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RECLAMATION PLAN

STANDARD MINE REMOVAL PROJECT
Gunnison County, Colorado

TDD No. 0609-03

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OPERATING SERVICES, INC.

In association with:
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STANDARD MINE REMOVAL PROJECT
RECLAMATION PLAN
Near Crested Butte, Gunnison County, Colorado

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1.0 INTRODUCTION

From 2005 to 2007, the U.S. Environmental Protection Agency's (EPA's) Removal Program performed site stabilization, repository construction, and tailings and waste rock removal to reduce the risk of impacts of site contaminants on human health and the environment. Additional removal efforts will occur during 2008. Previous reports describe the Removal Program efforts (URS Operating Services, Inc. (UOS) 2006; URS Corporation (URS) 2007; UOS 2007). Areas disturbed during the tailings and waste rock removal project will be reclaimed through soil revegetation, stream restoration, and wetlands restoration. This document was prepared to guide reclamation efforts that will be performed by EPA's Removal Program. Detailed specifications are not provided because of a preference to field fit the reclamation features. The areas designated for soil revegetation, stream restoration, and wetlands restoration are shown on Figure 1.

Reclamation goals are presented in Section 2. The approach and guidance for field fitting revegetation of impacted soils and roadways is presented in Section 3. The approach for field fitting stream restoration and wetlands construction are presented in Sections 4 and 5, respectively. Sequencing considerations are presented in Section 6.

2.0 RECLAMATION GOALS

Removal Action Objectives (RAOs) were developed for the site based on the Human Health Risk Assessment and the Baseline Ecological Risk Assessment and other site data. The Human Health Risk Assessment for the Standard Mine site indicated a risk of exposure to manganese by all-terrain vehicle riders (Syracuse Research Corporation 2007). Risks to other populations or from other chemicals were below a level of concern for both cancer and non-cancer risk. The Baseline Ecological Risk Assessment (BERA) for the Standard Mine site indicated a high level of risk to fish and benthic organisms from exposure to surface water, sediment, and pore water (U.S. Environmental Protection Agency (EPA) 2007). The BERA also indicated a high risk to terrestrial plants and soil invertebrates from exposure to site soils. Birds and mammals have increased risk from soil ingestion, surface water, and food. The Risk Assessments and other site data were used to develop the objectives for the removal action, which include:

1. Reduce human and ecological exposure to metals by reducing metals loading from site soils and tailings.

2. Reduce metals loading and risk to aquatic life in Elk Creek from surface water runoff and leaching from waste rock piles and tailings into Elk Creek.

3. Reduce erosion of tailings and waste rock to Elk Creek, Coal Creek, and the Crested Butte drinking water supply.

4. Eliminate the threat of a catastrophic failure of the tailings impoundment by removing the material/structure.

Most of the tailings and waste rock have been moved to the repository; however, some source materials and some soils containing residual amounts of contaminants will be left in place. The intent of reclamation is to further reduce risks to human and ecological receptors by reducing dust and soil toxicity. This reclamation will also stabilize excavated slopes and reduce erosion and sedimentation into Elk Creek. An additional intent is to return the area to a natural ecological habitat similar to the surrounding area. The means by which the reclamation efforts will meet the goals include the following:

- Adding lime and organic matter to site soils will make residual site contaminants less mobile and less available to plants. Adding lime to site soils will reduce soil toxicity by increasing soil pH and reducing acid production in contaminated soils. Adding organic matter will provide nutrients and soil structure favorable for plant growth and provide binding sites for site contaminants.

- Establishing a self-sustaining vegetative cover will reduce exposure of organisms to contaminated dust, reduce erosion of site soils into Elk Creek, and reduce leaching of contaminants from site soils into surface water and near groundwater and thus reduce contaminant loading into Elk Creek.

- Reestablishing a sustainable alignment for Elk Creek will reduce erosion and provide a more natural ecological habitat in and around the stream.

- Establishing a wetland adjacent to the new Elk Creek alignment will reduce erosion and create natural habitat similar to nearby high mountain wetlands and possibly retain site contaminants and reduce loading to Elk Creek.

Success toward meeting these goals will be evaluated using the techniques and criteria presented in Table 1. EPA and the U.S. Forest Service (USFS) have determined that a species diversity criterion such as may be applied at many reclamation sites would not be included here because of the emphasis on revegetation with local native species. While some of the seeds that will be raked from a nearby watershed and placed at the site may succeed, diversity that includes local native species is expected to occur over the long-term as nearby species invade the site.

