0009

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March 6, 2001

TO: Internal File

THRU: Dave W. Darby, Team Lead

FROM: Priscilla W. Burton, Soils Reclamation Specialist

RE: Soils Technical Analysis for Lila Canyon, UtahAmerican Energy, Inc., Horse Canyon Mine, C/007/013-SR98(1)-5

SUMMARY:

There are soils issues which remain outstanding in the most recent submittal (received January 19, 2001). These issues have been discussed with Tom Paluso of Environmental Industrial Services.

The soils section of this application has been reviewed by Robert Davidson (reviews 1 through 4), Paul Baker (fifth review), and myself (sixth review). The chronology for the Lila Canyon Mine Permit Application Package (PAP) is as follows:

Action	Date
Original PAP submittal	September 8, 1998
Administratively incomplete, PAP returned	November 6, 1998
Resubmittal	December 14, 1998
Administratively incomplete	February 1, 1999
Resubmittal	February 11, 1999
Administratively Complete	February 25, 1999
1st round - Technical Analysis w/ deficiencies	May 26, 1999
Resubmittal	July 30, 1999
2nd round - Technical Analysis w/ deficiencies	October 18, 1999

Action	Date
Resubmittal	November 29, 1999
3rd round - Technical Analysis w/ deficiencies	February 23, 2000
Resubmittal	March 10, 2000
4th round - Technical Analysis w/ deficiencies	June 29, 2000
Resubmittal	September 25, 2000
5th round - Technical Analysis w/deficiencies	November 20, 2000
Resubmittal	January 20, 2001

TECHNICAL ANALYSIS:

ENVIRONMENTAL RESOURCE INFORMATION

SOILS RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.21, 817.200(c); R645-301-220, -301-411.

Analysis:

Chapter 2, Soils, Sections 210 through 224, discusses the soil resources within the proposed Lila Canyon Mine. Relevant soils information is reviewed under the following headings in this Analysis:

- Prime Farmland Investigation
- Soil Survey Information
- Soil Characterization
- Substitute Topsoil

Prime Farmland Investigation

A reconnaissance investigation was performed by the Natural Resources Conservation Service (NRCS) on June 8, 1998. As there is no developed irrigation system and the soils are arid, it was determined that no Prime Farmland nor farmland of statewide importance existed

within the proposed Lila Canyon facilities and coal lease areas. The prime farmland determination letter is included in Appendix 2-1.

Soil Survey Information

The soil survey information contains both general and site specific surveys as follows:

(1) General, Third Order Soil Survey

Appendix 2-2 and Soils Map 2-1 make up the general Order 3 soil survey. The unpublished Order 3 soil survey for Emery County is currently in progress by the U. S. Department of Agriculture, Natural Resource Conservation Service (NRCS), however portions of the Order 3 soil survey relevant to the Lila Canyon Mine project were provided by the NRCS. The soil map (Plate 2-1) is scaled at 1:24,000 and includes map unit descriptions.

The Order 3 soil survey information provided by the NRCS identifies four soil mapping units located within the mine surface facilities area as:

- BNE2 Strych very bouldery, fine sandy loam, 3 to 20 % slopes
- BMD Strych very stony fine sandy loam, 3 to 30 % slopes
- NGG2 Gerst-Strych-Badland complex, 30 to 70 % slopes
- RZH Rock Outcrop-Atchee-Rubbleland Complex

In addition, the Order 3 soil survey (Appendix 2-2) and soil map (Plate 2-1) provide identities and information on the following soil mapping units as located within Permit Area "B" for Lila Canyon boundary as follows:

- DHG2 Comodore-Datino Complex
- DSG 2 (HUG) Midfork-Tingey-Comodore Complex
- GNA Neto fine sandy loam
- KXH Podo-Rock outcrop Complex
- MHE (MSC) Podo sandy loam, 1 to 8 percent slopes
- MRG Vassilla-Rock outcrop-Gerst Association
- MTH Cabba-Guben-Rock outcrop Complex
- MUE Cabba-Podo-Doney Complex
- NGG2 Gerst-Strych-Badland Complex
- NVF2 Gerst-Rubbleland-Badland
- NXC Lazear-Rock outcrop Complex, high rainfall
- RR Rock outcrop
- RWG Rock outcrop-Rubbleland-Vassilla Complex

- RZH Rock outcrop-Atchee-Rubbleland Complex
- UMF2 Guben-Pathead-Rabbitex Association
- VOH Guben-Rock outcrop Complex

Appendix 2-2 also provides typical soil pedon and soil descriptions for the following Soil Series:
Atchee, Cabba, Comodore, Datino, Doney, Gerst, Guben, Lazear, Midfork, Neto, Pathead, Pinon, Podo, Rabbitex, Strych, Tingey, and Travessilla.

