STATE OF COLORADO

Zuber - DNR, Rob <rob.zuber@state.co.us>

Two Rivers - Second adequacy review

1 message

Zuber - DNR, Rob <rob.zuber@state.co.us> Mon, Oct 17, 2022 at 8:14 AM
To: Bradford Janes <bjanes@raptormaterialsllc.com>, Garrett Varra <gvarra@raptormaterialsllc.com>

Good morning, Brad and Garrett -

Please let me know if you have any issues opening the attached document.

Thank you,
Rob

Rob Zuber, P.E.
Environmental Protection Specialist
Active Mines Regulatory Program

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

I am working remotely and can be reached by cell at 720.601.2276.
Physical Address:
1313 Sherman Street, Room 215
Denver, CO 80203
Mailing Address:
Division of Reclamation, Mining and Safety, Room 215
1001 East 62nd Avenue
Denver, CO 80216
rob.zuber@state.co.us | http://drms.colorado.gov

DRMS_Second_Adequacy_Letter_with_Enclosure.pdf
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COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

October 17, 2022

Bradford Janes
Raptor Materials LLC
8120 Gage Street
Frederick, CO 80516

Re: Two Rivers Sand, Gravel and Reservoir Project, File No. M-2022-013, 112c Permit Application, Second Adequacy Review

Mr. Janes -

The Division of Reclamation, Mining and Safety (Division/DRMS) reviewed the contents of the 112c permit application for the Two Rivers Sand, Gravel and Reservoir Project (TRP), File No. M-2022-013 and submitted preliminary adequacy letters on June 24, 2022 and August 5, 2022. We received responses to these items from Raptor Materials LLC (RM) on September 6, 2022.

The Division is required to issue an approval or denial decision no later than November 4, 2022, therefore a response to the following adequacy review concerns should be submitted to the Division as soon as possible, or another extension will be required.

The review consisted of comparing the application contents with the specific requirements of Rules 1, 3, 6.1, 6.2, 6.4 and 6.5 of the Minerals Rules and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials (effective date July 15, 2019). Any inadequacies are identified under the respective exhibit heading along with suggested actions to correct them.

As applicable, the Division requests that RM revise actual exhibits and re-submit them. It is not sufficient to provide clarifying language in an adequacy response letter.

The following items are listed by numbers that correspond to the original items in our June 24 letter. *New comments are in bullets and italic font below the original adequacy items.*

General Comments

1) On May 18, 2022, the Division approved a transfer of the Two Rivers Sand, Gravel and Reservoir Project 112 Application from Varra Companies, Inc. to Raptor Materials, LLC. Please provide a letter from Kevin Jeakins (as part of your response to this adequacy review) stating that Bradford Janes is authorized to act as a permitting representative of Raptor Materials LLC.
   - *No additional response is required from RM.*

2) Please commit to submitting Financial and Performance Warranties with the name Raptor Materials LLC.
   - *No additional response is required from RM.*

3) The Division received timely state agency comments from History Colorado and the Division of Water Resources, as well as a late comment letter from Colorado Parks and Wildlife. The letters from these agencies are included as an enclosure with this adequacy review letter. Please review the letters and provide comments accordingly.
   - *No additional response is required from RM.*

Application Form

4) The application form must be updated to indicate that the new permittee is Raptor Materials LLC.
   - *No additional response is required from RM.*

5) On Page 1, Item #1.1 of the application form, the Applicant indicated the type of organization as a corporation. Please provide the corporation seal on Page 8 of the application form, if the corporation does not have a seal please indicate "no seal".
   - ***Please revise Page 8 of the form and add the text "no seal."***

6.2 General Requirements of Exhibits

6) Rule 6.2.1(2)(b) requires maps be signed by a registered land surveyor, professional engineer, or other qualified person. Please submit signed copies of the Exhibit C and Exhibit F maps.
   - ***It is common practice for operators to provide signed maps. RM needs to comply with this request.***

6.4 Specific Exhibit Requirements - Regular 112 Operations

The following items must be addressed by the Applicant in order to satisfy the Mineral Rules and Regulations of the Mined Land Reclamation Board:

6.4.1 Exhibit A - Legal Description

7) The Applicant indicated that a portion of the permit area is in Sections 3 and 4 of Township 4 North, Range 65 West. However, it appears (based on the Exhibit Map in Exhibit B) that the text should indicate Range 66 West instead of 65 West. Please address this apparent error, and revise the Exhibit A text as necessary.
   - *No additional response is required from RM.*

8) It appears that the coordinates for the Central Field SW Entrance are incorrect. Please check them and revise the Exhibit A text as necessary. (The coordinates listed for this entrance appear to be near the Varra Coulson Project.)
   - *No additional response is required from RM.*

