COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

January 25, 2018

Interoffice Memo
Colorado Red Rose Granite Quarry
Ground Engineering Initial Slope Stability Evaluation Review

Jared,

I have reviewed Ground Engineering (GE) submission, "Initial Slope Stability Evaluation, Exterior Slopes" (the Report) on behalf of Colorado Red Rose Granite Quarry (RRGQ) and have the following comments.

GE's stability evaluation is limited to slope-parallel joints that are most relevant to the face of the quarry under static conditions. There were no evaluations done in regard to dynamic conditions for the joints or any roof/wall stability analysis within the cuts or "rooms" of the RRGQ. It was my understanding that there was a potential concern for stability issues within the quarry's "rooms" but due to the lack of knowledge of the site and information provided specific to this, I cannot comment regarding "room" stability. If part of the main concerns with RRGQ's permit revision is the roof stability, additional stability analysis will be required.

In the Report, GE analyzes a total of seven joint orientation for both planar and wedge failures. Variable assumptions for the slope stability analysis were all based on site specific information and accepted general values for the conditions outlined in the Report. Site specific lab testing was done on the granite for unconfined compressive strength outlined in GE's August 29, 2017 report as 12,020 psi and 19,580 psi. However, it should be noted that this referenced August report has not been provided to the Division. In the Report's analysis, a compressive strength of 8,000 psi was used. This value is considered conservative based upon the lab results of GE's previous report as well as general values for granite. All other assumptions and values used were based on conservative or respected values within their range.

Of the seven joints analyzed in the Report, one combination joint orientation (Joint Orientations 6 and 7) received safety factor value of 1 (failure). In the Report, GE states, "[i]n any case, this area should be observed regularly for indications of rock movement, particularly after heavy precipitation events." Additionally, it is also stated in the Report that, "[a]t the time of our field studies, the site was occupied an existing quarry operation and a single-family residence…" Based upon the description of the site, it appears there exists a potential for damage to be caused to the residential area adjacent to the RRGQ in the event of slope failure.

Based upon my review of the Report, I have the following adequacy comments:

- As part of the additional information provided with GE's Report, it appears that RRGQ is approved or are currently applying to blast within the quarry. It also appears that GE's slope stability evaluation does not consider dynamic loading in the Report. Please have RRGQ reevaluate slope stability to include dynamic loading in which it may experience in the event of blasting.

- References to a GE report dated August 29, 2017 have been observed throughout the Report. Please have RRGQ provide the report as it appears to provide additional information regarding values used within the Report.

- Within the Report, only the results of the stability analysis have been provided. Please have RRGQ submit the model associated with each joint orientation analyzed in the Report.

- As stated earlier, there exists a potential for damage to be caused to the residential area adjacent to the RRGQ in the event of slope failure. Please have RRGQ provide information on how they plan to mitigate slope failures, especially at areas of high potential (Joint Orientations 6 and 7).

If you have any questions, feel free to contact me at any time.

Sincerely,

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