3.0 RECLAMATION OF IMPACTED SOILS

Soils that have been impacted by the Standard Mine Removal Action, including native materials left after excavation of waste rock, waste rock left in place, and roadways that will not be left for future site work, will be revegetated prior to completion of the Removal Action. Soil conditions are variable across the site; therefore, revegetation will include three major types of effort: treatment, cover with native borrow soil, and no treatment. The method that will be used in each portion of the site will be determined after evaluation of field conditions and, where appropriate. laboratory and field analysis of site soils. The following guidelines will be used:

- Soils that were impacted by mine waste (soils previously covered by mine waste or soils containing mine waste) will be reclaimed by amending the soils with lime, organic matter, and fertilizer or by covering the existing soil with native borrow soil. Either technique will limit the availability and toxicity of metals in existing soils and provide a hospitable growth media that allows a sustainable plant cover (Redente 2002). Areas where excavation of site contaminants has left native soil will generally be amended with lime, organic matter, and/or fertilizer, as appropriate. Areas where tailings or waste rock were left in place will either be amended with lime, organic matter, and fertilizer or covered with at least six inches of native borrow soil containing adequate organic content.

- Cover with native borrow soil will be used primarily in areas where fill is necessary to provide a natural grade or where waste rock is left in place. There is a limited amount of native borrow soil from construction of the repository. Additional native borrow soil may be developed from USFS Site 1 (referred to as the "Staging Area") but there is a preference to minimize disturbance to other nearby potential soil borrow areas. Clean fill from distant sources is expensive and difficult to transport to the site and may not be certifiable as "weed free"; therefore, cover with clean fill from off-site will not be used as the primary revegetation technique.

- Areas to be reclaimed (i.e., those to be amended with lime, compost, and fertilizer, and areas to be covered in native borrow soil), and roadways that will not remain for future site work will be prepared for seeding and then seeded with a combination of native seeds harvested from a location approved by USFS and slender wheatgrass seeds.

- In general, rock outcroppings will be left as-is because they do not pose an exposure risk to site receptors and attempts to create a soil horizon over the rock would likely increase site erosion. Large areas of exposed bedrock and areas of bedrock covered with a thin layer of soil will be left as is; soil will not be added to these areas to produce a vegetative cover. Small amounts of fine-grained material covering the exposed bedrock will not be treated but will be left in place.

- Areas containing native materials that were not previously covered by or impacted by waste rock will not be treated.

- Erosion control measures will be implemented, where necessary, to reduce erosion into adjacent revegetation/wetland/stream features.

- Site access is difficult, so substitutions may be necessary to reduce the number of delivery or construction trucks that must travel to the site.

- Roadways will be reclaimed dependent on the anticipated future use. Repairs or changes to the road alignment will be performed in coordination with the USFS and affected private property owners.

Rock content, residual metals concentrations, pH, slope, acid base potential, and other factors vary across the site and will be taken into account in revegetation designs. Laboratory and field analysis/screening will be used to estimate these values prior to treatment. There is a preference to use existing site data to develop reclamation designs where reasonably appropriate.

The area shown as “A” on Figure 1 will not be treated; however, the roadway through this area may be scarified and seeded. There are two areas shown as “B” on Figure 1. These areas have had most of the waste rock removed and will be managed according to the guidelines shown above. The area shown as “C” on Figure 1 will contain the new Elk Creek alignment and associated wetlands. Soils within this corridor may be removed prior to stream bank and wetland construction and will be placed on adjacent ground and managed according to the guidelines shown above. The area shown as "D" on Figure 1 requires additional excavation of waste rock during 2008, primarily along the current Elk Creek alignment. The remaining soils will be managed according to the guidelines shown above.

Section 3.1 describes the approach to soil amendment. Section 3.2 describes how cover with native borrow soils will be accomplished, Section 3.3 describes areas that will not be treated, Section 3.4 describes erosion control, Section 3.5 describes management of roadways, and Section 3.6 lists estimated soil revegetation materials requirements.

3.1 SOIL AMENDMENT AND REVEGETATION

The following sections describe lime, compost, and fertilizer amendment rates, amendment application, and application and mixing methods. After amendments are applied and completely mixed into the soil, the disturbed areas will be seeded and mulched.