(2) Site specific, First Order Soil Surveys

In August 1998, a site specific Order 1 soil survey for the surface facilities area was performed by Mr. Daniel Larsen, Soil Scientist, Environmental Industrial Services, and his report is located in Appendix 2-3. The survey contains soil descriptions, soil pedon descriptions, soil salvage suitability analysis, laboratory soil testing data, field soil profile descriptions, soil and landscape photographs, a soils map, and a salvageable soils map. The detailed soil survey of the surface facilities site identifies six soil map units as follows:

- SBG Strych boulder fine sandy loam, 5 to 15 % slopes
- VBJ Strych very bouldery fine sandy loam, 5 to 15 % slopes
- XBS Strych extremely bouldery sandy loam, 10 to 45 % slopes
- RBL Rubbleland-Strych-Gerst complex, 20 to 70 % slopes
- DSH Strych fine sandy loam variant, 3 to 8 % slopes
- RBT Rock outcrop - Travessilla family complex

All mapping and soil survey work were performed according to the standards of the National Cooperative Soil Survey. Based on the site-specific soil descriptions, and laboratory data, each soil was classified according to current, unpublished NRCS soil taxonomy, and correlated to a specific soil series. The RBT soil unit references the Travessilla family complex; however, the Travessilla family has been revised by NRCS to the Atchee series which is a more appropriate for Map Unit RBT.

Soil productivity of existing soils was determined by Mr. George Cook from the Natural Resources Conservation Services, and results are shown in Appendix 3-7.

An addendum has been attached to Appendix 2-3 to include the Lila Canyon Mine, proposed portal fan site soil evaluation. Two soil descriptions were taken at the site and include pits LC11 and LC12. Rating of soil suitability criteria shows good ratings, except for water holding capacity with a poor rating. Average soil depth is about 15 inches, with a range of about three feet to zero. The deeper soils are at the upper edge of the bench which grade to bedrock sandstone at the lower edge. Soils are derived primarily from colluvial materials.

Soil Characterization

Soil pedons were characterized by the soil horizons at each sampling location. All profile descriptions were recorded on standard NRCS forms and are provided in Appendix D within Appendix 2-3. The soil horizons were sampled and characterized according to the State of Utah Division of Oil, Gas and Mining (DOGM) guidelines for topsoil and overburden[1]. Parameters included: soil texture; pH; organic matter percent; saturation percent; electrical conductivity; $CaCO_3$; soluble potassium, magnesium, calcium and sodium; sodium absorption ratio, and extractable selenium and boron. Available water capacity, alkalinity, total nitrogen and available phosphorus were not analyzed at this time; these parameters can be tested at reclamation time. Organic matter percent was substituted for organic carbon. Soil texture by hand-texture method, rock fragment content (% by volume), and Munsell color were determined in the field by Mr Larsen. Generalized soil properties, including percent surface stones and boulders, are summarized as follows for each soil type:

Table 1. Selected Soil Physical Characteristics.

Map Unit	%Surface Stones & boulders	Soil Depth	% Slope	Permeability	Water Erosion Potential
SBG	3-8	Very Deep >60"	5-15	Moderate to Moderately rapid	Moderate low
VBJ	8-20	Very Deep >60"	5-15	Moderately rapid	Moderate low
XBS	20-40	Very Deep >60"	10-45	Moderately rapid	Low to moderate
DSH	<2	Very Deep >60"	3-8	Moderately rapid	Moderate
RBL	>50	Shallow to Deep	20-70	Slow to moderately rapid	Severe on shale, Low on rock
RBT	>50	Shallow	30-100	Slow to moderately rapid	Severe to Low

Soil samples were sent to Inter-Mountain Laboratories, Inc. for analysis. Appendix C of Appendix 2-3 contains the laboratory data sheets for all analysis on the 22 samples and duplicate analysis. Overall, soil laboratory test results show a good rating for soil materials, except as noted below:

[1]Leatherwood, J., and Duce, D., 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining.