6.4.3 Exhibit C - Pre-Mining and Mining Plan Maps of Affected Land

9) The irrigation ditches need to be clearly shown and labeled on the Existing Conditions Map (Exhibit C-1).
   - *No additional response is required from RM.*

10) Also, per Rule 6.4.3(e), the existing vegetation at the site should be shown.
   - *No additional response is required from RM.*

11) The scale on Exhibit C-1 appears to be incorrect. Please check and revise as necessary.
   - ***An additional response is required from RM. The scale bar appears to have incorrect numbers. Rather than 400 feet and 800 feet, it appears that the numbers should be 200 and 400.***

12) The legend on Exhibit C-1 includes the 100-year floodplain, but the floodplain lines are not on the map. These lines should be added to this map as well as the Extraction Plan Map, Exhibit C-2.
   - *No additional response is required from RM.*

13) For the sake of clarity, the Division recommends that the entire permit area be permitted to be affected, and this should be stated in Exhibit C and Exhibit D. (The Division recognizes that this statement is made in Exhibit L.)
   - *No additional response is required from RM.*

14) During the pre-operations inspection on June 14, 2022, the idea of relocating the access point at the northwest corner of the site (to the east) was discussed. Please update Exhibit C-2 to reflect any change in that location.
    - *No additional response is required from RM.*

15) Please add the following to the Extraction Plan Map, Exhibit C-2: roads, parking and equipment storage areas, levees, soil piles, keyways, settling basins, and other structures pertinent to the mining operation that are not currently shown on the map. Comments on the map can indicate where these features are subject to change.
    - ***The Division reiterates that structures related to the mining operation need to be on Exhibit C-2. Regarding soil piles, RM states in the responses that, "There are no soil piles at this time," however, the purpose of the map is to illustrate the plan for soil piles in the future, and those should be shown on the map.***
    - ***The Division requests that the term "keyway" be clarified by RM. Is this actually a de-watering trench?***
    - *The purpose of Annual Reports is described in Rule 1.15. These reports are not to be used to make changes to the mining and reclamation plans. Those changes must be made with technical revisions and amendments.*

6.4.4 Exhibit D - Mining Plan

16) In this and other exhibits, an effort should be made to update agency names. For example, the Colorado Division of Wildlife is now Colorado Parks and Wildlife. The abbreviation CDH should be CDPHE.
    - *No further response required by RM.*

17) The mining plan (aka extraction plan) requires more detail. In particular, the plan should include a schedule that specifies the areas to be worked for given phases, with ranges of time periods. The phases described in Exhibit D should be coordinated with the Extraction Plan Map, Exhibit C-2. The operator can change the plan later, as needed, with technical revisions and/or amendments. Additional clarification on the sequence of the mining plan is necessary to calculate the required financial warranty.
    - ***RM needs to clarify an apparent contradiction between the response to item #17 and the approach to minimizing impacts on wildlife, as required by Rule 3.1.8. On page 15, the response states that "four separate extraction teams" could be used to hasten the extraction schedule. However, the ERO memorandum (August 26, 2022; page 2) describes an incremental approach that will protect mule deer habitat by only disturbing a relatively small area at one time. The text in the memo suggests that a maximum size for an active cell is 16 acres. This example illustrates the need to better define the mining and reclamation plans.***

18) The discussion on pages 6 and 7 regarding structures and easements should discuss which structures and easements will be relocated or removed from the site (if any).
    - ***As noted at the beginning of this letter, RM needs to revise actual exhibits (in this case Exhibit D) to address adequacy items and re-submit them. Also, please address the particular structures (above-ground and underground) and easements shown on Map C-1.***

19) On page 7, more detail is needed for the roads onsite. Please explain which roads will be built and which will be modified. Explain construction method and dimensions.
    - *No further response required by RM.*

20) On pages 12 – 13, the discussion on stockpiles should include text indicating that soil management practices will protect the soil piles from erosion, prevent contamination of the soil from toxic or acid-forming material, and insure that the soil will remain usable for reclamation.
    - *No further response required. The Extraction Plan does discuss how soil piles will be stabilized. It also discusses how fertilizer can compensate for the loss of organic matter. Finally, the applicant has stated that potentially toxic or acid forming materials would not be utilized in the reclamation activities.*

21) On page 14 in the second to last paragraph, the sentence that begins "Specific variations in the location of …" should be rewritten. The structure of this sentence does not follow standard rules of grammar, and (more importantly) the meaning is not clear. Please revise this statement accordingly.
    - ***RM needs to revise Exhibit D to address this item and re-submit it.***