3.1.1 Lime, Organic, and Fertilizer Amendment Rates

Lime Application Rate

Existing site soils have relatively low pH and have potential to produce additional acidity as minerals in the soil are oxidized. The low pH can stress vegetation and impact the long-term sustainability of vegetation. Therefore lime will be applied to the soil to increase the acid base account (ABA) to greater than zero.

The laboratory-measured ABA lime requirement is the basis for determining the lime application rate. The lime requirement is given in tons of calcium carbonate required per 1,000 tons of soil. For estimation purposes, 1,000 tons is equivalent to six inches of soil over one acre. The rate will be adjusted to account for lime quality (the calcium carbonate equivalence (CCE), particle size, and moisture content of the lime material) and the rock content in the soil. A safety factor of 25% will be used to account for incomplete mixing and variability in soil conditions.

$$\text{Field Lime Rate} = \frac{\text{Lab Lime Requirement} * (1 + \text{Safety Factor}/100) * (1 - \%\ \text{Rock}/100) * \text{Depth}}{(\text{Lime Efficiency}) * (\text{CCE}/100) * (1 - \%\ \text{Moisture}/100)}$$

The lime rock fraction is based on the relative reactivity of lime based on particle size. Larger lime particles are less reactive than smaller particles. For purposes of this project, the lime efficiency will be calculated using laboratory analysis of lime particle size and the following equation (URS Operating Services and Reclamation Research Group 2007):

Lime Efficiency = 0.015* (Fraction > 10 mesh) + 0.25 * (Fraction between 10 and 60 mesh) + 1* (Fraction < 60 mesh)

The depth of treatment will be determined by digging five or more test pits per acre to determine the depth of soil. The depth is expected to be irregular, even within one treatment area. In many cases the soil depth is less than 6 inches over bedrock. A maximum treatment depth of 12 inches will be used. The soil rock fraction will be estimated by conducting a sieve analysis in the field. Particles greater than 0.5 inch will be considered rock fraction.

To determine the volumetric field application rate:

$$\text{Field Lime Rate (by volume)} = \frac{\text{Field Application Rate (by weight)}}{\text{Bulk Density}}$$

Five pre-removal samples from various portions of the site and two samples collected after the removal of the tailings impoundment were analyzed for ABA (Tables 2 and 3). The wide variability in ABA results for different portions of the site and the heterogeneity of the remaining soils make calculation of an appropriate site-wide lime rate impractical. The high variability in laboratory-determined lime requirement doesn’t allow for an effective statistical analysis that could be used to estimate a lime rate that would ensure, for example, that 95% of the site soils would be adequately limed. A site-wide lime rate would result in either an unnecessarily high rate for areas with low lime requirements and/or low lime rates that don’t effectively neutralize the active and potential acidity of the remaining soil/tailing/waste rock, resulting in stressed plants and/or bare areas. Therefore, a custom rate will be developed for each portion of the site based on the results of ABA analysis on pre- and/or post-removal samples from the given portion of the site. Post-removal data will be emphasized where they are available; however, available pre-removal ABA data may be used to avoid the necessity of collecting additional samples. Using these pre-removal data represents a worst-case scenario and should not result in under-liming the areas. In locations without ABA data, samples will be collected and the ABA data will be used in the lime requirement calculations. The data used for each treatment area and the resulting lime application rate will be documented in the field notes.

Approximately five cubic yards of lime were spread over the west bank area prior to demobilization during October 2007. Pre-removal ABA results and information from the EPA Environmental Response Team's (ERT's) pilot scale revegetation study were used to determine the approximate lime amendment rate in 2007. Post-removal ABA samples were submitted for analysis to compare amendment rates but the results are not available as of the time of this report. Lime already applied to this area will be subtracted from the lime requirement to determine how much, if any, additional lime is required.

Compost/Organic Amendment Rate

The target organic carbon content for amended soils is 2%. Alternatively, a target organic matter content of 3% may also be used (based on USFS recommendations of 2% to 4% organic matter). These target rates provide adequate organic matter for plant growth and have been successful in similar projects. For purposes of determining the organic amendment rate, it is assumed that the remaining native soils and the remaining tailings/waste rock have no organic content. Adjustments to the organic application rate will be made for mixing depth and rock content but no adjustments will be made for mixing or other site features. The adjustment for rock content is based on the results of an ERT study that demonstrated that excess compost applied to rocky areas at Level 98 of the Standard Mine site resulted in reduced vegetation success (Huang 2008). The organic amendment rate will be calculated based on the organic carbon (or % organic matter) content and moisture content of the selected organic amendment (compost).