- **pH** was high (rated poor) in only one sample - LC3, 24-48" with pH 8.6. Sample LC4, 40-58" had a pH of 8.2, which is rated fair to good. All other samples tested from pH 7.1 to 8.0 for a good rating.

- **Electrical Conductivity** and **SAR** were high in samples LC3 48-55" and LC5 40-58". For sample LC3 48-55", the SAR was 18 with an EC of 2.48. Since the SAR is greater than 15, soil materials below 48 inches are considered unacceptable. For sample LC5 40-58", the SAR measured 15 with an EC value of 8.89 mmhos/cm. The SAR is rated unacceptable for coarse textured soils and the EC is rated poor; therefore, soil materials below 40 inches are considered marginal at best. Sample LC10 0-4" had an EC of 2.58 mmhos/cm which has a rating of fair. All other EC values were in the "good" range, from 0.29 to 0.67 mmhos/cm.

- **Soil textures** were classified as sandy loam, except for samples LC1 3-10" and LC10 0-4" which were sandy clay loam and silt loam respectively. Based on soil texture, all soils tested are rated as good for reclamation material.

- **Available water holding capacity** values ranged from good to poor. The majority of samples were rated as fair; with LC1 0-3" rated poor; and LC1 10-23", LC5 29-40", LC5 40-58", and LC6 5-18" rated good.

- **Soluble boron** tested at less than 5.0 mg/kg on all samples, resulting in a good rating.

- **Extractable selenium** content tested at 0.02 mg/kg or less, which is considered good since all readings are less than 0.10 mg/kg.

- **Organic matter** content is relatively low in these soils. Generally, the surface soils ranged between 1.0 to 1.5 percent organic matter and the subsoils were about 0.5 percent.

- A **calcic horizon** was verified in soil pedons LC1, LC5 and LC6 with $CaCO_3$ ranging between 20 to 21 percent. Pedons LC3 and LC4 have some $CaCO_3$ accumulation in the subsoil but is less than the 15 percent needed to be classified as a calcic horizon.

- **Soluble magnesium** exceeded soluble calcium below depths of 30 inches. In general for these samples, the soluble calcium decreases and magnesium increases with depth. Normally, higher ratios of calcium to magnesium exist in soil solutions. Calcium is retained much more readily than magnesium on soil colloid exchange sites, resulting in the total amount of calcium in soils exceeding that of magnesium. In this case, however, calcium is being removed from the soil solution by calcium carbonate precipitation. As a result, soluble magnesium exceeds soluble calcium in the lower soil horizons.

- The **percent rock content** within the proposed facilities area is the main deterrent for soil

suitability based on the current DOGM guidelines. Appendix 2-3 states that native soils with a higher rock content than the current DOGM guidelines allow, can be salvaged. DOGM encourages salvaging **native soils** with **intrinsic or indigenous rock content.** Using these natural rocky soils should enhance reclamation success by providing an environment similar to native conditions. Natural, intrinsic rock content provides for a more stable reclaimed surface, aids in water harvesting and water holding capacity of interstitial soils, and creates wildlife habitat and niches on the surface were surface boulders and larger cobble sized rocks are placed. However, care must be taken to avoid higher rock content in surface soils than is present in the undisturbed surface. Every effort should be made to minimize mixing the deeper subsoils containing extremely higher rock content with the surface soils and shallow subsoils containing lower amounts of rock.

Substitute Topsoil

The PAP does not propose any borrow material as a source for substitute topsoil.

Findings:

Information provided in the application considered adequate to meet the requirements of this section of the regulations.

OPERATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-230.

Analysis:

Chapter 2, Soils, Sections 230 through 234, discusses the soils operation plan for the proposed Lila Canyon Mine. Topsoil salvage and stockpiling and subsoil salvage and protection are reviewed under the following headings in this Analysis:

- Topsoil and Subsoil Removal
- Topsoil Substitutes and Supplements
- Topsoil Storage

Topsoil and Subsoil Removal

Available Soil Resources

The 1998 Order 1 soil survey, Appendix 2-3, identifies 157,600 cubic yards of available soil for salvage from the 48 acre disturbance (average salvage depth is 24 inches). This estimate is based on the entire disturbance area, however Plate 2-3, Soil Salvage and Replacement, shows an undisturbed island within the disturbed area boundary. Therefore, 157,600 cubic yards is an over estimation of available topsoil.