22) On page 14 in the last paragraph, the units are not specified (appears to be 125 feet), and this should be revised. Also, add a discussion on pipelines to this paragraph as appropriate.
    - ***RM needs to revise Exhibit D to address this item and re-submit it.***

23) On page 16, regarding the discussion on topsoil and overburden stockpiles, more detail is needed regarding the storage volumes and locations of the piles, including distances from the piles to the areas to be reclaimed. It is recommended that they be shown on Map C-5. It should also be stated that the piles will be configured to prevent obstruction of flood waters, namely elongate the piles to make them parallel to the flow direction.
    - ***It appears that the extensive discussion on soils does not include any information regarding the quantities of soil in stockpiles or the location of soil piles. This***

information is required for a detailed reclamation cost estimate and needs to be added to the Extraction Plan, Exhibit D.

24) In the section Plant Site Development & Operations, text should be added regarding the details of structures that will be built, including the conveyor. Dimensions and other details should be provided to aid in the estimate of demolition costs for these structures.
    - ***More detail is needed regarding the conveyor. Please provide the size of the conveyor. Also, provide the dimensions of pads and other foundations that will be used for this structure and provide an estimate of the total volume of concrete that will be used. Related to this, Exhibit L will need to be updated to include the cost of dismantling the conveyor.***
    - ***Please describe the measures to be taken to prevent material from overtopping the conveyor system and falling into the Big Thompson River.***

25) In the section Plant Site Development & Operations, text should be added regarding the control of prairie dogs. Will they be relocated?
    - *No further response required by RM.*

26) The applicant should discuss the following (related to Rule 3.1.8): How will the operation minimize impacts on mule deer habitat during the winter season (December 1 through April 30). This should include (but not be limited to) a discussion on fencing. Fencing should be limited as practical, and wildlife-friendly fencing should be used.
    - *No further response required by RM.*

27) Include a discussion on how the operation will allow for deer and other animals to "escape" the mining operations.
    - *No further response required by RM.*

6.4.5 Exhibit E - Reclamation Plan

28) The Application form specifies that the post-mining land use of the site will be developed water resource. Additionally, the Applicant has provided a shadowing/mounding analysis for the installation of clay liners. However, the Reclamation Plan notes (page 5) that lining of the reservoirs is an option only. If the Applicant wishes to maintain lining of the reservoirs as an option only, then the Application must be revised to reflect that the reservoirs will be reclaimed to open groundwater ponds. If the Applicant chooses to reclaim the reservoirs to open groundwater ponds, then the following options are available to address the liability associated with exposed groundwater:
    a) Provide adequate bond to backfill the pit to two feet above the historic highest groundwater level.
    b) Obtain a court approved augmentation plan prior to exposing groundwater at the site.

Alternatively, the Applicant may clarify that the post-mining land use of developed water resource will be achieved through clay lining the reservoirs. If the Applicant chooses to clay line the reservoirs, then the Applicant shall provide enough detail for the Division to calculate the cost to line the reservoirs.

- ***RM must update Exhibit E to remove ambiguity in the plan in general, and in particular in comparison to the application form.***

29) The reclamation plan requires more detail. In particular, the plan should include a schedule that specifies the areas to be reclaimed for given phases, with ranges of time periods. The phases described in Exhibit E should be coordinated with the Reclamation Plan Map, Exhibit F.
    - ***This item was not sufficiently addressed. Rule 6.4.5 requires details in the reclamation plan. In the event that an operator wishes to change the plan at a later date, a technical revision or amendment can be employed.***

30) The discussion on pit slopes (pages 4 – 5) should include a discussion on the method for grading these slopes, including push distances. Also, the discussion should include the method for verifying the final slopes and documenting this information.
    - *No further response required from RM.*

31) The reclamation plan needs to state that all compacted areas will be ripped prior to addition of topsoil and seed.
    - *No further response required from RM.*

32) The reclamation plan needs to include a clear plan for the storage and application of topsoil prior to seeding. The plan should include push distances to the areas and minimum depth.
    - ***It appears that the extensive discussion on soils does not include any information regarding the quantities of soil in stockpiles or the location of soil piles. This information is required for a detailed reclamation cost estimate and needs to be added to the Extraction Plan, Exhibit D.***

33) On page 6, the discussion on seeding should include timing of seeding (and planting if applicable). At what time of year will seeding operations be conducted?
    - ***RM needs to revise Exhibit D to address this item and re-submit it.***

34) The weed control paragraph (page 9) should reference the more detailed plan in Exhibit I/J.
    - ***RM needs to revise Exhibit D to address this item and re-submit it.***

35) The Backfill Notice must state the maximum quantity of inert fill that will be stockpiled on the site at any given time. This information is necessary to calculate the required financial warranty amount. Will buildings or other structures be constructed on backfill areas? If so, how will the material be placed and stabilized to prevent settling and voids?
    - *No additional response is required of RM, but the Division would like to make two comments for the record. The purpose of the Backfill Notice is to address imported material, not material that originates within the permit area. Also, if imported material contains rubble or similar, RM should handle this material to avoid any instability of slopes.*

36) The applicant should discuss the following related to the ponds:
    - The use of very flat slopes (8H:1V) and irregular shorelines in some locations, to allow for diverse habitat.
    - The use of constructed islands in the ponds for wildlife habitat.

