November 29, 2023
Revised March 5, 2024

RMR Aggregates, Inc.
6200 S. Syracuse Way, Ste. 450
Greenwood Village, CO 80111

Attention: Mr. Robert Wagner

Re: Response to Revision Request
Rock Failure Analyses and Stabilization
Mid Continent Limestone Quarry
Glenwood Springs, CO
KUE Project No. P-23018SS

Dear Mr. Wagner,

The Kilduff Underground Engineering, Inc. (KUE) consultant report dated August 29, 2023 and titled Rock Failure Analysis and Stability following was issued by RMR Aggregates, Inc. to the Colorado Division of Reclamation, mining and Safety (DRMS) on September 1, 2023. A review of the report and requested revisions were prepared by CO DRMS Environmental Protection Specialist Zach Trujillo in a report dated September 29, 2023. The following table lists the requested revisions / comments / questions and the response or action taken by KUE.

Sect.	No.	Requested Revision	KUE Action or Response
Reconnaissance Findings	1)	In the Report, KUE references borehole logs conducted by Colorado Fuel & Iron in comparison to so their site reconnaissance. The referenced borehole logs were not included within the Report and the Division has no records of the mentioned logs. Please have RMR or KUE provide the borehole logs conducted by CFI for the Division's review and record.	The relevant borehole logs have been attached to the report within Appendix B.
Failure Mode and Stability Analyses	2)	It is unclear to the Division which material strength properties were used in the stability analyses between the empirical values or post-backanalysis values found under Table 2. Please have KUE provide the Division with clarification on which material strength properties values reported in Table 2 were used within the stability analyses found within Appendix D.	KUE has clarified throughout the report that the models were run using the established empirical values that were corroborated by the backanalysis.
KUE Stability Recommendations	3)	Similarly to the comment above, it is unclear to the Division which material strength properties were used in the stability analyses under KUE's recommendations. Please have KUE provide the Division with clarification on which material strength properties values reported in Table 2 were used within the stability analyses found within Appendix D and Appendix G	KUE has clarified throughout the report that the models were run using the established empirical values that were corroborated by the backanalysis. Appendix G values for joint strength and other joint parameters that dictate stabilization are included in Appendix G.

KUE Stability Recommendations and Associated Stability Analysis	4)	Within Section 8 of the Report, it is unclear to the Division on what KUE is defining as the [redacted] in reference to KUE recommendations to remove said layer. Earlier in the Report, KUE labels the [redacted] It would appear to the Division that when referring to the [redacted] Please have KUE provide additional clarification on whether the recommendation is to remove just [redacted]	This has been clarified in what is now section 9. [redacted]
	5A)	Under Section 6 of the Report, a long-term static stability analysis was conducted using the postmining configuration of the massive limestone layer for varying bench slope geometries. A total of three bench slope geometries were analyzed with resulting FOS as provided in Table 4 of the Report.	Table was misnumbered and has been corrected to Table 6.
	5B)	However only the results from the bench slope geometry for 1.67:1 was provided under Appendix D.	Appendix D now includes stability runs for bench geometries of 1:1, 1.4:1 and 1.67:1 for both static and seismic
	5C)	Additionally, it appears an error exists in Table 4 for bench slope geometry of 1.67H:1V. The resulting slope stability analysis under Appendix D shows a FOS of 1.66 while Table 4 has a FOS of 1.63.	Appendix D is correct and the text has been edited.
	6A)	It appears the Division that inconsistencies exist with the material strength input parameters used within the analyses of Appendix G when compared to the values provided under Table 2 of the Report.	KUE has clarified throughout the report that the models were run using the established empirical values for rock strength. Appendix G values for joint strength and other joint parameters that dictate stabilization are included in Appendix G.
	6B)	Additionally, a different failure plane angle was used in comparison to other analyses provided.	The slope angle has been revised in Appendix G from 31 to 30 degrees. Parameters across the report have been corrected as necessary for consistency.

KUE Stability Recommendations and Associated Stability Analysis	7)	While not discussed in this Memo or in the Report, RMR is approved for blasting per the permit. Please have RMR or KUE address the potential impact blasting may have on the stability of the Mine and have it modeled within the provided active mining and post-mining analyses.	Section 7 Blasting Impacts to Stability has been added to address the potential impact blasting may have on the stability of the Mine.
	8)	When reviewing the associated stability analysis with mechanical stabilization under Appendix G, it was observed that none of the scenarios provided met the minimum FOS of 1.5 as stated in the Report.	Stability models in Appendix G have been revised to achieve a FOS of 1.5 static and 1.3 seismic.
	9)	Per Section 30 of the Policies of the Mined Land Reclamation Board, for generalized, assumed, or single test measurements for critical structures, the minimum recommended FOS is 1.5 for static conditions and 1.3 for seismic conditions. No seismic conditions were provided or evaluated by KUE in the Report. In order to ensure all requirements of Section 30 are satisfied, please have KUE provide stability analyses for the Mine under seismic conditions for all active mining and post-mining scenarios under KUE recommendations.	Long term steady state models for multiple bench geometries and active stabilization models have been run for both static and seismic and are included in Appendix D and G, respectively.

Technical Revision (TR-6) Adequacy Review-2

Sect.	No.	Requested Revision	KUE Action or Response
Blasting Impacts to Stability	10)	During the Division's review of the applied seismic coefficient, it was observed that the value was not provided within discussion of the Report. Additionally it was unclear as to what methodology was used in determining the applied seismic coefficient. Please have KUE provide additional clarification within Section 7 regarding the design seismic coefficient value used along with the methodology and rational.	Further discussion of reasoning and how the seismic design coefficient was selected has been included in section 7.
Long Term Stabilization and Configuration	11A)	FOS result for bench slope geometry of 1.67:1 with reduced limestone cohesion (1,500 psf) under static conditions within discussion of Section 6 of the Report.	FOS results added to Table 6
	11B)	FOS result for bench slope geometries of 1:1, 1.4:1, and 1.67:1 with reduced cohesion (1,500 psf) under seismic conditions within discussion of Section 6 of the Report.	FOS results added to Table 6
	12A)	Model result for bench slope geometries of 1:1, 1.4:1, and 1.67:1 with reduced cohesion	Model runs added to Appendix D

		(1,500 psf) under static conditions within Appendix D of the Report.	
	12B)	Model result for bench slope geometry of 1.67:1 with reduced cohesion (1,500 psf) under seismic conditions within Appendix D of the Report.	Model runs added to Appendix D