A-A

Scale - 1" = 20'

SECTION B-B

Scale - 1" = 20'

Figure 3.41-1

REVISIONS		
NO.	DATE	BY
1	06/09/89	KLT
2	March 2004	vsm

Soldier Creek Coal Company

SOLDIER CANYON MINE

SCALE:	TITLE:	DRAWING NO.
1" = 50'	TYPICAL RIPARIAN REVEGETATION LAYOUT	A 121

DRAWN BY	DATE	CHECKED	DATE	APPROVED	DATE
C.L.A.	4-26-84				

SC8

Appendix 3-E

Seed Mixtures

Intermediate (Temporary) Seed Mixture - All Areas

	Variety	Rate (lbs/ac)
Intermediate wheatgrass (Agropyron intermedium)	Oahe	2.0
Slendar wheatgrass (Agropyron trachycaulum)	Primar	3.0
Thickspike wheatgrass (Agropyron dasystachyum)	Critana	4.0
Western wheatgrass (Agropyron smithii)	Rosana	3.0
Yellow sweet clover (Melilotus officinalis)	Common	1.0
Alfalfa (Medicago sativa)	Ranger	1.0
	TOTAL	14.0

Permanent Seed Mixture - Central Mine Facilities Area

	Variety	Rate (lbs/ac)
Mountain big sagebrush (Artemisia tridentata var. vaseyana	Hobble Crk	0.2
Bluebunch wheatgrass (Agropyron spicatum)	Secar	2.5
Thickspike wheatgrass (Agropyron dasystachyum)	Critana	2.0
Great Basin wildrye (Elymus cinereus)	Common	3.0
Indiana ricegrass (Oryzopsis hymenoides)	Paloma	2.5
Western wheatgrass (Agropyron smithii)	Rosana	3.0
Alfalfa (Medicago sativa)	Ladak	0.5
Lewis-flax (linum lewisii)	Common	1.0
Yellow sweetclover (Melilotus officinalis)	Common	0.5
Antelope bitterbrush (Purshia tridentata)	Common	1.0
Rubber rabbitbrush (Chrysothamnus nauseosus var. albicaulis)	Common	1.0
Saskatoon serviceberry (Amelanchier alnifolia)	Common	1.0
Winterfat (Ceratoides lanata)	Common	2.0
Blueleaf aster (Aster glaucodes)	Common	0.5
Rocky Mountain penstemon (Penstemon strictus)	Common	0.5
	TOTAL	21.2

Replaced in 2004

Permanent Seed Mixture - Sewage Lagoons Area

	Variety	Rate (lbs/ac)
Great Basin wildrye (Elymus cinereus)	Common	3.0
Indian ricegrass (oryzopsis hymenoides)	Paloma	2.5
Thickspike wheatgrass (Agropyron dasystachyum)	Critana	3.0
Western wheatgrass (Agropyron smithii)	Rosana	2.0
Slender wheatgrass (Agropyron trachycaulum)	Primar	3.0
Alfalfa (Medicago sativa)	Ranger	0.5
Lewis flax (Linum lewisii)	Common	1.0
Northern sweetvetch (Hedysarum boreale)	Common	0.5
Yellow sweetclover (Melilotus officinalis)	Common	0.5
Birchleaf mountain - mahogany (Cercocarpus montanus)	Common	1.0
Saskatoon serviceberry (Amelanchier alnifolia)	Common	1.0
Utah juniper (Jumiperus osteosperma)	Common	0.5
	TOTAL	18.5

Permanent Seed Mixture - Topsoil/Storage Area

	*Rate (lbs/ac)
Black Sagebrush (Artemisia nova)	0.5
Squawbush (Rhus trilobata)	2.0
Yarrow (Achillea millifolium)	0.1
Pacific Aster (Aster chilensis)	0.2
Northern Sweetvetch (Hedysarum boreale)	1.5
Lewis Flax (Linum lewsii)	1.0
Yellow Sweetclover (Melilotus officinalis)	0.5
Blue Grama (Bouteloua gracilis)	0.4
Western Wheatgrass (Elymus smithii)	3.0
Bluebunch Wheatgrass (Elymus spicatus)	3.0
Slendar Wheatgrass (Elymus Trachycaulus)	2.0
Indian Ricegrass (Stipa hymenoides)	2.0
Wyoming Big Sagebrush (Artemisia tridentata var. wyomingensis)	0.25
Mountain Big Sagebrush (Artemisia tridentata var. vaseyana)	0.25
Rubber Rabbitbrush (Chrysothamnus causeosus var. hololeucus)	0.5
Winterfat (Eurotia lanata)	1.0
TOTAL	18.20

Permanent Seed Mixture - Refuse Disposal Area

	Variety	Rate (lbs/ac)
Great Basin Wildrye (Elymus cinerus)	Common	3.0
Indian Ricegrass (Oryzopsis hymenoides)	Paloma	2.5
Thickspike Wheatgrass (Agropyron dasystachyum)	Critana	3.0
Western Wheatgrass (Agropyron smithii)	Rosana	2.0