Section 232.100, Available Soil Resources Table, identifies a **potential soil salvage** volume of 148,630 cubic yards from a 40.77 acre disturbance area (average salvage depth of 25.4 inches). Table 2 of this technical analysis summarizes the potential soil salvage volumes as presented in the Available Soil Resources table in Section 232.100 of the application. The Available Soil Resources table in Section 232.100 shows **actual topsoil salvage** as 49,440 cubic yards from 23.61 acres for an average salvage depth of 15.6 inches (summarized in Table 4 below).

Table 2. Potential Soil Salvage Volumes.

Potential Soil Salvage Volumes			
Soil Map Unit	**Potential Salvage (inches)**	**Acres**	**Volume (yd^3)**
SBG	48	11.69	75,439
VBJ	30	9.95	40,132
XBS	12	8.89	14,342
DSH	40	1.85	9,949
RBL	8	7.44	8,002
RBT	6	0.949	766
Total		40.77	148,630

Potential salvage depths were generated for each soil map unit based on evaluations of all field and laboratory data, plant rooting depth and subsurface rock content. Soil salvage areas are broken down by soil survey map units and are identified on the Salvageable Soils Map, Appendix A2 of Appendix 2-3, Order 1 Soil Survey. The Salvageable Soils Map shows each soil survey map unit, soil description sites, and potential salvage depths. Typically, the dark colored A horizon is often referred to as topsoil. However, if the A horizon is less than six inches deep, "topsoil" will imply both the A and B horizons that contain fine to very fine roots. Soil salvage

depth, rooting depth and subsurface rock content are compared in Table 3 of this technical analysis

Table 3. Percentage of Rocks and Depth of Fine Roots in the Potential Soil Salvage Layers

Map Unit	Salvageable Soil Layer (inches)	Depth of Fine Roots* (inches)	Subsurface Rock Within Soil Salvage Layer (percent)
SBG	48	48	10 to 65
VBJ	30	18	5 to 65
XBS	12	12	25 to 40
DSH	40	26	<5 to 45
RBL	8	not listed	30
RBT	6	6	35

*Only those soils having fine roots described with a frequency of "many" or "common" were included

Topsoil Salvage Practices

State regulations are specific in requiring that all topsoil be removed from the area to be disturbed (R645-301-232.100). Since the A horizon is less than six inches deep, the Mining and Reclamation Plan (MRP) defines "Topsoil" as the suitable soil for plant growth, generally, the upper 6 to 12 inches that consist of both the A and B horizon materials. Therefore, the MRP states that **actual topsoil salvage** will consist of removing the surface layer (true topsoil) averaging about 8 inches thick over the disturbed area and additional portions of subsoil about 10 inches thick and treating the mixture as topsoil. Large stones, 36" or less, are considered part of the soil layer and are included in the topsoil volume estimates. The Available Soil Resources table (see Table 4 below) in Section 232.100 shows **actual topsoil salvage** as 49,011 cubic yards from 23.43 acres for an average salvage depth of 15.6 inches. Plate 2-3, Soil Salvage and Replacement, shows each of the proposed disturbed soil map units and salvage depth in each unit based on reduced acreage from the undisturbed island within the disturbance area, and on a maximum salvage depth of 18 inches, or down to shale, whichever is less.

The application says the total volume of soil stored in the topsoil pile would be approximately 49,000 cubic yards. Soil recovered from the fan site may be stored near the fan. The applicant needs to indicate where soil from the fan site will be stored. If stored at the fan site, the location of the storage pile needs to be shown on a map together with cross sections of the planed storage pile. If soil from the fan area is not stored in the main topsoil area, the applicant needs to adjust the volume estimation for the main topsoil pile.

Table 4. Actual Soil Salvage Volumes

Actual Soil Salvage Areas	Soil Depth (inches)	Acres	Soil Volume (yd^3)
Topsoil* SBG	18	11.10	26,873
Topsoil* VBJ	18	3.95	9,551
Topsoil* XBS	12	3.94	6,420
Topsoil* DSH	18	1.36	3,291
Topsoil* RBL	8	2.38	2,596
Topsoil* RBT	6	0.88	709
Total		23.43	49,440

* A horizons < 6 inches; topsoil defined as top 18 inches.

