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DIVISION OF RECLAMATION
MINING AND SAFETY

Date: February 28, 2018

To: Michael A. Cunningham, Environmental Protection Specialist
Colorado Division of Reclamation Mining and Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

Re: City of Golden, Empire Pit No. M-1977-534-AR01
Technical revision, Empire pit, Reclamation permit number M - 1977 -534

Dear Mr. Cunningham:

Guanella Reservoir was dedicated in 2005 and in 2006 the Denver Post wrote an article with a picture of the south bank of the reservoir and it showed how the south bank was being well vegetated after one growing season.

After Consulting with our Environmental Reclamation Expert, Dr. Samuel Bamberg, we have these comments and questions in an effort to help in the successful Reclamation of the Guanella Pit Area.

1. Will the contaminated material be removed to the full depth and width of contamination before a minimum of 18 in. of viable subsoil and topsoil is placed including under the fence?

2. Will all material imported from offsite be certified weed-free, including soil amendments, seeds, backfill material, manure, other organic material and equipment?

3. The 12in of low permeability clay soils and top soil should have a measurable definition and specification of permeability, organic content, biomass content, living organism specifications, allowable rock, clay, loam, sand content, compaction and fertilizer requirement.

4. How will the top soil be protected from wind erosion and leaching until a successful cover crop has been established and permanent cover established?

5. Does this plan address the contamination from salt, recycled asphalt and other foreign material buried and mixed in the adjacent areas?

6. What will be the expected coverage rate and root depth from the reclamation seed mix after one year, 3 years and 10 years for a successful completion of reclamation?

Hopefully these questions and comments will be helpful and lead to a timely and successful long-term viable reclamation of the area. Also attached is a copy of the latest letter from Dr. Bamberg to add to his previous report filed earlier.

We have some other ideas for the area that might be more economical if you are interested.

Sincerely,

Sally Buckland

cc: Dan Hartman, Golden

Evaluation Report
Review Reclamation on the Guanella Ranch

To:
Phil Buckland
Sally Guanella Buckland
PO Box 36
Empire, CO 80438

From:
Samuel Bamberg, PhD
Reclamation Specialist
14415 Club Villa Dr. Unit E
Colorado Springs CO 80921

March 2018

1. Introduction

The purpose of this report is and to evaluate for adequacy the proposed Technical Revision Request to the 112 Reclamation Plan by the City of Golden, and to evaluate and review the current and past reclamation for success to the intended land use as pasture. The changes to the Reclamation Plan will not be adequate to support rangeland pasture, and the current reclamation was not successful in restoring the soils, topography or vegetation.

2. Evaluation of the Technical Revision

Golden submitted a Request for a Technical Revision to the Empire Pit, Reclamation Permit No. M-1977-534 to Colorado Division of Reclamation, Mining and Safety (DRMS) on January 23, 2018. This request for a TR to the Reclamation Plan was in response to DRMS deficiencies identified in reclamation-revegetation progress based on DRMS inspection of the property on September 1, 2017. A "Technical Revision" is defined under DRMS rules 2CCR 407-4: **"(49) "Technical Revision"** means a change in the permit or an application, which does not have more than a minor effect upon the approved or proposed Reclamation Plan. 103(11)(b),(c). The DRMS will decide the technical revision on March 5, 2018 unless they extend the time to do so. If DRMS does not act by that date, the Technical Revision is automatically approved.

Golden is proposing to remove saline soils on 28,675 ft^2 (0.66 acres, 2/3 acres) to a depth of 18 inches on the southwest side of the pit adjacent to the reservoir dam (see Photo 1 copied from the TR application to DRMS). Twelve inches of clay subsoil will then be applied topped with six inches of topsoil.

Photo 1. Area to be changed as proposed in the Technical Revision,

There are several concerns with this approach to reclamation and revegetation on this alluvial terrace along Clear Creek. The six inches of topsoil is inadequate to support pasture land vegetation since the original top-soil and viable subsoil was 13 to 20 inches thick with abundant roots and organic matter (Unit 27, Lone Rock-Breece, gravelly sandy loam, USRCS 1983, Empire, Colorado soil survey). The shallow low permeability clay subsoil will restrict root growth, and reduce plant productivity. The site will not support rangeland pasture, and allow grazing.

Alluvial soils in the valley above Empire on this ranch were a sandy clay loam that was deposited in the flood-plain along the creek. It is high in organic matter and fertile from plant growth and decay of dense vegetation and root biomass. The disturbed gravel operation site is considered a river terrace about 20-25 feet above the flood plain to the north along the creek.

Topsoil in this valley generally consists of loose friable soil of natural loam, sandy loam, silt loam or clay loam and humus that can sustain plant life; neither acid or alkaline: free of foreign materials, stones greater than one inch, concrete, cinders, brick, asphalt, weeds, or noxious materials. Texture should be a sandy loam to clay loam with less than 5% gravel including no stones greater than $1^{1/2}$ inch. There are two classifications for this type of topsoil:

1).	Sand - 25-75%, avg. 50%	or 2).	10-20%
	Silt – 15-40%, avg. 27.5%		10-70%
	Clay - 15-30%, avg. 22.5%		5-30%

Organic matter should be 3-20%, with the recommended amount for this soil at 6 to 8%
Other soil properties include a pH of 6.1 to 7.8, and Nutrient of Nitrogen at 5ppm, Potassium at 5ppm, Phosphorus at 30ppm, and Iron at 5ppm. If applied as fertilizer: Nitrogen 26.8 lb/acre, Potassium 26.8 lb/acre, Phosphorus 133.8 lb/acre.

