# STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106




## MEMORANDUM

**To:** Stephanie Reigh

**From:** Tim Cazier, P.E.

**Date:** March 22, 2013

**Re: Mineral Joe Mine Drainage Design – Second General Stormwater Comments, Permit No. M-1977-284 / AM-01**

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The Division of Reclamation, Mining and Safety (DRMS) engineering staff has reviewed the February 27, 2013 Drainage Design Plan for the Mineral Joe Mine prepared by Whetstone Associates, Inc. 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(1), 6.4.21(10) and 7.3.1. Please note, 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).

**General Comments:**

1. The hydrologic method and analyses are very well presented with assumptions stated and substantiated. Sections 1.2 through 2.2.3, and 3.0 through 5.1 are a great example of what is expected of hydrologic/runoff analyses for EPPs.
2. Page 5, section 2.3.1. Trapezoidal channels were assigned side slopes of 1.5H:1V or 2H:1V. Based on the photographic evidence presented in Figure 9 (p. 25), these values may be appropriate for the channels as constructed. However, steep side slopes are unstable and prone to sloughing that can lead to channel blockage and failure when constructed in erodible material. These channels require modification in design and construction (if already in place). The DRMS requires channel side slopes be no steeper than 3H:1V, unless it can be demonstrated that the specific material will be stable under the design flow at 2.5H:1V.
    a. Please redesign these channels as appropriate.
    b. Please commit to constructing/improving these channels to meet the redesigned configuration to be approved by the DRMS.

3. Page 6, Cowan's formula. The formula at the top of page 6 uses "$n_b$" and "m", Table 3 uses "$n_0$" and "$m_5$". Please confirm the $n_0$ is used for $n_b$ and $m_5$ is used for m.

4. Cowan's method results in higher Manning's values when compared to the more traditional values published in "Open Channel Hydraulics" (Chow, 1959) and others (e.g., Van Haveren; 1986, Mays, 2001). Also note that channel roughness is seldom uniform. Therefore, the DRMS requires channels be evaluated 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). The DRMS will accept roughness values obtained using Cowan's method for capacity, but an alternative method should be selected to evaluate channel stability. Please provide a complete summary analysis of expected channel performance for both stability and capacity for the redesigned channels.

5. Page 7, section 2.3.4. This section states HEC 15 was used to evaluate diversion ditches to determine if channel protection is required. No constructed channel evaluation results were provided with the drainage Design Plan.

    a. Please provide criteria for the referenced evaluation (Note the DRMS requires channel protection for channel velocities that exceed five feet per second under design flow conditions).

    b. Please clarify the statement that "… channel protection will be placed to the full channel depth listed for each structure." Will channel protection be placed in existing channels? If so allowances need to be made for the reduction in conveyance capacity. Please elaborate.

    c. The fourth bullet states "Riprap shall extend 1.0 x flow depth above flow level." This may conflict with the previous statement ""… channel protection will be placed to the full channel depth listed for each structure." Channel protection will be required to extend to the full design depth, including freeboard. (Note: 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 $v^2/4g$). Please clarify the design/redesign intent.

    d. There is no reference to design drawings (as-built or proposed). Please provide channel design/redesign drawings, stamped and signed by a professional engineer registered in Colorado.

    e. The last paragraph discusses using "gravel mulch". Please describe where gravel mulch will be used and why. If flow velocities are expected to exceed five feet per second for gravel mulch applications, please demonstrate the specified material will be stable under design flow conditions.

6. Page 11, Figure 1. There appears to be significant Upper Diversion Structure and Middle Diversion Structure channel segments extending beyond their respective delineated sub-basins. Figure 1 also identifies an additional 0.28 acres, and 0.18 acres that appear to contribute to these structures, respectively. Please explain why sub-basins N/C and N/D don't extend to the diversion discharge point and correct Figure 1, Table 7 and the WinTR-55 hydrologic analyses as appropriate.

7. Page 13, Figure 2. Please identify sub-basin MFA and make similar corrections to sub-basins N/C and N/D as discussed in Comment 6.

8. Page 16, Table 10. In reference to Comment 4, the Manning's n values used for reach routing, appears to be what the DRMS would consider capacity roughness values. For long routing reaches, this can result in significant peak flow attenuation when compared to routing with stability roughness values. The WinTR-55 results indicate no significant attenuation, likely due to the short reach lengths. The routing reach roughness values should reflect stability roughness values for future analyses. No action is necessary for this submittal.

9. Page 16, Section 4.5.1. Section 4.5.1 states the stormwater and sediment retention pond (SWRP) is 13.3 feet deep. Please review the Colorado Office of the Sate Engineer (OSE) Dam Safety Rules (specifically Rule 4.2.5) to determine if the SWRP should be under jurisdiction of the OSE, based on the 10-foot height limit. Provide the DRMS with a response as to why or why not the SWRP is jurisdictional.

10. Page 24, Section 5.2 and Tables 14 and 15. This section discusses diversion channel capacity. Table 14 suggests all channels are designed or constructed to be a minimum 5.0 feet in depth. The DRMS could find no flow velocity evaluation in this submittal.

    a. Please confirm all listed channels have a minimum design or constructed depth of 5.0 feet or provide a summary of minimum design/constructed depths. Your response should include stamped and signed design and/or as-built drawings indicating these depths.

    b. Please provide stability analysis results indicating design flow velocities are either less than or equal to five feet per second or channel protection is designed and/or placed with appropriate analyses demonstrating adequate protection is provided by the specified channel protection.

11. Page 26, SWRP spillway. A spillway is required for retention ponds. The DRMS acknowledges the Operator is committing to construct the recommended spillway upon approval of this permit amendment. However, design drawings stamped and signed by a professional engineer registered in Colorado is required. The drawings should address the following:

    a. The expected depth to erosion resistant material on the northwest side of the berm, of which the design is said to take advantage.

    b. Based on Figures 4 and 5, the width of the existing berm is approximately 10 – 15 feet wide. The second paragraph and Table 17 state the spillway will be 10 feet wide. The last paragraph states the spillway will be constructed on the northwest side of the berm, rather than the middle of the berm. and Figure 13 suggests a "V" shaped spillway. Please provide a plan view, longitudinal and lateral cross-sections on the drawings showing how the spillway will be constructed and protected to prevent head cutting the berm in the event the spillway is utilized during the 100-year, 24-hour design storm event. The design also needs to provide spillway and spillway channel protection analyses demonstrating the protection is adequately sized.

    c. There is no way presented in the SWRP design plan to drain the pond via gravity. The DRMS suggests the Operator consider a low level outlet be designed into the

pond in case a call is put on the Dolores River, the Operator can comply with the DOWR requirements. (*NOTE – The DRMS checked with the Colorado Division of Water Resources (DWR) District 63 water commissioner (Tom Brigham) regarding the status of the Dolores River appropriations. DWR's requirement to release retained stormwater within 72 hours is seasonal and is subject to change.*).

12. Page 30, Section 6.1. The last bullet suggests silt fence will be placed in the ephemeral drainage. Silt fence is ineffective and will fail when subjected to concentrated flow. Please clarify the intent to use silt fence in this instance.
13. P. 36, Attachment 3. As noted in Comment 11, design drawings stamped and signed by a professional engineer registered in Colorado is required for spillways as well as all other engineered structures associated with stormwater controls related to the EPP.

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