Topsoil salvage at the proposed exhaust fan site located near the coal outcrop will be stored on-site, in the immediate disturbance area for fan installation. The proposed fan site is at an elevation of about 6400 feet and is located on a narrow bench, with a slope of about 40 to 45%. The soil survey identifies an approximate salvage depth of 6 inches for the RBT soils. The applicant needs to show the location of the fan site topsoil storage area on appropriate maps in the application.

Topsoil salvage will occur under the supervision of a soil scientist. Topsoil will be removed from excavation areas and stockpiled prior to construction activity. Any vegetation and boulders that might interfere with topsoil salvage will be removed prior to topsoil removal. No attempt will be made to segregate topsoil and subsoil. According to Section 232.100, boulders of approximately three feet in diameter and larger will be separated from the topsoil. The applicant estimates there are about 10,000 cubic yards of these boulders above ground, and this volume is in addition to the topsoil volumes. These will be piled or placed at appropriate locations, such as adjacent to roads and pads, but no attempt will be made to collect them into common piles. Rocks less than three feet in diameter will be stored with the topsoil.

Topsoil removal sequence will start from the lower elevations of the site and proceed up slope. Surface disturbance may not be required on all of the acreage identified as "Disturbed Area." i.e. Plate 2-3, Soil Salvage and Replacement, shows three undisturbed islands within the disturbed area boundary. Soil will be salvaged from localized areas within these undisturbed islands as follows:

1. **Topsoil Pile Access.** Plate 2-3 shows an access road to the topsoil. Soil on this road needs to be salvaged before construction.

2. **Topsoil Pile Storage Area.** Plate 2-3 shows a rectangular topsoil storage area. The Division recommends scraping the top 18 inches of soil from the VBJ soils in this area and using the topsoil to form berms around the perimeter of the topsoil storage yard. This initial clearing of topsoil from the interior of the topsoil storage yard will allow free equipment access throughout the area. At reclamation time, the compacted subsoils can be ripped and the bermed topsoil replaced.

The Disturbed area boundary must include topsoil storage area , but need not include the disturbed area shown on Plate 7-1 as DA-1. In fact, Plate 7-2 shows drainage control structures (DD-1) on the south side of the disturbed area (DA-1), yet the application presents no plans to salvage soil from this area (Plate 2-3). The disturbed drainage ditch (DD-3) should handle the disturbed area drainage and it would seem that construction of DD-1 is needless disturbance. The Utah regulatory program specifies that measures should be taken to disturb the smallest practicable area of disturbance (R645-301-331. Therefore, the Division would like to see DD-1 removed from the Mining and Reclamation Plan.

Subsoil Segregation and Salvage Practices

Section 232.100 of the application states that after topsoil removal, underlying subsoil will be used as fill or left in place. Subsoils have increased carbonates and large percentages of rocks (> 70%). Within the RBL and RBT soil areas, Mancos Shale is encountered within 6 - 8 inches. In no case will the Mancos Shale be salvaged with the overlying soils (Section 232.300). All practical precautions will be taken during design, construction, and reclamation to assure that shales or shale material will not be pushed over the top or mixed with un-salvaged subsoils (Section 232.100, page 12).

Regulation R645-301-232.500 says the Division may require that the B horizon, C horizon, or other underlying soils be removed and segregated, stockpiled, and redistributed as subsoil if it finds that such subsoil layers are necessary to comply with the re-vegetation requirements of R645-301-353 through R645-301-357. While it is difficult to determine exactly how much soil is needed, studies of plant phenology have clearly shown that plants in arid areas use soil water from increasing depths as the growing season continues, and if there is inadequate rooting depth, production and vegetative cover will decrease.[2] A good indication of the depth of soil needed is the rooting depth of the plants currently growing on the site, as reported in the Order I soil survey (see Table 3 above).

The MRP states that subsoil deeper than18 inches from Soil Map Units SBG, DSH, and

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[2]Baker, Paul B. 1988. Nutrient and Water Relationships between Crested Wheatgrass and Two Shrub Species. M.S. Thesis. Utah State University. Logan.

VBJ will not be salvaged and will remain for use as construction fill during grading activities. Although these subsoils will be used as fill, they will be needed during reclamation to reestablish rooting depth potential. Therefore, contamination of the subsoil with shale will not be permitted (Section 232.100, page 12). Furthermore, a certified soil specialist will be on site during any pad construction and reclamation.

