0015

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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May 11, 2001

TO: ~~Internal File~~

THRU: Paul B. Baker, Team Lead

FROM: Priscilla W. Burton, Soils Reclamation Specialist

RE: Soils Technical Analysis of the Wild Horse Ridge Significant Revision, Co-Op Mining Company, Bear Canyon Mine, [redacted]5-SR98(1)-5.

SUMMARY:

Wild Horse Ridge will add 7.3 acres of disturbed area to the permit. Of those 7.3 acres, 3.6 acres require topsoil salvage. The 8,700 cubic yards of salvaged topsoil will be stored in a single pile formed on a slope between the lower conveyor access road and a catch basin on the right fork of Bear Creek.

The chronology for the Wild Horse Ridge Significant Revision (SR) is as follows:

Action	Date
Original SR submitted	12/18/1998
Administratively incomplete, SR returned	2/19/1999
Resubmitted	9/27/1999
Administratively Complete	11/3/1999
1st review findings - technically deficient	1/24/2000
Resubmitted	5/8/2000
2nd review findings - technically deficient	6/28/2000
Resubmitted	1/24/2000 and 3/26/2000

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 8, Soil Resources, Sections 8.1 through 8.7, discusses the soil resources within the proposed Wild Horse Ridge project for the Bear Canyon Mine. Relevant soils information includes prime farmland investigation, current and past soil surveys, soil characterizations, and substitute topsoil identification. The Analysis section discusses resource information as follows:

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

Prime Farmland Investigation

A Prime Farmland site investigation was performed by the Natural Resources Conservation Service (NRCS). A negative determination was made for Prime Farmland or farmland of statewide importance within the proposed Wild Horse Ridge area (sections 24 and 25 T.16S. R. 7E. and sections 19 and 30 T.16S.R. 8E). The determination letter from the NRCS is dated July 9, 1999, and is included in Appendix 8-C.

Soil Survey Information

Chapter 8 supplies soil resource information for the Bear Canyon Mine and the proposed Wild Horse Ridge expansion based on six soil surveys as follows:

1. 1980. Soil and vegetation survey for Bear Canyon, USDA San Rafael Soil Conservation District and the Soil Conservation Service, Appendix 8-B pp 1 to 13.
2. 1990. Order I soil survey, USDA Soil Conservation Service, Appendix 8-B pp 13
3. 1992. Substitute topsoil survey for Bear Canyon, Appendix 8-E.
4. 1996. Soil samples collected by Co-Op for Wild Horse Ridge. Appendix 8-F.
5. 1998. Order II soil survey of Wild Horse Ridge, USDA Natural Resource Conservation Service.
6. 1999. Order I soil survey of Wild Horse Ridge, conducted by Environmental Industrial Services, Appendix 8-F. The survey incorporates information from the

1998 Order II, NRCS soil survey and the 1996 soil sampling. The Wild Horse Ridge site contains seven soil mapping units as follows:

A Pathead-Cabba Complex, 30 to 70 % slopes
B Winetti, High Elevation, 5 to 30 % slopes.
C Winetti, High Elevation-Rock Outcrop, 10 to 30 % slopes
D Doney, Deep, 10 to 30 % slopes
E Datino-Guben Complex, 30 to 80 % slopes
F Guben-Pathead Complex, 30 to 80 % slopes
G Doney-Cabba-Podo Complex, 30 to 80 % slopes

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 of the soils was classified according to current NRCS soil taxonomy, and correlated with NRCS's Order II soil survey. Documentation of field data is presented in Map B-Soil Data Collection Map; Appendix C-Field Soil Profile Descriptions and Transect Data; Appendix D-Soil Profile and Landscape Photographs. Appendix F contains information comparing soil mapping units between the 1999 Order I soil survey to NRCS's Order II soil survey. Adjustment summarizations were given for each specific change in identifying and renaming soils within the Wild Horse Ridge area.

