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

Date: **October 10, 2022**

To: **Rob Zuber**

CC: **Jason Musick, Michael Cunningham**

From: **Zach Trujillo**

RE: **Two Rivers Application, DRMS File No. M-2022-013**
Second Technical Adequacy Review

Rob,

As requested I have reviewed the adequacy responses for the Two Rivers Sand, Gravel and Reservoir Project (Two Rivers) submitted by Raptor Materials, LLC (RM) in relation to the requested and applicable Rules, Regulations and Policies. The primary focus of this review was to ensure all adequacy items from my original adequacy letter dated June 1, 2022 have been satisfied in relation to Rule 6.5 of the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials. Additionally, proposed geotechnical stability support material as part of the application was reviewed in relation to Section 30 of the Policies of the Mined Land Reclamation Board (Section 30).

The following is my adequacy items and Two Rivers' associated response:

1. *Division: Please provide updated slope stability models and associated FoS using the correct friction angle for bedrock.*

   Two Rivers: We reran the four slope configurations with the suggested friction angle of 22 degrees. Predicted factors of safety for the four mine wall scenarios varied between 1.3 and 1.5. Model outputs are presented in Attachment B.

   The Division has reviewed the updated slope stability analyses with the corrected friction angle for bedrock and the associated Factors of Safety (FoS) exceed the minimum criteria of Section 30. Please see the summary associated with Adequacy Comment #3 for more information. **No additional response is necessary.**

2. *Division: Please provide additional discussion in regards to conditions or scenarios which determine one of the four proposed highwall slope configuration.*

   Two Rivers: The different mine wall slope analyses were intended to represent, as much as possible, the different soil profiles and mine depths that will be encountered. As such, it is anticipated that each slope profile will be encountered at various locations during mining.

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Jared S. Polis, Governor | Dan Gibbs, Executive Director | Virginia Brannon, Director

Two Rivers' response satisfies the Division's associated adequacy comment and **no additional response is necessary.**

3. *Division: Please provide slope stability analyses for the four highwall scenarios under seismic conditions including rational for the seismic coefficient used in the analyses.*

   Two Rivers: The four slope configurations were ran using a uniform horizontal and vertical acceleration factor of 0.075. This factor was chosen based on the United States Seismic Zone Map, which was based on the Uniform Building Code seismic values. Predicted safety factors varied between 1.15 and 1.26. Model outputs are presented in Attachment C. Included in Attachment C is the United States Seismic Zone Map.

   Two Rivers has provided the Division with slope stability models for the four scenarios under static (with corrected friction angle – see adequacy comment #1) and pseudo static conditions. Based on the information in the Report provided by Two Rivers and Table 1 of Section 30.4, FoS will be compared to strength measurements resulting from multiple tests for a critical structure. For static conditions, minimum required factor of safety is 1.3 and for pseudo static conditions, minimum required factor of safety is 1.15. Each of the corresponding FoS meet the minimum requirements of Section 30. See the following table of resulting FoS. Additionally, the provided rational and supporting Attachment C satisfies the Division's associated Adequacy Comment #3. **No additional response is necessary.**

Factors of Safety				
Scenario	Two River		Section 30 Requirements	
	Static	Pseudo Static	Static	Pseudo Static
Plate 1	1.305	1.15	1.3	1.15
Plate 2	1.4	1.169		
Plate 3	1.505	1.259		
Plate 4	1.41	1.175		

Based on the responses provided by Two Rivers, I have no additional comments. This concludes my review and comments for the proposed 112c Permit Application for the Two Rivers Sand, Gravel and Reservoir Project submitted by Raptor Materials, LLC in relation to the requested and applicable Rules, Regulations and Policies. If you have any questions feel free to contact me.

Sincerely,

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