Plate 2-4 shows the locations of cuts and placement of subsoil fills during construction of the operations. The reverse operation will occur during reclamation (Section 242.100): where upon the identified subsoil will be replaced in its approximate original location. The volume of these subsoils should be included in the application.

Plates 5-7A through 5-7C are cross sections of the existing, operational, and reclamation topography. Using these plates, the Division has cross checked the cut and fill areas shown on Plate 2-4. It seems that at Station 10+00, the cross sections do not agree: Plate 2-4 shows a fill where Plate 5-7A-3 shows a cut at reclamation. The vertical scale on plates 5-7A through 5-7C is 1" = 50', this scale is not sufficient to use the cross sections as checks against all of cut and fill areas shown on the Soils Transfer Map, Plate 2-4. (Some of the soils are being cut 23 inches deep and some are cut 99 inches deep. Some are being placed 53 inches deep and some are being placed 1" deep.?) Detailed cross sectional maps of a larger scale would be appropriate to show the subsoil cut and storage areas.

Without such detailed cross-sections, the best way to ensure subsoil recovery from Soil Map Units SBJ, DSH, and VBJ is through the use of pedestals during pad development (for comparison with the salvageable Soils Map Appendix A-2) followed by an as-built map which shows locations of the soils as they are stored in the pad. Commitments to use pedestals for verification of subsoil removal depth and to create an As-Built are needed in the Mining and Reclamation Plan.

During operations, protection of subsoil is addressed in Section 232.500: "Subsoils being used as pad material will be protected by a surface of asphalt, concrete or gravel. Those areas covered by gravel will have an impervious membrane placed between subsoil and gravel."

Adverse Conditions

Section 232.710 says soil will not be removed from the area between the rock slope and the ROM stockpile due to rockiness and steep slopes. For the same reasons, disturbance will be minimal in this location, with only two bents planned to hold the conveyor.

Measures to protect the unsalvaged, undisturbed soil will include:

- Jersey barriers along the perimeter of the ROM stockpile to prevent encroachment of coal onto the undisturbed ground (Section 232.710).
- Quarterly inspections of the undisturbed area (Section 234.220).

- Periodic cleaning of the undisturbed area soil, if the accumulation of coal fines exceeds one inch (Section 232.710 and 234.200).
- A covered conveyor and an enclosed crusher (Plate 5-8). (Plate 5-8 shows and incorrect North arrow direction.)

Wind blown coal fines and coal spills will inevitably adversely affect the soil. Additional measures could include establishment structures similar to snow fences. What direction is the prevailing wind?

Topsoil Substitutes and Supplements

Sections 224, 231.200, 232.720, 233, and 233.100 thru 233.400 state that no topsoil borrow or substitute topsoil is needed.

Refuse Pile

Under the definitions in R645-100, the material generated in excavating the rock slopes is considered underground development waste (coal mine waste) that must be disposed of in a refuse pile. In addition to the rock slope material, coal processing waste and other underground development waste will be disposed of in the refuse pile. Appendix 5-7 indicates that 25,000 CY of refuse will be generated. This refuse will be examined and tested as necessary (page 82 Section 536.) More detail is required to inform the Division of what testing will occur and with what frequency. This detail might extend to any refuse encountered over the life of the mine.

Plates 5-2 and 7-5 show rock storage areas north of the slope, rock and refuse storage area. As discussed in Section 232.100 (page 12) of the application, boulders may be stockpiled in these locations. These sites are not coal refuse disposal areas.

Figure 1 Appendix 5-7 differentiates between structural fill (rock slope waste) and refuse. The area designated for refuse is approximately two acres (300' x 300') and can hold 19,500 cubic yards.

The MRP plans for four feet of cover over the refuse pile (section 232.500 and Appendix 5-7. Topsoil will be salvaged to a depth of 18 inches and stored in the stockpile. The subsoil will be excavated an additional 30 inches and pushed to the side. Refuse material will be placed in the excavated four foot hole created from the subsoil removal (Section 232.500 and Appendix 5-7). Once the hole is filled, the subsoil will be placed over the top of the refuse. Another hole will be excavated by removing subsoil adjacent to the previous hole. The topsoil removal and storage, subsoil removal, refuse placement, and subsoil replacement procedures will be repeated as additional refuse disposal is needed.