The 1990 and 1999 Order I soil survey for the Bear Canyon Mine and Wild Horse Ridge cover approximately 32 acres in Bear Canyon and in the Wild Horse Ridge mine expansion area. Approximately 480 acres are mapped on two soil maps (Plate 8-1 and Plate 8-1A) which are scaled at 1-inch equals 200-feet, with 5-foot contour intervals. A total of 10 different soil mapping units are identified. Plate 8-1 shows three soil mapping units as DZE, PDR, and TR, with "D" identified as disturbed area soils. These three mapping units are for the existing Bear Canyon Mine disturbance area. Plate 8-1A identifies the 7 soil mapping units as contained in the 1999 Order I soil survey for the Wild Horse Ridge mine expansion project as follows:

Appendix 8-F Soil Map Unit	**MRP Soil Map Unit**	**Soil Name**
A	PC	Pathead-Cabba Complex
B	WIN	Winetti, High Elevation
C	WR	Winetti, High Elevation-Rock Outcrop
D	DON	Doney, Deep
E	DG	Datino-Guben Complex
F	GP	Guben-Pathead Complex
G	DCP	Doney-Cabba-Podo Complex

Appendix 8-F identifies the approximate range and average soil salvage depth for each soil map unit, based on evaluations of all field and laboratory data, plant rooting depth and soil rock content. In the following table, DOGM staff has itemized the depth of salvage along with root and subsurface rock information for each soil type:

Map Unit	Salvage Layer (inches)		Fine Roots Rooting Depth (Inches)	Subsurface Rock Within Soil Salvage Layer (Percent)
	Approximate Range	Average Depth		
PC	8 - 15	12	15	<5 to 45
WIN	10 -30	15	no pit	no pit information
WR	0 - 20	10	24	50 to 60
DON	30 -60	40	60	7 to 15
DG	20 - 40	30	20	45
GP	0 - 30	10	36	60
DCP	6 - 30	15	34	12 to 40

Soil Characterization

Section 8.3, Soil Information, identifies and describes each of the 10 soil groups as contained in the 1990 and 1999 Order I soil surveys. Soil descriptions for each of the 10 soil mapping units are summarized in Table 8.3-1 and in Section 8.3.2.

Wild Horse Ridge

In May 1999, a site specific Order 1 soil survey for the proposed Wild Horse Ridge project area was performed and prepared by Mr. Daniel Larsen, Soil Scientist, Environmental Industrial Services (Appendix 8-F). The detailed survey contains soil descriptions, soil pedon descriptions, soil salvage suitability analysis, laboratory soil testing data, field soil profile descriptions, soil and landscape photographs, soils map, soil data collection map and salvageable soils map. 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 C within Appendix 8-F. Field parameters for each soil pedon description includes horizon information, soil color, texture, rock fragment, soil structure, roots, clay films, and effervescence with 0.1N hydrochloric acid. In addition, general site descriptions include vegetation, climate regimes, land form physiography, relief, elevation, slope, aspect, erosion condition, permeability, drainage class, depth to saturation (ground water) if encountered, salts or alkali if present, and surface rock. Generalized soil properties are summarized as follows for each soil type:

In 1996, four soil pits (WHRS-1 thru WHRS-4) were analyzed in the Wild Horse Ridge planned disturbance area. Test results are included with the Order I soil Survey in Appendix F. Pit locations are shown on Plate 8-1A.

Map Unit	Map Symbol	Land Form	% Slope	Parent Material	Soil Depth	Texture	Rock Fragment Class	General Vegetation
A	PC	foothills	30-70	colluvium and shale	shallow to deep	sl, l, cl	stony to very cobbly	Pinion-Juniper
B	WIN	narrow canyon bottoms	5-30	alluvium and colluvium	deep	sl, l, ls	gravelly to bouldery	Cottonwood Douglas-fir Dogwood Wildrose
C	WR	narrow canyon bottoms	5-30	alluvium, colluvium and sandstone	shallow to deep	sl, l, ls	gravelly to bouldery	Cottonwood Douglas-fir Dogwood Wildrose
D	DON	toe slope, slight bench	10-30	colluvium, slope wash	deep	sl, l, ls	non-stony to stony	Ponderosa Pine Juniper Douglas-fir
E	DG	steep canyon slope, north aspect	30-80	colluvium and shale	moderate deep to deep	sl, l, cl	very stony to non-stony	Douglas-fir Pinion Mt. Mahogany Serviceberry
F	GP	canyon side slope	30-80	colluvium, sandstone and shale	shallow to moderate deep	sl, l, cl	very stony to bouldery	Douglas-fir Pinion Mt. Mahogany
G	DCP	steep canyon slope, south aspect	30-80	sandstone, shale and colluvium	shallow to moderate deep	sl, l, cl	very stony to non-stony	Pinion-Juniper Grass