As stated earlier the proposed TR changes to the salt contaminated soils are inadequate to support native productive vegetation.

Other questions and concerns with the Technical Revision of this current review are:

1. Will the contaminated materials be removed to the full depth and width of contamination before a minimum of 18 in. of viable subsoil and topsoil replaced?
2. What will the excavated material below 18 in. be replaced with, and what are the material and backfill specifications?
3. Will all material imported from offsite be certified weed-free, including soil amendments, seeds, backfill material and equipment?
4. The 12in of low permeability clay soils should have a measurable definition and specification of permeability and organic content, biomass content, living organism, and include specifications for rock, clay, loam, and sand content.
5. What will be the compaction of the replacement soils, moisture content, gradient and top cover and mineral and fertilizer of the subsoil and topsoil?
6. How will the top soil be protected from wind erosion and leaching until a successful cover crop has been established and permanent cover established?
7. How will the living organisms, bacteria, microbes and earthworms be protected until vegetation is sufficient to sustain the reclaimed area?
8. How will soil contamination be measured and at what levels for what contaminants?
9. How will the material be removed from under the existing fence and the adjacent soils to the west be removed or prevented from migrating contamination to the Reclamation area?
10. The area to the west needs to have a barrier to prevent leaching and wind erosion of contaminated material on to the reclamation area?
11. What will be the expected germination of the reseeded area and criteria for successful reclamation?
12. Is the certified weed-free approved seed mix compatible with the proposed soil, moisture, climate, altitude?
13. What season will the area be prepared and reseeded?
14. What will be the expected coverage rate of the reclamation seed mix after one year, 3 years and 10 years for a successful completion of reclamation?
15. What type of mulch will be used and the life of the mulch, moisture retention of the mulch, wind resistant characteristics of the mulch?
16. What will be the soil be tested for fertilizer needs and results after reclamation and will a certified a lab be used, such as Colorado State University?
17. What is the weed control plan for the area and surrounding areas?
18. How long will the existing weed seeds be viable and the approved seed mix time to be self-sustaining?
19. What are the timing and time of year, what temperature and growing seasons are required for the revegetation and reseeding of the areas?

20. Does this plan address the contamination from recycled asphalt and other foreign material buried and mixed in the adjacent areas?
21. How will the area be monitored, by whom and for how long?
22. How have the areas contaminated been identified by surface observation after 4 years or has core drilling and sampling been done throughout the area to the depth of the native material under the Reclamation area? Salt was also stored to the southeast of the area noted on the map as well as rubbish, recycled asphalt and other non-native material buried. Some pictures of known areas will be attached later in this report. Has the area been excavated in these areas and sampled in other areas?

3. Evaluation of the current and past reclamation for success

The gravel pit site was reclaimed in fall 2013 per the original reclamation plan. Photo 1 shows the gravel pit and site during full operation and before reclamation was started.

Photo 2. Gravel pit site in 2011.

Salt and other road material (asphalt) were stored onsite, and used for road construction and sanding roads in winter. Photo 3 shows the salt and sand stored onsite during operations, and Photo 4 shows salt being buried onsite.

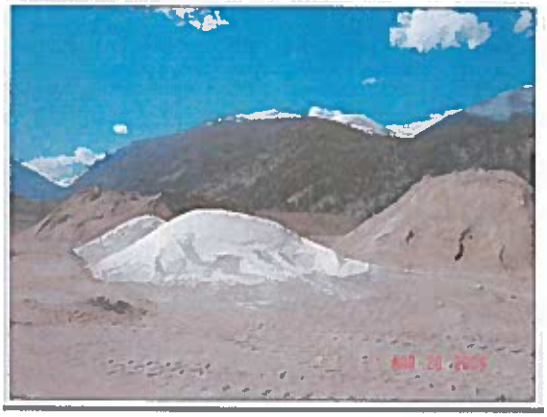

Photo 3. Salt and sand onsite in 2009.

Photo 4. Salt buried onsite in 2013.

The pit was reclaimed in fall 2013 by grading to bury onsite contamination, debris and asphalt, and then topsoil applied and seeded. Photo 5 shows debris being buried in a pond, and Photo 6 shows topsoil with large stones that was applied.

Photo 5. Debris and rock buried in pond.

Photo 6. Imported topsoil used to cover dirt.

The pit was graded smooth, topsoil moved on the surface, and rocks segregated on the edges (see Photos 6 and 7). The topsoil contained large rocks and stones that reduce the quality of the soil as good growth media.