This process is shown in Figure 2, Appendix 5-7. From this figure, one can see that refuse placement will actually exceed the excavation to create surface which is level over the

entire structural fill area. Although the excavation is only 4' deep, refuse will be placed 15 to 19 feet deep. Figure 2, Appendix 5-7 appears to show an abrupt end to the rock slope and refuse pile storage area. The rock slope/refuse pile should blend into the surrounding terrain. The Division would like to see a profile of the length of the rock slope/refuse pile.

The part of the disposal site reserved for coal mine waste as shown on Figure 1, Appendix 5-7 is in the DSH soil mapping unit. The Available Soil Resources table in Section 232.100 indicates the potential salvage depth in this unit is 40 inches. According to the plan for the refuse pile, 18 inches of soil would be salvaged from the entire refuse pile area, and an additional 30 inches of subsoil would be moved to the side to facilitate burial of the refuse. This goes eight inches below the potential salvage depth for this mapping unit; however, it does not appear there are serious restrictions to the soil between 40 and 48 inches. Below 48 inches, however, there are serious restrictions due to high rock contents and salt levels. The Division wants to ensure that the subsoil below 48 inches from the DSH soil mapping unit is not utilized during reclamation for plant growth medium. For this reason, a commitment in the Mining and Reclamation Plan is requested to provide pedestals during construction to verify soil removal depths.

Topsoil Storage

The topsoil stockpile will be located and protected to avoid contamination and unacceptable compaction. The plan further states that the stockpile surface will be left rough and irregular to increase moisture retention during rainfall and snow melt. Seeding will be done following topsoil placement and after September 15. A silt fence or berm/ditch configuration will be used at the perimeter of the pile to protect against soil loss from water erosion.

Topsoil storage is addressed in several locations in the MRP: Section 231.100 (soil removal) ; Section 231.400 (pile construction) ; Section 232.100 and Figure 1 Appendix 5-7 (pile dimensions and storage capacity); Plate 5-2 (location and cross sections);Section 234.230 (mulching and seeding); Table 3-4 (stockpile seed mix).

An approximate location is given for the topsoil to be salvaged from fan portal disturbance along with the fan topsoil pile configuration on Figure 1 Appendix 5-7. How will the soil be salvaged from the fan site?

Findings:

Information provided in the application is not adequate to meet the requirements of this section of the regulations. The applicant must provide the following in accordance with:

R645-301-232, Salvage soil from all areas that would be disturbed by coal mining and reclamation activities including the access road to the topsoil pile and around the topsoil pile location.

R645-301-521.162 and R645-301-232.100 Clearly identify the proposed disturbed area on all maps and salvage topsoil from areas designated to be disturbed. i.e. compare DA-1 and DA-9 shown on Plate 7-2 with the same areas on Plate 2-3.

R645-301-231.100 and R645-232.500 Use pedestals or other survey method to verify subsoil salvage depth according to Salvageable Soils Map Appendix A-2 and provide an As-Built map showing the location and volume of the subsoil stored in the pad for use as additional rooting media.

R645-301-234.100 Outline how soil from the fan site will be salvaged.

R645-301-553.252 Provide information on the details of testing of rock slope waste and other refuse: at what frequency will the gob be sampled? And what parameters will be analyzed?

R645-301-331 Remove ditch DD-1 from the Mining and Reclamation plan in an effort to disturb the smallest practicable area.

R645-301-536 a) Adjust Figure 2, Appendix 5-7 cross sections to show that the rock slope/refuse pile blends into the surrounding terrain; and, b) Add a cross section showing the profile of the rock slope/refuse pile.

R645-301-512.120 Verify the direction of the North Arrow on Plate 5-8.

RECLAMATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-240.

Analysis:

Chapter 2, Soils, Sections 240 through 244, discusses the soils reclamation plan for the proposed Lila Canyon Mine. The following topics are discussed in this Analysis:

- Soil Redistribution
- Soil Nutrients and Amendments
- Soil Stabilization

Soil Redistribution

Section 240, Reclamation Plan, describes the steps taken for reclamation. Reclamation will begin once all surface facilities and structures have been demolished and removed. Disturbed areas will be restored to approximate original contour (AOC) using pad material.

In Section 232.500, the application says subsoil ranging in thickness from 12 to 30 inches from cutslope sites will be used as fill material for site development and replaced in an approximate original sequence during reclamation. Subsoil from Soil Map Units SBJ, DSH, and VBJ used as construction fill need to be identified and used appropriately during reclamation as root zone subsoils, as previously discussed.