Seven soil samples were selected from representative soil layers during soil inventory and were characterized according to the State of Utah Division of Oil, Gas and Mining (DOGM) guidelines for topsoil and overburden[1]. Sampled parameters include: pH; electrical conductivity; saturation percent; SAR includes Ca, Mg, and Na; texture includes % very fine sand, sand, silt and clay; TOC includes organic matter percent; $CaCO_3$; Boron ($CaCl_2$ extraction); Selenium (AB-DPTA extraction); AWC includes 1/3 and 15 bar analyses; and ESP.

Soil samples were sent to Inter-Mountain Laboratories, Inc. for analysis. Appendix B contains the laboratory data sheets for all analysis on the seven samples. Some summaries of soil laboratory results are noted below, excluding sample CW10-1 which is discussed below:

[1]Leatherwood, James and Dan Duce. 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.

Parameter	Results (Range)	DOGM Rating *
pH	7.4 - 7.8	Good
EC (mmhos/cm)	0.33 - 0.64	Good to Poor
Saturation %	30 - 48	Good
SAR	0.3 - 0.7	Good
Texture	SIL, SL, L	Good
Boron (mg/Kg)	0.5 - 1.6	Good
Selenium (mg/Kg)	<0.02	Good
Avail Water Cap. (in/in)	0.06 - 0.14	Fair to Good

* State of Utah Division of Oil, Gas and Mining (DOGM) guidelines for topsoil and overburden.

For all soils, except CW10-1, soil tests indicate that the soils generally rate fair to good for reclamation use. The one exception is soil sample CW10-1, which was taken from a light-colored soil layer at about 20 to 30 inches in depth on a road cut in Soil Map Unit F. The sample was taken to document properties of a calcic horizon in a Guben soil. Soil test results indicate an unacceptable level of selenium (0.26 mg/Kg) and a poor rating for electrical conductivity (10.2 mmhos/cm). The sample was also higher in boron (2.5 mg/Kg), calcium (7.5 meq/L), magnesium (160 meq/L), sodium (35 meq/L), SAR (3.7) and pH (8.3) than the other soil samples. The CW10-1 sample site is at the edge of the existing road accessing the future portal site. The soil survey states that Co-Op Mining does not anticipate that this soil would be involved in site disturbance for portal development and that further assessment may be required if disturbance along this section of road is proposed. Every effort should be made to minimize disturbing and/or mixing the deeper subsoils (20 to 30 inches) of this section of road cut.

The **percent rock content** within the mine site disturbance or proposed facilities area is the main deterrent for soil suitability based on the current DOGM guidelines. Although DOGM suitability criterion considers >30% (by volume) rock fragments (for both gravels <3" in size and cobbles 3 to 10" in size) to be unacceptable, and >10% stones and boulders >10" in size to also be unacceptable, the recent trend by DOGM is to salvage **native soils** with **intrinsic or indigenous rock content.** Using indigenous rocky soils should enhance reclamation success by providing an environment similar to native conditions. However, higher rock content greater than is present in the surface soils needs to be avoided. 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.

Substitute Topsoil

The PAP does not propose any borrow as a source for substitute topsoil. However, in 1992, in-place overburden and disturbed soils within the facilities area, were evaluated for use as substitute topsoil material. Results are contained in Appendix 8-E.