$$\text{Compost Rate} = \frac{\text{Target Soil \%OC} * (\text{1,000 tons/acre-6''}) * \text{Depth} * (\text{1-Soil Rock Fraction})}{\text{Compost \% OC} * (\text{1- \% Moisture in Compost/100})}$$

$$\text{Compost Rate (by volume)} = \frac{\text{Organic Amendment Rate}}{\text{Compost Bulk Density}}$$

Fertilizer Amendment Rate

Fertilizer will be applied at a rate of 40 pounds/acre nitrate nitrogen (NO_3-N) and 60 pounds/acre phosphorus pentoxide (P_2O_5). This rate was recommended from analysis of soil excavated from the repository cover soil (Table 4). Additional nutrients will be provided by the compost. Commercially available fertilizer that also contains potassium may be used if that is more cost effective.

3.1.2 Amendment Application and Mixing

In order to provide a hospitable growth environment for plants, amendments must be thoroughly mixed with site soils. The lime and fertilizer will be evenly applied and mixed with the soils then the organic amendment will be added and mixed. The means to provide even material application and mixing will be determined after consultation with the construction contractor prior to implementation. In order to evaluate the effectiveness of mixing, pH indicator solution will be applied to random sample locations and no areas should show pH < 5 and no more than 20% of the soil profile should have pH less than 6.5. A visual inspection will also be performed to determine the thoroughness of mixing.

3.1.3 Seed and Mulch

Depending on the type of lime used at the site, the treated soils may have high pH levels that could harm the seed; therefore, treated soils will be evaluated in the field for paste pH. The paste pH must be below 8.5 prior to seeding.

Prior to seeding, the seedbed will be prepared by driving over the treatment areas with a track vehicle. The track vehicle will be driven up and down slopes (rather than side to side) to create a terrace-like environment for the seeds. This should reduce erosion of seeds, soils, and amendments and will reduce the need for mulch. The areas will not be excessively compacted. Roadways that require seeding will be ripped to reduce compaction prior to seeding.

The USFS has indicated a preference for planting seeds raked from nearby stands of vegetation. After attempts to rake seeds near the Standard Mine were unproductive due to steep and rocky terrain, the USFS selected a location near Taylor Reservoir for harvesting seeds for Standard Mine reclamation. Approximately 15 pounds of seed and chaff were collected during a 2007 trial resulting in 2.6 pounds of viable seed. Additional seed collection will be conducted by Western Native Seed during 2008. Native seeds harvested by Western Native Seed will be supplemented with slender wheatgrass seeds obtained from the USFS National Resource Conservation Service (NRCS) to yield a total of 40 pounds of pure live seed (PLS) per acre. More information regarding 2007 seed collection and composition is provided in Table 4.

Seed collection is expected to occur during mid-September. Seeding will take place as soon after that as possible. Seeds will be drill-seeded into the soil where practical or broadcast seeded at double the drill-seed rate.

In order to determine if mulching is necessary the site will be evaluated for signs of erosion after the 2008 snowmelt. If it appears that significant erosion occurs during snowmelt, mulching is necessary and the seeded areas will be covered with 2,000 to 4,000 pounds per acre of weed-free straw that will be crimped into the soil after seeding by using a crimper or by driving a track mounted vehicle over the seed and mulch. If no mulching is performed, seeds will be mixed into the soil no more than ¾ inch by either driving over the seeded area with a track mounted vehicle or by pulling a springtooth harrow or other implement behind an ATV or other vehicle across the seeded area.

(This section was prepared with recommendations from John Scott of the U.S. Department of Agriculture, Natural Resource Conservation Service, Gunnison, Colorado. Mr. Scott may be available, with one week or more notice, to visit the site prior to seeding to make additional recommendations.)

3.2 COVER WITH NATIVE BORROW SOIL

Native borrow soil (from the repository or staging location) may be placed over existing soils in lieu of or in addition to amending the existing soils with lime, organic, and fertilizer. It is anticipated that the available native borrow soils will be used to cover tailings/waste rock left in place and areas where fill is required to leave a natural slope; however, the technique may be more widely used depending on borrow soil availability.

Areas covered in eight inches or more of native borrow soil will not be amended with lime or organic matter prior to soil addition; however, fertilizer may be added after soil placement. Areas containing tailings/waste rock that will be covered in less than eight inches of native borrow soil may be amended with lime that will be lightly tilled into the surface prior to placement of native borrow soil to provide additional protection for plant roots.

