ANNUAL SOIL MONITORING
AT THE
WEST RIDGE MINE, UTAH
2001

Prepared
for
WEST RIDGE RESOURCES, INC.

Prepared by

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February 7, 2002

INTRODUCTION

An "experimental practice" for the protection of soil resources was designed and implemented at the West Ridge Mine site. The experimental practice was designed to test the effectiveness of burying soils in-place rather than salvaging (removing) them and returning them at the time of final reclamation. The in-situ topsoil was covered with a geotextile material followed by bedding material to create working areas for surface operations of the mine.

As one means to monitor the buried soil resources, West Ridge Resources has committed to sampling mine pad areas in specific locations to determine whether or not they are being affected by coal and surface operations. In the document called *West Ridge Mine Experimental Practice Annual Evaluation 2000: Addendum to Appendix 2-6*, page 4, it states that "an annual monitoring program, starting in the year 2000, to sample and determine if the mine pad areas affected by the coal are being acidified". Number 2 on this same page states that "samples will be analyzed for acid/toxic-forming potential per Division guidelines....". In consulting with a soil specialist for the State of Utah, Division of Oil, Gas & Mining (DOGM) prior to sampling in 2001, it was determined that the most appropriate parameters to be analyzed on the mine pad areas were: pH, electrical conductivity (EC), sodium adsorption ratio (SAR) and calcium carbonate ($CaCO_3$). Moreover, it was determined that sampling should be done at the depth of 6-12 inches as opposed to 3 inches as stated in addendum cited above.

METHODS

Soil samples were taken at the West Ridge Mine site in specified locations on September 11, 2001. Sample locations are shown on Map 2-2. A brief description of these locations follow.

T1	Located in the right fork, it was originally described to be 64 ft northwest of the Jersey Barrier in the center of the canyon. Because this location was so close to construction and where equipment was placed at the time, the sample was taken about 25 ft north of that location.
T2	Located in the left fork in the coal storage area, the sample was taken at the base of the dike in the center of the canyon.
T3	Located in the load-out area, the sample was take 54 ft uphill from the belt footer on the north side of the ditch.

The soil samples were taken at a depths from 3 to 6 inches at the above-described locations. Soils were analyzed at the Brigham Young University, Soil and Plant Analysis Laboratory. Parameters and laboratory methods used are shown below.

pH	ASA Mono. No. 9, Part 2, (2 ed), 1982. Method 10-3.2, page 171. Perform pH on saturated paste.
ECe	Electrical conductivity reported as mmhos/cm 25°C. ASA Mono. No. 9, Part 2, (2 ed), 1982. Method 10-3.3, page 172-173.
SAR	Sodium Adsorption Ratio. Calculated from soluble Ca, Mg and Na.
CaCO3	Method S-13.20. Acetic acid dissolution method. Western States Laboratory Proficiency Testing Program. Soil and Plant Analytical Methods. 1998.

RESULTS

The laboratory results indicated no problems were evident from the parameters analyzed. The results are shown on Table 1. The laboratory report has been included in the Appendix of this report.

Table 1: Laboratory Results for Soil Sampling at West Ridge Mine (2001)

Sample No.	pH	EC	SAR	CaCO3
T1	8.04	6.20	2.19	19.21
T2	7.52	2.70	0.74	5.10
T3	7.83	4.20	1.94	15.00
Mean	7.80	4.37	1.62	13.10
SDev.	0.26	1.76	0.78	7.24

APPENDIX

(Lab Report)

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 09-21-2001
Time: 19:51:14
Customer # 49
Telephone: 489-6937

Benson Agriculture and Food Institute

Agronomy and Horticulture Department

SOIL TEST REPORT AND RECOMMENDATIONS

Name: Mt. Nebo Scientific
Street: P.O. Box 337
City: Springville State: Ut Zip: 84663

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
T2	Natives	7.52						

Soil Test	Results	Very Low	Low	Adequate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N							
Phosphorus ppm P							
Potassium ppm K							
Salinity-ECe mmhos/cm	2.70		X				no salinity problem
Calcium PPM Ca	369.30						
Magnesium PPM Mg	356.40						
Sodium PPM Na	83.36						
Sodium Adsorption Ratio SAR	0.74	X					no sodium hazard
% $CaCO_3$	5.10						no acid problem

NOTES:

BRIGHAM YOUNG UNIVERSITY

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Benson Agriculture and Food Institute

Agronomy and Horticulture Department

Name: Mt. Nebo Scientific
Street: P.O. Box 337
City: Springville State: Ut Zip: 84663