Findings:

Information provided in the application is 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 8, Soil Resources, Section 8.8, Removal, Storage and Protection of Soils, and Section 8.9, Selected Overburden Materials or Substitutes, and Appendix 3O, Wild Horse Ridge are all pertinent to the discussion of the plan for topsoil salvage and protection during operations of the proposed Wild Horse Ridge area. Five tables in the plan for the Wild Horse Ridge area are also key to the discussion of soil salvage activity:

Table 8.9-3 Summary Table
Table 8.3-2, Soil Unit Acreage Within the Disturbed Area,
Table 8.9-1, Reclamation Area Summary, and
Table 8.11-1, Final Grading Test Sample Density.
Table 3O-1, Summary of Cut and Fill Volumes

The Applicant considers the Summary Table 8.9-3 as being the most accurate table in the plan.[2] All other Tables must reconcile with this one. Table 8.3-2 divides recontour acres by soil type, with soils PC, WIN, WR, DON, DG, GP, DCP being located within the 3.6 acre Wild Horse Ridge disturbance. Table 8.9-1 divides recontoured areas by designated operational areas. Table 8.9-1 divides the recontoured areas by disturbed area. Tables which include disturbed acreage values all agree that the total disturbed acreage for Wild Horse Ridge is 3.6 acres.

This discussion of operational practices will cover the following topics:

- Topsoil and Subsoil Removal

[2]Personal communication with Charles Reynolds during site visit 3/23/01.

- Topsoil Substitutes and Supplements
- Topsoil Storage

Topsoil and Subsoil Removal

Topsoil Salvage Volumes

Topsoil salvage areas are identified on the Soil Suitability Map C, Appendix 8-F, Order 1 Soil Survey. Cut and fill volumes are located in Table 3O-1 of Appendix 3-O, Wild Horse Ridge Blind Canyon Seam Pad and Conveyor Access Roads.

Table 3O-1 shows 8,700 CY of topsoil salvaged from the lower conveyor access road (1,669 CY), the upper conveyor access road (2,171 CY), and the Blind Canyon seam portal pad (4,860 CY). This soil will be stored in wooded area between the proposed lower conveyor access road and the right fork of Bear Creek as shown on Plate 8-7, WHR Topsoil Stockpile and Plate 7-1F, Hydrology Map.

Section 8.9.6 indicates that the soil below the stockpile (Doney soil, map unit D) could provide an additional 2, 354 CY of topsoil during reclamation. This additional soil is included in the summary Table 8.9-3 as being available. Therefore, the sum total provided for Wild Horse Ridge in Table 8.9-3 (11, 054 cubic yards) is 2,354 cubic yards more than that itemized in Table 3O-1. Table 3O-1 itemizes 8, 700 cubic yards of topsoil will be recovered as does the narrative on page 8-41.

Table 8.3-2 projects that approximately 11,049 CY of soil will be salvaged from all the Wild Horse Ridge area. The Division arrived at the 11,049 CY figure by multiplying the "acreage with topsoil recovered" column by the "estimated topsoil depth column" for soils with symbols PC, WIN, WR, DON, DG, GP, DCP (see Table below). This approximation of 11,049 includes the Doney soil which will be buried under the WHR topsoil pile. This approximation is within 5 yards of the 11,054 CY of topsoil stated in Table 8.9-3, the difference is probably due to rounding errors.

Wild Horse Ridge Topsoil Areas and Available Salvage Volumes

Soil Map Unit	Estimated Salvage (inches)	Total Disturbance Acres	Potential Volume (yd^3)	Projected Salvage Acres	Projected Volume (yd^3)
PC	12	0.53	1,097	0.41	661
WIN	15	2.45	4,255	0.52	1,049
WR	10	0.72	968	0.50	670
DON	40	0.45	2,312	0.43	2,310
DG	30	1.71	7,058	1.44	5,808
GP	10	1.16	1,560	0.08	107
DCP	15	0.28	383	0.22	444
Total		7.30	17,633	3.60	11,049

