STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

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COLORADO DIVISION OF RECLAMATION MINING & SAFETY

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MEMORANDUM

To: Bob Oswald

From: Tim Cazier, P.E. TC

Date: January 4, 2013

Re: **Permit No. M-2012-032, Revenue Mine Surface Water Systems Designs – Stormwater Comments – Review of November 29, 2012 Adequacy Response**

The Division of Reclamation, Mining and Safety (DRMS) engineering staff has reviewed the responses, revised exhibits, drawings, and calculations associated with stormwater management for the Revenue Mine and prepared by Greg Lewicki And Associates. The following comments are posed to ensure adequate engineering analyses and design practices are implemented to eliminate or reduce to the extent practical the disturbance to the hydrologic balance expected by the mining operation with respect to water quality and quantity in accordance with Rules 3.1.6, 6.4.21(10) and 7.3.1. Please note that as this site is a designated mining operation (DMO), compliance with Rule 7.3.1 is applicable, thus requiring certified designs and specifications for engineered elements associated with the environmental protection plan (EPP).

Map G-1:

1. The Soil Map Unit 112 (Cryothents-Rock outcrop) is categorized as being hydrologic soil group (HSG) C. The Soil Resource Report for Ouray Area, Colorado, Parts of Gunnison, Hinsdale, Ouray, San Juan, and San Miguel Counties categorizes 112 as HSG D. Please provide rationale for the use of lower runoff potential HSG for Soil Map Unit 112.

Map G-1B:

2. Channel COLL A appears to be intended to route runoff from SWB-6A to the upper segment of channel COLL #1.
   a. The peak flow shown on the drawing and calculated in Appendix 6 is 4.36 cfs. The peak flow from SWB-6C is only 2.06 cfs. The drawing should show cumulative peak flow values for the purpose of hydraulic design analyses. Please provide clarification and/or corrections as necessary to the drawing and hydraulic designs to account for runoff from SWB-6A/COLL A adjacent to SWB-6C.
   b. Similar to Comment 2a, if COLL A is routed to COLL #1, please provide clarification and/or corrections as necessary to the drawing and hydraulic designs

to account for runoff from SWB-6A/COLL A and SWB-6C in the COLL #1 segment adjacent to SWB-6D.

3. Channel COLL B appears to be intended to route runoff from SWB-6B to the upper segment of channel COLL #2. The peak flow shown on the drawing and calculated in Appendix 6 is 6.4 cfs. The peak flow from SWB-6E is only 1.62 cfs. The drawing should show cumulative peak flow values for the purpose of hydraulic design analyses. Please provide clarification and/or corrections as necessary to the drawing and hydraulic designs to account for runoff from SWB-6B/COLL B adjacent to SWB-6E.
4. The runoff listed on the drawing for SWB-6F is 1.32 cfs. The calculated runoff Appendix 6 is 1.24 cfs. Please correct the flow presented on the drawing.
5. Channel COLL #3, similar to Comments 2 and 3, please confirm or make necessary corrections to the drawing and hydraulic design calculations to ensure the cumulative runoff is considered in the design of COLL #3 for segments adjacent to SWB-7A, SWB-7B, and SWB-7C.
6. The runoff listed on the drawing for SWB-7B is 3.07 cfs. The calculated runoff Appendix 6 is 2.49 cfs. Please correct the flow while considering Comment #5.
7. The runoff listed on the drawing for SWB-7D is 2.18 cfs. The calculated runoff Appendix 6 is 4.79 cfs. Please correct the flow presented on the drawing.
8. COLL #5 is very near the Atlas Drainage.
    a. Provide assurance that COLL #5 will not be undermined by the Atlas Drainage.
    b. Provide assurance that the 90 degree bend in COLL #5 as it approaches the Atlas Drainage will be armored such that it will not breach and flow into the Atlas Drainage.

Map G-2: Sediment Pond 1

9. There appears to be a typographical error for the Sediment Pond 1 Spillway Design principal spillway outlet elevation. The stated elevation makes the pipe have no elevation drop. Please provide a corrected elevation.
10. The stated storage capacity of Sediment Pond 1 is 1.05 ac-ft. Section 4.5 (Exhibit G) states the pond will store both the 10-, and 25-year, 24-hour design storm runoff volumes. However, the sum of the 10- and 25-year runoff volumes (1.39 ac-ft) on the Stage-Storage curve exceeds 1.05 ac-ft. Only runoff volume calculations for the 100-year design storm were provided. Please provide runoff volume calculations for the 10-, and 25-year, 24-hour design storms.
11. As the site is a DMO, any embankment fill is considered an EPF. Please reference embankment material fill and compaction specifications on Map G-6.
12. Please provide hydraulic calculations for the emergency spillway.