SOIL TEST REPORT AND RECOMMENDATIONS

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
T3	Natives	7.83						

Soil Test	Results	Very Low	Low	Adequate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N							
Phosphorus ppm P							
Potassium ppm K							
Salinity-ECe mmhos/cm	4.20				X		salinity a problem for sensitive crops
Calcium PPM Ca	520.30						
Magnesium PPM Mg	243.80						
Sodium PPM Na	214.88						
Sodium Adsorption Ratio SAR	1.94		X				no sodium hazard
% CaC03	15.00						no acid problem

NOTES:

Date: 09-21-2001
Time: 19:50:42
Customer # 49
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Benson Agriculture and Food Institute

Agronomy and Horticulture Department

Name Mt. Nebo Scientific
Street P.O. Box 337
City Springville State Ut Zip 84663

SOIL TEST REPORT AND RECOMMENDATIONS

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
T1	Natives	8.04						

Soil Test	Results	Very Low	Low	Adequate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N							
Phosphorus ppm P							
Potassium ppm K							
Salinity-ECe mmhos/cm	6.20				X		salinity a problem for sensitive crops
Calcium PPM Ca	661.90						
Magnesium PPM Mg	45.38						
Sodium PPM Na	215.84						
Sodium Adsorption Ratio SAR	2.19		X				no sodium hazard
% CaCO3	19.21						no acid problem

NOTES:

naturally occurring growth media. The Travesilla pockets would be salvaged and placed in the topsoil stockpile. Colluvial growth medium (CGM) from the loop area will be stored within the core of the upper cell embankment of the sediment pond (a sign will be placed on these stockpile areas to indicate the nature of the material stockpiled and to protect the material from contamination); CGM from the left fork coal pile area will be stored also within the upper cell embankment. During final reclamation the CGM in the upper cell embankment of the sediment pond will be used to backfill the loop area cutslopes. The structural material forming the inside surface of the upper cell embankment of the sediment pond (ie. the imported, compacted material) will first be removed and disposed of since it may be contaminated with coal fines.

During construction, material available from the cut slopes will be used as fill and placed into the adjacent pad areas. If, during pad construction, additional fill is needed (i.e. if there is a deficit of native fill materials available from the adjacent cut areas) then imported fill material will be brought in and placed on top of the native fill in order to complete the pad levels. During reclamation, the process will be performed in reverse order. In other words, the uppermost part of the fill (consisting primarily of the imported material) will be removed first and will be disposed of underground or off site. The native fill, located at the lower (deeper) level of the pads (i.e. located under the imported fill) will be used primarily to fill in and restore the adjacent cut slopes. Fill from the pads will be replaced in the adjacent cuts in 18"-24" lifts and compacted sufficiently to achieve adequate structural stability.

The reverse order of construction and reclamation applies to large boulders as well. During initial construction, large boulders which occurred naturally along the surface were placed in the bottom of the fill areas above the culvert after the culvert had been installed. Native fill materials from the adjacent cut slopes were then placed over these boulders as the pads were constructed. In essence, the larger boulders were being "stored" in the depths of the pad fill until the time of final reclamation. During reclamation, the boulders will be re-exposed and will be placed once again on the reclaimed surface to replicate their original premining occurrence. Since the boulders were the first to go into the fill during construction, (followed by the native fill and lastly by the imported fill), they will be the last to come back out of the fill during reclamation. Since they will come out last, they will be available to be placed back along the surface of the reclaimed slopes.

In the main canyon area, where pad fills are more shallow, the boulders were "stored" in the outslopes of the sediment ponds along with the colluvial growth medium (CGM) obtained from the loop area rubbleland. (The structural portion along the inside surface of the pond embankments was constructed with imported fill material, which was placed and compacted as needed, to achieve the necessary structural engineering parameters.

During construction of the mine yard area colluvial surface material from the truck loop area and the west side of the left fork coal storage area was stored separately to be reused during final reclamation. This surface colluvium contains pockets of Travesilla and is a naturally occurring growth media. Colluvial growth medium (CGM) from the loop area was stored within the core of upper cell embankment of the sediment pond; CGM from the left fork coal pile area was stored within the coal pad. During final reclamation the CGM in the upper cell embankment of the sediment pond will be used to backfill the loop area cutslopes. The structural material forming the inside surface of the sediment ponds (ie. the imported, compacted material) will first be removed and disposed of since it may be contaminated with coal fines. Likewise, the cap layer overlying the coal pad CGM material will be removed and disposed of, revealing the CGM material stored below. This coal pad CGM material will then be used to backfill the cutslopes in the left fork of the coal storage area.