In Table 8.9-1, reclamation areas for the Wild Horse Ridge are labeled TS-12, TS-13, TS-14, and TS-15. Table 8.9-1 itemizes the acreage to be reclaimed within each area and acreage to be graded within each of these areas. According to Table 8.9-1, areas TS-12 through TS-15 will add 7.3 acres of total area to the permit. All of the 7.3 acres will be reclaimed, however, only 3.6 acres will require recontouring during reclamation. The difference is due to:

- The Wild Horse Ridge access road, 3.04 acres of which is pre-existing; and
- The lower conveyor belt access road, 0.36 acres of which will not require grading during final reclamation; and
- The upper conveyor belt access road, 0.3 acres of which will not require regrading during final reclamation.

Re-contour acres agree with projected soil salvage acres for Wild Horse Ridge. Table 8.9-1 shows re-contouring on 3.6 acres while Table 8.3-2 shows projected soil salvage over 3.6 acres.

The plan states that actual soil salvage depth and resulting volumes may vary according to actual conditions as they are encountered in the field during construction. State regulation R645-301-232.100 is specific in requiring that all topsoil be removed from the area to be disturbed. The plan states that Charles Reynolds or other supervisory personnel approved by the Division will be present during topsoil salvage to instruct equipment operators in the proper techniques of salvage and to ensure that required horizons are removed. Approved supervisory personnel will document topsoil salvage operations, including salvage history, soil salvage areas, soil salvage volumes, and soil placement in the stockpiles.

Subsoil Segregation and Soil Salvage Practices

In several of the soil mapping units the topsoil is less than six inches. State regulations state that if topsoil is less than six inches, the operator may remove the topsoil and the unconsolidated materials immediately below the topsoil and treat the mixture as topsoil. Therefore, the Order I soil survey, Appendix 8-F, shows that topsoil salvage will include the topsoil and the horizon immediately below the topsoil, based upon rooting depth and other criteria established in the Order 1 soil survey soil salvage will be between 10 and 40 inches.

A single elevated report of selenium was noted in Guben-Pathead soil taken from a cutslope near the switchback of the existing Wild Horse Ridge Road. The site of the sample is shown on Map B in Appendix F as CW 10 (20 - 30 inches depth). The road to the No. 3 Mine will be constructed from this in-place material: page 3-7 of PAP states, "the road base material was analyzed, none of the soil investigations revealed any acid- or toxic- forming materials." This statement is not entirely correct as high EC (10.2 mmhos/cm) and elevated selenium (0.26 mg/kg) were reported from 20 - 30 inches in the GP soil. The area of discussion is only 0.08 acres. The top ten inches of this soil will be salvaged and placed in the topsoil pile. The Division will allow the use of the subsoil as road base because of the very small acreage involved and because the level of selenium identified is within the limit of 0.3 ppm in upland ephemeral drainage as recommended in the soon to be published revised soil guidelines.[3]

Adverse Conditions

Section 8.9.6, Wild Horse Ridge Disturbance, states that topsoil salvage will vary where bouldery material precludes accurate salvage of the specified depths. If bouldery surface areas and otherwise steep areas are accessible to construction machinery, then soils in these same areas are expected to be salvaged. Either steep, rocky surface slopes are safe for constructing cut slopes and likewise soil salvage, or they're not safe for either activity. Likewise, if steep, rocky slopes and extremely bouldery surface materials render themselves suitable for construction and as construction fill using conventional construction equipment, then these same areas and indigenous materials can be rendered suitable for topsoil salvage. Therefore, the plan states that topsoil will be salvaged from all areas accessible by equipment, including bouldery and steep slopes.