Organic matter may be added to the native borrow soil prior to placement. When available, organic content data will be used to determine the need for and application rate for compost amendment. If organic content data is not available, it will be assumed that the native borrow soil contains some organic content but that the soils require addition of compost to achieve an additional 1% organic carbon in the resulting soil. Fertilizer will be added to the surface of areas covered with native borrow soil.

During construction of the site repository, the soil layer was excavated from the repository footprint and stockpiled. Some of this soil is available for use in site reclamation. Agronomic analysis on the soil is listed in Table 4. The pre-existing vegetative cover was good. The soil contained 5.3% organic matter so no organic amendment is necessary. The recommended fertilizer rate is 40 pounds per acre nitrogen (N) and 60 pounds/acre P_2O_5 (Table 5).

Any area covered with native borrow soil will be seeded and mulched as described in Section 3.1.3.

3.3 NO TREATMENT

Exposed bedrock does not pose a risk to human health and the environment. Small amounts of soil on the bedrock would be difficult to revegetate. Soil or soil amendments placed on the bedrock would likely be washed downstream during the spring runoff or storm events and contribute to the erosion problems. Therefore, areas of exposed bedrock greater than approximately 100 square feet will not be reclaimed. If a small amount of residual soil (less than two inches to three inches deep) remains on the exposed bedrock, erosion control will be placed to minimize the potential for erosion into Elk Creek and reduce the impact of erosion on downgradient features that will be reclaimed.

Native materials that have not been impacted by the Removal Action will not be treated or covered with native borrow soils, but will be ripped to reduce compaction, then seeded and mulched as described in Section 3.1.3.

3.4 EROSION CONTROL

Erosion control measures will be implemented to protect the vegetation and reduce transport of sediment and site contaminants into other reclamation features and/or Elk Creek. Existing run-on/runoff controls, including portions of the ditch along the site access road, will be maintained and additional controls may be implemented. A preference for natural erosion control measures such as placement of timbers or coir log will be preferred over silt fence or other non-degradable means.

Mulching and erosion control may be accomplished using erosion matting on steep slopes (2 horizontal:1 vertical) if the soil is not rocky and if the erosion matting is placed so that it rests in full contact with the treated soil. The erosion matting must be properly trenched in on the upgradient side so water does not flow beneath the matting.

3.5 ROADWAYS

Roadways will be reclaimed dependent on the anticipated future use. Repairs or changes to the road alignment will be performed in coordination with the USFS and affected private property owners. The access road to Level 1 will remain in its current alignment. Upon completion of the Removal Action, the access road will be repaired. Access to Level 2 and beyond will be maintained; however, the current road alignment may be changed to allow for waste rock removal in the vicinity of Level 2. The existing access road to the tailings impoundment and other downhill features will not be maintained; however, an access route may be identified and marked for long-term access.

Abandoned roadways that contain mine waste will be treated or covered with native borrow soil then seeded and mulched. Abandoned roads within the removal area that do not contain mine waste will be ripped to reduce compaction, then seeded and mulched as described in Section 3.1.3.

3.6 ESTIMATED SOIL REVEGETATION MATERIALS REQUIREMENTS

Materials requirements were calculated using the following assumptions:

- The lime product to be used in the reclamation has a calcium carbonate equivalence of approximately 90 percent, 0 percent moisture, and 95 percent passes through a 60 mesh sieve.
- Compost contains 30 percent organic carbon and 20 percent moisture.
- Ammonium nitrate (33-0-0) and triple super phosphate (0-45-0) fertilizer are used.
- The area shown as “A” on Figure 1 will not be treated.
- The area shown as “B” on Figure 1 and located west of area “D” has 60 percent exposed bedrock, no cover with native borrow soil, and 60 percent rock content.
- The area shown as “B” on Figure 1 and located east of area “C” has 30 percent exposed bedrock, 30 percent will be covered with native borrow soil, and 50 percent rock content.
- The area shown as “C: on Figure 1 has no exposed bedrock, no cover with native borrow soil, ½ acre will be covered with wetland, 4,800 square feet will be covered by the new Elk Creek alignment, and 50 percent rock content.
- The area shown as “D” on Figure 1 has 60 percent exposed bedrock, no cover with native borrow soil, and 50 percent rock content.
- Soils to be treated contain 50 percent rock greater than one-half inch. [This assumption may be low because in many areas more than 80 percent rock content is expected.]
- Treatment depth averages six inches in each treatment area (not including exposed bedrock where no treatment will occur) except the “B” area east of the “C” area.