Photo 6. Imported topsoil on graded surface

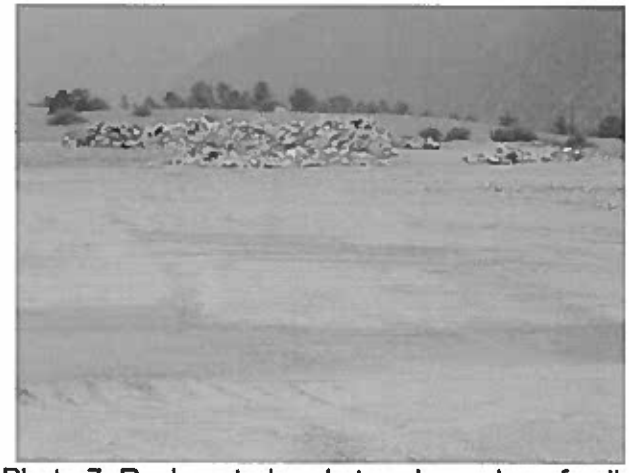

Photo 7. Rock sorted and stored on edge of soil.

Topsoil was spread on the soil surface and graded to an estimated 4 to 6 inches (see photos 8 and 9). There was little or no humus or organic matter in the soil, and the texture was gravelly and sandy with little loam.

Photo 8. Topsoil spread on the prepared surface.

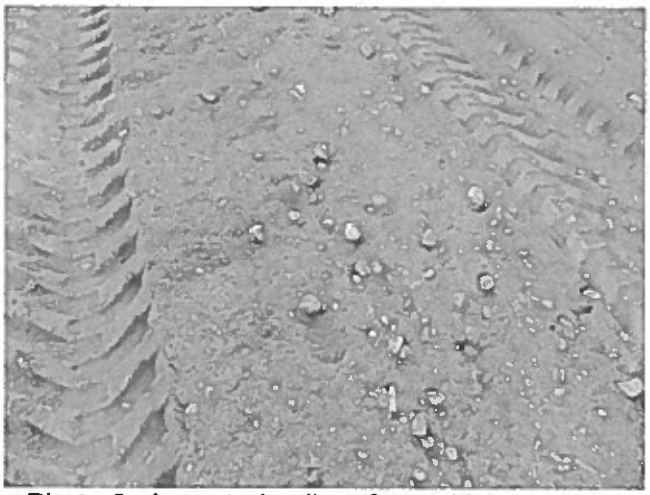

Photo 9. Imported soil surface with stones.

The vegetation that germinated had plant growth that was sparse and not productive. Photo 10 shows sparse plant growth in 2015, and Photo 11 show mostly bare soil and a rock/gravel surface in 2017. Photo 12 shows asphalt on the soil surface, and poor plant productivity, and Photo 13 shows bare soil in the salty soil in 2017.

Photo 10. Sparse plant growth in 2015.

Photo 11. Bare soil with sparse plant growth in 2017

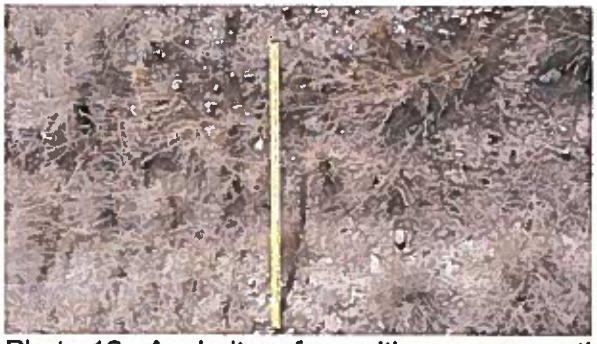

Photo 12. Asphalt surface with sparse growth.

Photo 13. Bare soil in salty soil.

In Photo 14 the native soil on the bank shows excellent growth, while the imported soil was mostly bare. As show in Photo 15 weeds are dominant with little grass on portions of the reclaimed soils.

Photo 14. Example of Good plant growth on native soil used on reclaimed area.

Photo 15. Weeds dominant in the vegetation.

4. Summary and conclusions

Reclamation on the Empire Pit site cannot be considered successful due to several inadequacies and deficiencies. There are problems with soil and substrate conditions that prevent revegetation to a productive rangeland that will support grazing. The problems identified in this report include:

1. Soils and substrate had been contaminated with salt, road asphalt and debris, trash, and other junk that were not removed or buried adequately.
2. Soil in the area contaminated with salt does not support vegetation, and the changes proposed in the TR will not result in good plant growth or productivity. The imported topsoil is too shallow and the clay subsoil will prevent good root penetration resulting in drought conditions.
3. Topsoil applied on the graded surface was of poor quality with many rocks and gravel, and little organic matter or humus. The nutrient status was not known, but was probably poor and allowed weeds to germinate and persist.
4. Revegetation was sparse and many areas were bare and had little plant cover.

The remedy and solution to poor reclamation is to correct the deficiencies. The soil can be improved by adding supplement organic matter and humus, or additives containing a carbon source such as biochar and a bacteria and fungi source such as MycorrPlus. Reseeding with a good seed mix containing native adapted plant seed with the supplement will improve plant growth and productivity.