Rocks - Boulders and Large Stones

Reference to Robert Davidson's discussion with Jim Nyenhuis (Nyenhuis 1997) concerning salvaging soils with higher rock content has been misrepresented in the Appendix 8-F, Section 2.5, Soil Suitability for Salvage. The general idea is to salvage otherwise suitable soil

[3]Burton, Priscilla and Robert Davidson. 2001. Guidelines For Management of Topsoil and Overburden.. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining. This document has been reviewed by academics and regulatory personnel and will be published after review by industry representatives.

containing indigenous amounts of rock that are typical within the soil salvage area. The main idea is that higher rock content (than Division guidelines deem acceptable) offer a greater potential for reclamation success as follows:

- Allow a greater potential for moisture infiltration into the interstitial soils.
- Provide for a more stable reclaimed surface.
- Provide additional surface cover in sparsely vegetated areas, thus helping protect against raindrop impact and resulting soil surface erosion.
- Create wildlife habitat niches.
- Create micro-climates for plant establishment and vegetation survival.

Topsoil Substitutes and Supplements

Wild Horse Ridge topsoil pile is estimated as containing the 8,700 CY of salvaged soils and 2, 354 CY of soil beneath the pile (in-place) for a total of 11,054 CY of soil. The native, undisturbed soil held in place will be demarcated by permeable fabric strips placed over the soil surface prior placing salvaged topsoil in the stockpile. Co-Op Mining has proposed using the additional 2,354 CY of topsoil held in place for other areas during reclamation; therefore, this soil is actually considered soil borrow.

Topsoil Storage

The Section 8.9.6 states that the Wild Horse Ridge topsoil stockpile will be located in the lower section of the right fork of Bear Canyon in the area of soil map unit "DON" (Plate 8-1A). The topsoil stockpile is shown on Plate 2-4F in the lower convergence section between the primary No. 3 mine access roads and the primary conveyor access road No. 1.

The topsoil pile will be located adjacent to a catch basin which will be created in the ephemeral drainage. The topsoil pile itself will be approximately ten feet in elevation and 20 feet distant from the ephemeral drainage. The topsoil stockpile will be surrounded with a containment berm and protected as discussed in Section 8.8.1.3. Prior to stockpiling salvaged topsoil, permeable fabric strips will be placed over the original soil surface to preserve the location of the contact zone between the native topsoil and the stockpile.

Topsoil stockpile information concerning soil compaction and stockpile size and dimension is provided as follows:

- During topsoil pile construction, soil compaction will be minimized by limiting the extent of equipment traffic and affected area. Where compaction does occur, the compacted material will be ripped and loosened prior to seeding.

- The Wild Horse Ridge topsoil stockpile is detailed on Plate 8-7 which shows the projected stockpile, size, placement, final configuration and cross sections. According to Plate 8-7, typical slopes range from approximately 6:1 for east facing, 2:1 for west facing, 3:1 for north facing, and 2:1 for south facing.

- Appendix 3O, Figure 3O-1 and associated cross sections show the lower conveyor access road and topsoil stockpile. Cross sections showing the topsoil stockpile final configuration and resulting slopes correlate with Plate 8-7.

Shower House Topsoil Stockpile

Prior to construction on the shower house pad, topsoil was salvaged and stockpiled. The final topsoil stockpile consisted of 1200 cubic yards. The Wild Horse Ridge amendment states that Co-Op proposes to relocate this topsoil stockpile to the Wild Horse Ridge topsoil stockpile. Following relocation, As-builts will be submitted updating the MRP.

Tank Seam Access Road Topsoil Stockpile

Topsoil was salvaged and stockpiled from the Bear Canyon Mine Tank Seam access road during construction. Volume of topsoil contained in this stockpile is approximately 1000 cubic yards. During construction of the Wild Horse Ridge area, Co-Op proposes to relocate this topsoil stockpile from the upper storage pad to the Wild Horse Ridge topsoil stockpile. Following relocation, As-builts will be submitted updating the MRP.