Section 241 says that after AOC is achieved, the disturbed surface will be scarified where practical, prior to soil redistribution. Rippers mounted on the rear of a dozer will be used to "scarify" the disturbed surface. Ripping will be on a minimum of 6 feet spacing (Section 241, page 19). The application needs to say to what depth the area would be ripped.

The applicant needs to give more detail of the grading sequence with regard to subsoil and ripping. It is unclear from the brief discussion of ripping whether the subsoil will be ripped after being replaced or if ripping will only be done on fill before the subsoil is replaced. The Division suggests grading be done in approximately the following order:

1. Grade all areas where no subsoil is being stored.

2. Replace subsoil on areas from which it was moved.

3. Rip the subsoil.

4. Replace topsoil.

5. Replace boulders.

6. Gouge the topsoil.

Soil replacement volumes are shown below in Table 5. Soil replacement includes topsoil placement and 4 feet of soil cover over the refuse area. This table does not show volumes of subsoil to be used in pad construction.

After topsoil redistribution, pocking will be the primary method for roughening the surface. Pocking is described in Figure 1, Appendix 5-8, as imprinting the soil surface with a pattern of depressions measuring approximately 36 inches across by 8 inches deep. The purposes for pocking are to capture and retain moisture and to provide a cradle for seedlings and

vegetation. Best available technology will be used for enhancing the ability of the soil to absorb moisture.

Section 242.100 says previously stockpiled topsoil will be redistributed on the same areas in a thickness which approximates the reclaimed thickness on the scarified, post-mining graded surface. The plan states that every reasonable effort will be made to replace the same thickness of salvaged soil to each respective area.

On flat areas, soil will be reapplied using road grader and/or crawler tractor. On steep slope areas, soil will be reapplied using a front-end loader, crawler tractor, and/or trackhoe. Boulders will be replaced to achieve a near natural surface condition.

Table 5. Soil Replacement Depths and Volumes.

Soil Replacement Reclamation Needs	Soil Depth (inches)	Acres	Soil Volume (cubic yards)
Rock Slope & Waste Rock Storage	30^	3.4	13,307
Topsoil* SBG	18	11.10	26,873
Topsoil* VBJ	18	3.87	9,364
Topsoil* XBS	12	3.87	6,250
Topsoil* DSH	18	1.36	3,291
Topsoil* RBL	8	2.35	2,524
Topsoil* RBT	6	0.88	709
Total			62,318

* Since the A horizons are less than 6 inches, the plan identifies topsoil as the top 18 inches or all material down to shale, whichever is less.
^ Does not include the 18 inch topsoil placement.

Soil Nutrients and Amendments

Section 241 states that an inoculum will be applied to the soil to help assist in reactivating and regenerating soil organisms. The seed mixture will be either hand broadcast over the area and raked into the soil surface, or sprayed on the surface using hydro-mulch. A wood fiber mulch will be hydro sprayed over the seed bed, then the surface will be sprayed with a tackifier. The tackifier will be applied at a rate of 50 pounds per acre.

Section 231.300 and Section 243 state that topsoil will be sampled and tested prior to replacement to determine what nutrients are necessary at reclamation time. Grab samples will be collected from the stockpile at various locations and depths. Fertilizer, if needed, will be applied

to the topsoil prior to seeding and mulching activities. Sampling will either be performed by a Certified Soil Scientist, or by a person considered to be qualified by the operator and the Division of Oil, Gas and Mining.

Soil Stabilization

Section 244.100 states that vegetation will be the primary method for controlling erosion and fugitive dust. Other measures that will help in erosion control and soil stabilization are pocking and rock placement. In addition, wood fiber mulch will be applied at a rate of 2,000 pounds per acre to the reclaimed areas that have been graded and covered by topsoil or substitute topsoil. The wood fiber mulch will be tacked to the surface with a tackifier.

Section 244.200 states that pocking will be the primary method used to roughen the soil surface as per Figure 1 in Appendix 5-8.

Findings:

Information provided in the application is not considered adequate to meet the requirements of this section of the regulations. The applicant must provide the following in accordance with:

R645-301-241 and R645-301-242, Specify the depth of ripping and provide detail of the sequence of ripping and subsoil placement. i.e. ripping comes after grading, but before subsoil rooting medium placement.

RECOMMENDATIONS:

The application should not be approved until the applicant has adequately addressed the deficiencies discussed in this memorandum.

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