Replaced in 2004

Permanent Seed Mixture - Refuse Disposal Area

	Variety	Rate (lbs/ac)
Slender wheatgrass (agropyron trachycaulum)	Primar	3.0
Alfalfa (Medicago sativa)	Ranger	0.5
Lewis flax (linum lewisii)	Common	1.0
Northern sweetvetch (Hedysarum boreale)	Common	0.5
Yellow sweetclover (Melilotus officinalis)	Common	0.5
Birchleaf mountain-mahogany (Cercocarpus montanus)	Common	1.0
Saskatoon serviceberry (Amelanchier alnifolia)	Common	1.0
Utah Juniper (Juniperus osteosperma)	Common	0.5
	TOTAL	18.5

Permanent Seed Mixture - Riparian Area (with Cutting and Seedling Planting Specifications)

	Variety	Rate (lbs/ac)
Great Basin wildrye (Elymus cinereus) N-G	Common	3.0
Kentucky bluegrass (poa pratensis) I	Merit	0.3
Mountain brome (Bromis marginatus) N-G	Bromar	3.0
Slender wheatgrass (Agropyron trachycaulum) N-G	Primar	2.5
Streambank wheatgrass (Agropyron riparium) N-G	Sodar	3.0
Western wheatgrass (Agropyron smithii) N-G	Rosana	3.0
Lewis flax (Linum lewisii) N-	Common	1.0
Alfalfa (Medicago sativa) I	Ranger	1.0
Antelope bitterbrush (Purshia tridentata) N-Or	Common	1.0
Woods rose (Rosa woodsii) N-Or	Common	2.0
Yellow sweetclover (Melilotus officinalis) I	Common	1.0
Sweet anise (Osmorhiza occidentalis) N-F	Common	1.0
	TOTAL	21.8
Seedling Species		
Narrow leaf cottonwood (Populus augustifolia)	NA	15
Cutting Species		
Endemic willow (Salix spp)	NA	125
Narrowleaf Cottonwood (Populus augustifolia)	NA	50
	TOTAL	190

*Rates based on drill seeding pure live seed (PLS). The rate would be doubled if the seeding method employed is surface broadcasted.

Replaced in 2004

DECIDUOUS STREAM BANK FINAL SEED MIX

	Rate (lbs/ac)	#pls/ft^2
Great Basin Wildrye (Elymus cinereus)	3.0	10
Kentucky Bluegrass (Poa pratensis)	0.3	10
Mountain Brome (Bromus marginatus)	6.0	8
Slender Wheatgrass (Elymustrachycaulus)	6.0	18
Streambank Wheatgrass (Elymus lanceolatus)	3.0	12
Western Wheatgrass (Agropyron smithii)	3.0	8
Yarrow (Achillea millefolium)	0.2	19
Sweet Anise (Osmorhiza occidentalis)	2.0	6
Mountain Lupine (Lupinus alpestris)	4.0	1
Antelope Bitterbrush (Purshia tridentata)	1.0	0.5
Woods Rose (Rosa woodssi)	4.0	4
Mountain Snowberry (Symphoricarpos oreophilus)	4.0	5
Total	36.5	101.5

Bare-root Stock - 50 of each species per acre

Narrowleaf Cottonwood (Populus angustifolia)
Willow spp. (Salix spp) species endemic to area
Red Osier Dogwood (Cornus stolonifera)

SEWAGE LAGOON & TOPSOIL STORAGE AREA FINAL SEED MIX

	Rate (lbs/ac)	#pls/ft^2
Great Basin Wildrye (Elymus cinereus)	3.0	10
Indian Ricegrass (Oryzopsis hymenoides)	3.0	11
Thickspike Wheatgrass (Elymus lanceolatus)	4.0	14
Western Wheatgrass (Agropyron smithii)	4.0	10
Blue Grama (Bouteloua gracilis)	1.0	17
Northern Sweetvetch (Hedysarus boreale)	2.0	1
Annual Sunflower (Helianthus annuus)	1.0	2
Scarlett Globemallow (Sphaeralcea coccinea)	0.3	3
Utah Juniper (Juniperus osteosperma)	1.0	1
Wy. Big Sagebrush (Artemisia tridentata wyomingensis)	0.3	18
Black Sagebrush (Artemisia nova)	0.5	10
Shadscale (Artiplex confertifolia)	1.2	2
Total	21.3	99

CENTRAL MINE FACILITIES AREA FINAL SEED MIX

	Rate (lbs/ac)	#pls/ft^2
Great Basin Wildrye (Elymus cinereus)	3.0	10
Indian Ricegrass (Oryzopsis hymenoides)	3.0	11
Slender Wheatgrass (Elymustrachycaulus)	3.0	9
Western Wheatgrass (Agropyron smithii)	3.0	8
Bluebunch Wheatgrass (Agropyron spicatum)	2.5	7
Northern Sweetvetch (Hedysarus boreale)	2.0	1
Prairie Sage (Artemisia ludoviciana)	0.25	14
Rocky Mountain Penstemon (penstemon stictus)	2.0	14
Blueleaf Aster (Aster glaucodes)	0.5	6
Mountain Big Sagebrush (Artemisia tridentata var. vaseyana)	0.3	18
Utah Serviceberry (Amelanchier utahensis)	4.0	4
Winterfat (Eurotia lanata)	4.0	12
Antelope Bitterbrush (Purshia tridentata)	6.0	3
Total	33.55	117