Topsoil Salvage and Stockpile Summary

The plan summarizes (Table 8.9-3) available topsoil for the 36.4 acre Bear Canyon Mine site as follows:

Topsoil Stockpile Description	**Cubic Yards**
Main	1,480
Ball Park	3,400
Shower House Pad	1,200
Tank Seam Road	1,000
Wild Horse Ridge	11,054
Total	**18,134**

Findings:

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

RECLAMATION PLAN

TOPSOIL AND SUBSOIL

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

Analysis:

Chapter 8, Soil Resources, Section 8.10, Redistribution of Soils, and Section 8.11, Nutrients and Soil Amendments, discuss the soil reclamation plan for the proposed Wild Horse Ridge area. The information is reviewed in this order:

- Soil Redistribution
- Soil Nutrients and Amendments
- Soil Stabilization

Soil Redistribution

Based on the 3.6 re-contoured acres (Table 8.3-2) and the 8700 CY of soil salvage (Table 3O-1), the average topsoil replacement thickness for the Wild Horse Ridge disturbed area should be 18 inches.

The MRP divides the mining area up into different reclamation areas. The Wild Horse Ridge area is divided up into areas TS-12, TS-13, TS-14, and TS-15 as follows:

TS-12, Wild Horse Ridge Access Road

The Wild Horse Ridge Access Road already exists and provides access to a hunting lodge located further up the hillside. After mining, this road will remain and continue providing access to the hunting lodge. During upgrading and widening of the road during mining, topsoil will be recovered (15 inch depth) from isolated areas of new additional disturbance (0.22 acres). During reclamation, salvaged soils will be redistributed to the same additional disturbed areas (0.22 acres) of the road at the same depth (15 inches).

TS-13, Conveyor Belt Access Road/ Topsoil Stockpile Area

The plan states that following re-contouring of this area at the time of final reclamation, topsoil recovered prior to construction will be redistributed to obtain an approximate depth of 13

to 14 inches. Soil salvage ranges from 12 inches on the slopes in the upper portions of the road to 40 inches from lower portions of the road. The plan states that 2,054 cubic yards of topsoil from this area may be utilized in other areas of the mine site.

TS-14, Upper Conveyor belt/Access Road

The upper conveyor belt/access road will have 10 to 30 inches of topsoil recovered. Topsoil redistribution will be performed in conjunction with regrading due to the remoteness of the site and the reclamation procedures of this area. The plan states that topsoil recovered from this area will be redistributed at an average depth of 13 to 14 inches.

TS-15, WHR Blind Canyon Seam Portal

This area will have 10 to 30 inches of topsoil salvaged for reclamation. Topsoil redistribution will be performed in conjunction with regrading due to the remoteness of the site and the reclamation procedures of this area. The plan states that topsoil recovered from this area will be redistributed at an average depth of 13 to 14 inches.

Soil Nutrients and Amendments

Section 8.11, Nutrients and Amendments, states that following final grading, each of the reclamation areas will be sampled (see Table 8.11-1 for Sample Density) and the collected soil samples analyzed. The plan states that additional samples will be taken in the event that the initial sample indicates unsuitable material. Composite samples will be taken from 0 to 2 feet and from 2 to 4 feet at each sample location. The section concludes that all necessary fertilization and chemical treatments will be applied according to the results of the soil sampling and analysis program approved by the Division. In addition to analyzing the samples for micro nutrients, analyses will also include standard fertility test for pH, EC, nitrogen, phosphorus, and potassium. All sampling, testing and result interpretation will be done by a qualified soil scientist. The soil scientist will be qualified to sample, test and interpret data results. Prior to sampling and testing of the topsoil material, the soil scientist's qualifications will be reviewed by the Division.

Soil Stabilization

Following backfilling and regrading, the re-graded surface will be scarified by a ripper to a depth of 14 inches to help reduce surface compaction, provide a roughened surface to help topsoil adherence, and help promote root penetration. Steep slope areas will be roughened by ripping to create ledges, crevices, pockets, and screes (talus slopes at the base of cliffs) to allow better soil retention and vegetation establishment.

To minimize compaction of replaced topsoil, travel on reclaimed areas will not be allowed. Co-Op will guard against erosion by using mulch, tackifier, and erosion control matting. Topsoil will be redistributed in the fall of the year to help promote vegetation establishment. In all cases, a very rough seed bed will be prepared.

Findings:

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

RECOMMENDATION:

The submittal meets all the requirements for approval.

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