In areas where topsoil was replaced after approximate original contour (AOC) was achieved, the surface will be roughed/gouged, seeded and mulched. Hay mulch will be applied to the surface at a rate of 2,000 pounds per acre to areas that have been regraded and covered by topsoil or substitute topsoil. These areas will then be roughened/gouged using a backhoe bucket. The surface roughening/gouging will result in a pattern of irregularly shaped depressions measuring approximately 24" x 36" x 18 " deep over the surface of the regraded area. The purpose of these depressions is to capture and retain water (moisture), provide a cradle for seedlings and other plant materials, as well as minimize sediment loss from the revegetated slopes. Gouging will also serve to incorporate the hay mulch into the top 12-18 inches of the soil. The appropriate seed mix from Tables 3-2A through 3-2D will be used to seed the prepared surface. Reseeding will be accomplished by hydroseeding or broadcast seeding the areas. Hydroseeding will combine the tackifier and a small amount of mulch with the seed mix to mark the area of coverage during application. A weed-free straw mulch will be applied over the seed at a rate of 2,000 pounds per acre and held to the surface with a mulch and tackifier applied at a rate of 500 pounds per acre.

In areas where topsoil has been protected with geotextile fabric, the fill will be removed from the geotextile area and the geotextile carefully peeled away from the soil. Where necessary, the soil will be reclaimed and revegetated in 5-10 foot horizontal increments that can easily be accessed and worked from the adjacent remaining pad fill level. It is anticipated that after the pad fill is removed in lifts and the geotextile fabric is peeled away in vertical increments, the underlying soil material could be somewhat compacted. To increase the ability of the soil to absorb moisture, the surface of the re-exposed soil will be gouged and a hay mulch worked into the soil. The hay will be applied at a rate of 2,000 pounds per acre. Gouging would create a pattern of depressions measuring approximately 24" x 36" x 18" deep and will serve to control erosion through water retention, minimize siltation and allow for air and water penetration into the soil horizon thus promoting vegetation establishment and growth. Gouging will allow rain, snowmelt

An alternate method of dealing with co-mingling of native and imported fills is the use of a good-quality boundary layer of fill between the two. Imported fill material will be tested to assure that it meets DOGM acceptable substitute topsoil criteria. Based on this testing a separate pile of good/fair material will be made. A layer of this material will be used as the first imported to be placed on top of the native fill. When topping off the pads this good/fair layer will serve as a boundary layer during final reclamation. To diminish any negative environmental impacts to native soils and fills from salt contamination, a protective layer of good-fair fill material could be placed between the native and any imported poor-quality fill materials. During reclamation, the poor quality fills would be removed first, thus exposing the good quality fills and contact native fills. These contact soils would then be used first as backfill against the cutslopes, thus further minimizing any negative impact from possible salt contamination.

There are two areas of cut-and-fill that warrant special attention, namely the cut area in the vicinity of the truck loop (loop area), and the sideslope cut area on the west side of the left fork in the coal pile area (coal pad slope). Excavation of the loop area will be necessary to accommodate construction of the truck loadout and the crusher building. Removal of material from the coal pad slope will be necessary to provide for the coal storage requirements. Both of these areas contain identified topsoil deposits as well as an additional surface layer of rubbleland colluvium. This rubbleland surface colluvium contains pockets of Travesilla soils and is a natural growth medium. During construction in the loop area and the coal pad slope area, the identified topsoil deposits (including pockets of Travesilla) will be salvaged and stored in the right fork storage area as described previously. The remaining surface colluvial growth medium (CGM), is also considered a reclamation resource. During construction special care will be taken to store this material in designated areas where it will remain protected during the life of the mine. By protecting this colluvial growth medium (CGM) it can later be re-used during final reclamation. Salvage of all topsoil (including pockets of Travesilla) and CGM will be under the direction of an on-site soils specialist. The loop area CGM covers an area of about 59,400 square feet; the coal slope CGM covers about 21,600 square feet, as shown on Map 5-10. Assuming an average salvage depth of 12", approximately 2,200 cubic yards of CGM is expected to be salvaged at the loop area, while 800 cubic yards is expected from the coal pad slope.

The loop area CGM will be stored within the core of the upper cell embankment of the sediment pond. (The face of the dams however, will be constructed of a structural imported fill material, compacted to 95%). The CGM core will be protected for the life of the mine because these areas are off limits to the normal day-to-day operations of the mine. (Upon final reclamation this cap layer will be removed and disposed of.) Some of the loop area CGM can also be placed along the west side of the upper pond embankment where it will be protected until final reclamation. (A topsoil marker sign will be placed near these stockpile areas to indicate the nature of the material stockpiled and to protect the material from contamination.) The sediment ponds and office pad will be among the last structures to be removed from the minesite during final reclamation. Therefore, CGM material stored therein will be well positioned to be recovered during final reclamation as backfill material in restoring the adjacent cutslopes in the loop area. The CGM material placed on the outslopes of the pond embankments will be roughened and seeded with the interim revegetation seed mix. The reseeded area will then be mulched.