The estimated lime, compost, and fertilizer requirements are presented on Table 6. The quantities are rough estimates based on the above assumptions and should not be used to order materials until the assumptions are confirmed in the field. Additional materials such as coir logs and stakes will be necessary for erosion control.

4.0 STREAM RESTORATION DESIGN

“Approximately 1,000 linear feet of Elk Creek will be reconfigured to approximate conditions found immediately upstream and downstream of the Standard Mine site. The new channel will be a Rosgen A2/A3 type, which is steep and entrenched with cascading, step/pool flows that are stabilized by bedrock and boulders. The boulders used to stabilize the channel will be in the form of vortex weirs, which will be installed across the new channel every 15 to 25 feet. At least three of these weirs will be reinforced with large woody debris and used to create wetlands. The final layout of Elk Creek will be determined in the field based on site conditions." (Alpine ECO 2008)

The stream restoration design was developed by Clay Speas, Forest Fisheries Biologist, Grand Mesa, Uncompahgre and Gunnison National Forests (Speas 2007). The design, materials lists, and associated performance criteria are provided as Appendix A to this report.

5.0 WETLANDS RESTORATION DESIGN

Approximately 0.5 acre of ecologically functional wetlands will be created along the 1,000 feet of the reconfigured Elk Creek channel. Approximately three wetlands will be constructed immediately upstream of the reinforced vortex weirs, and numerous narrow "fringe" wetlands will be constructed along approximately 50 percent of the new channel. "The wetlands will be very gently sloping upward from the low flow channel of Elk Creek. The portion of the wetlands closest to the channel will be reinforced with a biodegradable erosion control blanket (ECB) to protect newly installed wetland plants from high velocity flows. The final size, location, and configuration of the Elk Creek wetlands will be determined in the field based on site conditions."

"The new wetlands will consist of both palustrine emergent and palustrine scrub/shrub types. There will be three wetland planting zones including the ECB/Plugs Zone, Plugs Zone, and Willow Zone. The ECB/Plugs Zone is the area immediately adjacent to the newly created channel and will be planted with 50,000 herbaceous wetland plants per acre. The Willow Zone is the area immediately upgradient of the Plugs Zone and will be planted with 5,600 willow cuttings per acre." (Alpine ECO 2008)

The wetlands restoration design was developed by Andy Herb, Ecologist, Alpine Ecological Resources, LLC. The design, materials lists and associated performance criteria are provided as Appendix B.

6.0 SEQUENCING

Reclamation of impacted soils and installation of the new Elk Creek channel and associated wetlands must be sequenced so that no one aspect of the work is holding up other tasks. Sequencing considerations include:

- There may be a preference for treating the west slope area soils ("B" area on the west side of the site) prior to installation of the new Elk Creek channel to reduce the number of vehicles that must cross the new channel after construction.

- Excavation of the "D" areas cannot be completed until the new channel is in place. A temporary crossing over the new stream will be required to complete the excavation and subsequent soil treatment and seeding.

- It is expected that existing soils will be removed from the new Elk Creek/wetland corridor (portions of the "C" area) prior to construction of those features. Materials removed from the channel corridor may be placed on existing soils outside the corridor and require treatment after construction of the Elk Creek channel and the associated wetlands is complete. Alternatively, if there are locations where the treated soils will be left in the channel or wetland, treatment will take place prior to construction of those features.

- The soil amendment material delivery schedule may impact the timing of treating soils.

It is expected that construction of the new Elk Creek alignment will be started in July 2008 followed by wetland construction. Removal of additional waste rock in the "D" area and other site locations is expected to occur throughout the summer.