Map G-3: Sediment Pond 2

13. Only runoff volume calculations for the 100-year design storm were provided. Please provide runoff volume calculations for the 10-, and 25-year, 24-hour design storms.
14. As the site is a DMO, any embankment fill is considered an EPF. Please reference embankment material fill and compaction specifications on Map G-6.

15. Please provide hydraulic calculations for the emergency spillway.

Map G-4: Sediment Pond 3

16. The stated storage capacity of Sediment Pond 3 is 0.2075 ac-ft. Section 4.5 (Exhibit G) states the pond will store both the 10-, and 25-year, 24-hour design storm runoff volumes. However, the sum of the 10- and 25-year runoff volumes (0.22 ac-ft) on the Stage-Storage curve exceeds 0.20 ac-ft. Only runoff volume calculations for the 100-year design storm were provided. Please provide runoff volume calculations for the 10-, and 25-year, 24-hour design storms.
17. As the site is a DMO, any embankment fill is considered an EPF. Please reference embankment material fill and compaction specifications on Map G-6.
18. Please provide hydraulic calculations for the emergency spillway.

Map G-5: General Comments

19. Collection ditches are proposed to have 1.5H:1V side slopes. Side slopes this steep are inherently unstable. Please revise the side slopes to no steeper than 2.5H:1V (3H:1V is preferred).
20. Diversion ditches are proposed to have 2H:1V side slopes. Side slopes this steep are inherently unstable. Please revise the side slopes to no steeper than 2.5H:1V (3H:1V is preferred).
21. Half pipe channel segments are proposed for several steep sections. The use of half pipes typically requires significant maintenance. The Division will accept half pipe channels during the operational phase of the mine, provided the Operator will provide a written commitment to perform frequent inspections and perform the necessary maintenance. However, half pipe channels are not acceptable for reclamation channel design. Please submit alternate designs for the post-mining phase.
22. No hydraulic calculations for any channels were provided. Please provide hydraulic design calculations for all engineered channels. Calculations should include channel evaluations for both stability and capacity, i.e., minimum and maximum expected roughness. For example, an excavated earth channel, after weathering would be expected to have a minimum $n = 0.018$ (use to evaluate stability or maximum expected velocity); and a maximum $n = 0.025$ (use to evaluate capacity). In addition, the DRMS requires channel freeboard be evaluated for all engineered channels: channels shall be designed with a minimum of 0.5 feet of freeboard unless the velocity head ($v^2/2g$) is significant, then the minimum required freeboard is half the velocity head, or $v^2/4g$. NOTE – *some half pipe channels were estimated by the Division's engineering staff to have a half-velocity-head of greater than 4 feet. As such these channels are not properly designed because insufficient freeboard is available.*
    a. Please provide a rationale for the selected roughness coefficients, and evaluate each designated channel/ditch design slope for both capacity and stability. *NOTE – the "flow capacity" and "velocity capacity" presented on the drawing is not specifically related to the design flows.*
    b. Please design all engineered ditches with the appropriate freeboard and provide channel design depths for construction.

<u>Map G-7</u>:

23. As discussed in Comment #22, the velocity in the half pipe channels can be expected, in some cases, to well exceed 20 fps. Please provide some hydraulic calculations to demonstrate the 10-foot long rock-lined energy dissipation zones are sufficient to dissipate the hydraulic energy; and demonstrate the proposed 24-inch riprap will be adequate.
24. Design suggestion: Partially burying the upgradient edge of the half pipe channels will not function properly for very long and will end up with additional sediment in the pipe. Please consider extending the proposed conveyor belt material from about a quarter of the pipe diameter to the top of the half pipe, then burying a minimum 12-inch extension of the same conveyor belt material into the excavated slope.

<u>Map G-8</u>:

25. HDPE Inlet – No pipe profile is provided. There appears to be a variable slope and a near 90-degree horizontal bend based on inspection of Map G-1B. The Division is concerned about hydraulic gradient fluctuations in the pipe that may lead to pipe collapse if air vents are necessary and not provided. Please provide hydraulic gradient analyses to address pipe slope variations and losses at bends.

If either you or the applicants have any questions regarding the comments above, please call me at (303) 866-3567, extension 8169.