The coal pad slope CGM material will also be stored in a protected area. This material will be pulled from the west side slope of the left fork in order to provide a place for the future coal pile to rest. Travesilla soils in the coal slope area will be salvaged separately from the CGM and stockpiled with the other topsoils in the right fork topsoil area. The CGM material will be removed from the slopes and stored within the core of the upper cell embankment. The CGM can then be recovered and used as backfill to reclaim the adjacent coal pad cutslopes from whence the material came from originally. Refer to Map 5-10 for CGM storage locations.

An area that warrants special attention is the nose pad and the access road leading to it. The nose pad will serve as the anchor location for the elevated conveyor gallery and discharge structure, and is therefore a critical path construction item. The nose pad and access road will be constructed in manner that avoids side casting material onto the upper undisturbed portion of the nose cut access road and slope. These excavations will be done using a track hoe, and all excavated material will be hauled back down and used as pad fill in the bottom of the canyon. Material from the lower section of the road may be temporarily placed on the slope between the nose cut access road and the mine yard access road below. This material and material from the slope itself will be utilized in the mine yard pad fill.

Another area that warrants special consideration is the substation pad. The substation will be located on a fill pad within a small draw located next to the portal bench. This substation site is on the south side of the canyon in an area where topsoil is expected to occur. A substation grounding grid will have to be constructed within the pad fill. It is important that this grounding grid function properly since it is an integral part of the mine's electrical system. In order to provide proper grounding field performance, electrical engineers may determine that the geotextile can act as an insulator and should not be used below the grounding gridwork under the substation. If it is determined that geotextile should not be used under the substation, topsoil in this area will be salvaged instead.

(refer to Appendix 5-4). In general, restored cut slopes will have a final slope of about 2:1 which is close to the predominate slope angle existing naturally in the canyon in its pre-mining condition.

Track hoes, dozers, and/or front end loaders will be used to backfill the cuts. Heavy equipment will utilize the existing adjacent pads as work platforms from which the backfilling operation can be staged. Initially, in areas where the pad fill is relatively deep, fill removal will involve heavier machinery such as dozers and/or end loaders. In a single earthmoving operation, fill material will be removed from the pads and relocated to the adjacent cutslopes. However, once the fill removal process gets close to the geotextile boundary in the S/T/F areas, (and the marker strip boundary in the S/R/F/ areas) work will proceed with the track hoes instead of dozers. These nimble machines are much better suited for the careful excavation requirements near the geotextile and the marker strip boundaries. The trackhoes will also be better suited to uncovering the boulders that have been stored at the base of the fill near the bypass culvert. As the fill removal process continues downward, care will be taken to not disturb the geotextile and also to not disturb the culvert. For the time being, a 12"-18" deep "working" layer of fill will be left over the geotextile to protect it while equipment continues to work on top of the geotextile during subsequent cutslopes rehabilitation and re-topsoiling activities. In the S/R/F areas similar care will be taken to not sub-excavate down into the original rubbleland surface as the pad fill is being removed. The marker strips will aid in this process. After the pad fill has been removed, the backfilled culvert will then serve as the primary access way for machinery and materials associated with the remaining reclamation efforts.

There will inevitably be some co-mingling of the native fill and the imported fill, both during construction, and then again when the fill is being removed during reclamation. However, the imported fill meets DOGM's acceptable soil suitability criteria. Fill material will be inspected and tested to ensure that it is free of salts, oils, petroleum products and any other contaminants before being used as backfill in the cut areas. After the slopes have been re-established the surface will be roughened with a backhoe to provide a suitable surface for subsequent top soiling and/or reseeding applications.

During initial construction colluvial surface material from the truck loop area and the west side of the left fork coal storage area were stored separately to be reused during final reclamation. This surface colluvium contains pockets of Travesilla and is a naturally occurring growth media. Colluvial growth medium (CGM) from the loop area was stored within the core of the upper cell embankment of the sediment pond; CGM from the left fork coal pile area was stored within the upper cell embankment of the sediment pond . During final reclamation the CGM in the sediment pond will be used to backfill the loop area cutslopes. The structural material forming the inside surface of the sediment ponds (ie. the imported, compacted material) will first be removed and disposed of since it may be contaminated with coal fines.

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Special consideration will be given to disposal of the designated portal face-up material. This material was generated during initial construction when the portal highwall area was being excavated. Weathered and/or burned coal material from the outcrop coal seam was removed and stored in the mine pad fill in a non-structural area above the shop/ warehouse facilities. During reclamation this portal face-up material will be uncovered and hauled back to the portal area. This material will be placed within the portals and/or adjacent to the portal highwall and then covered with at least four feet of backfill.

Sediment control during pad fill excavation and cutslope re-establishment will be accomplished by continued use of the sediment pond located at the downstream end of the yard area. Even as the sediment ponds themselves are being removed, the lower pond embankment (dam) will still be left in place to provide sediment control during the reclamation activities. The full length of the bypass culvert system will remain intact