7.0 LIST OF REFERENCES

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Figure 1 Level 1 Reclamation Plan

TABLE 1
Reclamation Performance Criteria

Measure	Method of Measure	Criteria
Soil in Treatment Areas		
Acid base account	Laboratory analysis of samples collected from 0 to 6 inch depth or maximum treatment depth, whichever is less.	> -5 for all composite samples. Mean value of all samples is >0.
pH ≥ 6.5	Laboratory analysis or field paste pH	Laboratory analysis shows pH ≥ 6.5 for amended soils. Not applicable to borrow soils.
Organic carbon	Laboratory analysis	≥1% in top 6 inches
Vegetation in Revegetation Areas		
Bare areas < $10m^2$	Visual inspection and field measurements. Bedrock outcrops or areas containing a high number of large rocks will be identified during construction and will not be included in the evaluation.	No single bare area >10 m^2 and total of bare areas not >10% of total area. Exposed bedrock and areas covered by large rock will not be included as bare areas.
Cover	Point-Intercept transect	Cover of areas ≥ 45% within 5 years. Cover will include rocks >2” and plants. Interim measurements may be performed to determine progress toward this goal.
Weeds	Visual observation	Must be less than 5% after one year of growth and less than 1% in subsequent years
Stream banks		
Channel configuration	Comparison of GPS coordinates immediately after construction and 2 years later.	After 2 years, the channel is within 5 feet of the constructed channel
Vortex weirs condition	Visual observation	Intact and functioning as designed
Wetlands		
Area	Comparison of GPS coordinates or other survey immediately after construction and 2 years later	Area intact. Palustrine emergent (PEM) wetlands are within 12 vertical inches of low-flow water surface elevation. Palustrine scrub/shrub (PSS) wetlands are within 19 inches (vertical) of the low flow water surface elevation.
Wetland soil	Visual observation and measurements	Wetland contains appropriate substrate and hydrologic regime to support wetland vegetation (4 inches of topsoil or similar fine-grained material)
Herbaceous wetland plantings	GPS survey or other survey	Area covered by planting has increased by >10% after 2 years
Woody wetland plantings	Survivability count Volunteer willows count as live willows	At least 40% of planted willow cuttings are alive after 2 years
Erosion		
Erosion	Visual observation	No visible signs of significant erosion in revegetation areas, stream banks, or wetlands.

TABLE 2
Pre-Removal Sampling Analytical Results

	Mill Site	Northeast Waste Rock	North Waste Rock	Tailings Impoundment	West Waste Rock
Arsenic[1]	580 U	1,900 U	1,500 U	460	460 U
Chromium[1]	200 U	200 U	200 U	200 U	200 U
Cobalt[1]	300 U	300 U	300 U	300 U	300 U
Copper[1]	310	1,100	690	63 U	280
Iron[1]	65,000	160,000	130,000	80,000	82,000
Lead[1]	5,800	19,000	15,000	470	4,600
Manganese[1]	630	4,000	9,300	820	7,000
Mercury[1]	5 U	12 J	5 U	5 U	5 U
Molybdenum[1]	5.7 U	5.7 U	5.7 U	5.7 U	5.7 U
Nickel[1]	81 U	81 U	180 J	81 U	81 U
Ribidium[1]	150	210	190	76	170
Selenium[1]	8.4 U	51	39	13 J	12 J
Strontium[1]	130	65	61	17 U	46 J
Zinc[1]	660	4,700	11,000	820	4,800
Zirconium[1]	400	270	240	130	300
SPLP Arsenic[2]	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
SPLP Barium[2]	0.11	0.05 U	0.05 U	0.05 U	0.05 U
SPLP Cadmium[2]	0.05 U	0.14	0.33	0.05 U	0.05 U
SPLP Chromium[2]	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
SPLP Copper[2]	0.068	1.1	0.05 U	0.05 U	0.05 U
SPLP Lead[2]	11	7.3	1.8	0.15	0.1 U
SPLP Selenium[2]	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
SPLP Silver[2]	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
SPLP Zinc[2]	1.4	22	53	0.3	1.9
Acid Base Account					
Acid Potential[3]	11.1	71.9	93.8	5.2	37.5
Acid/Base Potential[3]	-11.1	-71.9	-91.6	-5.2	-26.7
Neutralization Potential[3]	0.5	0.5	2.2	0.5	10.8
Lime requirement[3]	25	107.4	127.4	11.4	49.1
SMP Buffer pH	5.7	5	5.8	6.4	6.7
SMP Lime Requirement[3]	8.9	14	8.1	3.9	1.8
Sulfur, Total[4]	0.48	2.49	2.82	0.23	1.27
Sulfur, HCL Extractable[4]	0.1	0.01	0.01	0.1	0.01
Sulfur, HNO3 Extractable[4]	0.2	1.4	2.2	0.09	0.9
Sulfur, Residual[4]	0.08	0.9	0.8	0.01	0.3
Sulfur, Water Extractable[4]	0.08	0.3	0.4	0.03	0.07

1 Milligrams per kilogram (mg/kg)
2 Milligrams per liter (mg/L)
3 tons/1,000 tons
4 Percent
U Not detected

TABLE 3
Post-Removal Sampling Analytical Results

Analysis	SP-02 From former tailings impoundment	SP-03 From former tailings impoundment
ABA Analysis		
Acid Potential[1]	13	18
Acid Neutralization Potential[1]	4	6
Acid/Base Potential[1]	-9	-12
Lime requirement[1]	30	34
SMP Buffer pH	4.3	4.3
SMP Lime Requirement[1]	15	15
Agronomic Analysis		
pH	4.3	4.3
Salts (mmhos/cm)	2.320	2.320
Texture Estimate	SCL	SCL
Organic Matter, %	1.1	1.1
Nitrate N (ppm)	5.2	5.2
Phosphorus P (ppm)	2 B	2 B
Potassium K (ppm)	7 B	7 B
Zinc (ppm)	23.70	23.70
Iron (ppm)	3.2	3.2
Manganese (ppm)	19.90	19.90
Copper (ppm)	1.47	1.47

1 tons/1,000 tons
2 Percent
SCL Sandy clay loam

TABLE 4
2007 Native Seed Collection

	100 seed weight	Seeds per pound	Viability	Percent of gathered material*	Pounds active seed per pound of gathered material*	Pounds live seeds per pound of gathered material*	% of total pounds of live seeds
Kentucky bluegrass	0.0224	2,026,786	82 %	2.14	0.017548	35,566.04	17.9
Tufted hairgrass	0.0196	2,316,327	40 %	2.65	0.0106	24,553.06	12.3
Sedge	0.0282	1,609,929	66 %	11.49	0.075834	122,087.4	61.3
Fringed brome	0.4336	104,704.8	92 %	5.96	0.054832	5,741.173	2.9
Rocky Mountain fescue	0.0644	704,968.9	96 %	1.64	0.015744	11,099.03	5.6
Inert	--	--	--	76.12			
TOTAL						**199,046.7**	

Data from Wyoming Seed Analysis Laboratory analysis on seed gathered near Taylor Reservoir during 2007 by Western Native Seed:
* pounds of seed per 100 pounds of gathered material, where the gathered material includes seeds and the chaff collected with the seed.

TABLE 5
Repository Overburden Native Borrow Soil Analytical Results

Analysis	Result
pH (standard units)	5.2
Salts (mmhos/cm)	0.3
Lime %	Low
Texture Estimate	Loam
Organic Matter, %	5.3
Nitrate N (ppm)	1
Phosphorus P (ppm)	2.8
Potassium K (ppm)	142
Zinc (ppm)	41.4
Iron (ppm)	144.7
Manganese (ppm)	107.6
Copper (ppm)	4.2
Recommended Fertilizer	
N (pounds/acre)	40
P_2O_5 (pounds/acre)	60

mmhos/cm Millimhos per centimeter
ppm Parts per million
N Nitrogen
P_2O_5 Phosphorus pentoxide

TABLE 6
Estimated Soil Amendment Material Requirements

Location	Total Area (acres)	Treatment Area (acres)	Lime (tons)	Compost (tons)	Fertilizer (pounds ammonium nitrate/pounds TSP)
B-West Bank	0.64	0.26	44	9	31 / 34
B-East	2.07	0.83	519	46	134 / 147
C	0.76	0.15	82	6	18 / 20
D	0.41	0.17	36	7	20 / 22

TSP Triple super phosphate

Assumptions:

B-West Bank has 60% exposed bedrock, no cover with native borrow soil, and 60% rock content.

B-East has 30% exposed bedrock, 30% will be covered with native borrow soil, and 50% rock content.

C has no exposed bedrock, no cover with native borrow soil, ½ acre will be covered with wetland, 4800 square feet will be covered by the new Elk Creek alignment, and 50% rock content.

D has 60% exposed bedrock, no cover with native borrow soil, and 50% rock content.

All treatment areas have a 6-inch average treatment depth (not including the portion considered exposed bedrock) except B-East which has an 8-inch average treatment depth.

Lime has 90% CCE, 0% moisture, and 95% of the particles pass through a 60 mesh sieve.

Compost has 30% organic carbon and 20% moisture.

Fertilizer calculations assume ammonium nitrate (33-0-0) and triple super phosphate (0-44-0) are used.