    - *No further response required from RM.*

6.4.5 Exhibit F - Reclamation Plan Map

37) The permit boundary is not shown on this map and needs to be added (or the line weight needs to be larger to improve clarity).
    - *No further response required from RM.*

38) A legend should be added to the map clearly showing what the hatching and other features represent. A yellow box is shown at the southeast corner of the site; please indicate if this symbol represents a real feature or if it is an error.
    - ***The issue with the yellow box was not addressed. Please explain this feature on the map. Also, please remove the scale in the upper left portion of the map since it appears to be inaccurate.***

39) It appears that the map requires more detail regarding the processing area. Do the topographical lines on Exhibit F accurately show the post-mining topography? If not, the map needs to be updated.
    - ***Please add a text box to the map explaining the topographical lines. If they illustrate pre-mining conditions, this should be stated.***

40) Per Rule 6.4.6, post-mining land uses should be shown on the map. This is especially important for the material processing and wash pond areas.
    - ***RM needs to revise Exhibit F and re-submit it. As appropriate, the language included in the response letter from RM should be added to the map in a text box or in notes in the title block.***

41) Several structures and easements are shown on Exhibit C-1, and none are shown on Exhibit F. Please explain if all of these structures will be removed during the mining and reclamation operations.
    - ***Please confirm that Exhibit F is accurate. Are all above-ground and underground structures that will remain after mining is complete shown on the map?***

42) The Division recommends adjusting the scale on this map. The current version includes considerable area that is beyond the permit boundary.
    - *No further response required from RM.*

6.4.7 Exhibit G - Water Information

43) On Page 1 of Exhibit G, the text states that the site will drain internally. Please add a statement that the site will be operated to prevent any significant runoff from disturbed areas from flowing offsite. Also state that the site will be operated to prevent any negative impacts to the hydrologic balance of the two rivers.
    - ***The Division agrees that the word "minimize" is appropriate, rather than "prevent." However, RM needs to revise Exhibit G and re-submit it. Exhibit G should include the statements requested in the original adequacy letter (using the word "minimize" as noted above).***

44) Describe the physical dewatering system and provide a description of the operation of this system.
    - ***Please add to Exhibit G a summary of the system with references to other exhibits and other documents (e.g., the Water Quality Control Division application), as appropriate.***

45) The Water Information exhibit should provide a detailed discussion of floodplain management at the site. This must include a discussion of the conveyor crossing of the Big Thompson River. It should also reference the Floodplain Permit report by Headwaters Corporation, as appropriate.
    - ***The text provide in the RM response that explains floodplain management at the site must be added to Exhibit G.***
    - *As noted above, Annual Reports should not to be used to make changes to the mining and reclamation plans, including the locations of structures. Those changes must be made with technical revisions and amendments.*
    - ***Please explain the relevance of the Headwaters Corporation report included in the original submittal.***

46) To ensure that the Two Rivers project does not impact the hydrologic balance of the rivers, the application needs to include a water quality monitoring plan, specifically for the alluvium. The groundwater monitoring plan should be developed in accordance with Rule 3.1.7(7)(b) and should include a Quality Assurance Project Plan (QAPP) for the collection of groundwater samples. The plan should provide mitigation steps if there is an exceedance at a groundwater or surface water monitoring location. Potential impacts to quality and/or quantity the nearby domestic wells should also be addressed. A copy of the Division's Groundwater Monitoring and Protection Technical Bulletin has been included as an enclosure to this letter for your reference.
    - ***A water quality monitoring plan is required for this permit. Please develop that and include in the revised Exhibit G.***

47) Change "NPDES" to "CDPS" to reflect the requirements of the Water Quality Control Commission.
    - *No further response required from RM.*

Exh H - Wildlife

48) Indicate which recommendations on wildlife protection in "Threatened and Endangered Species Habitat Assessment, Two Rivers Parcels" (ERO, 2022) will be implemented at the site. This report was submitted with Exhibit H of your application.
    - *No further response required from RM.*

Exhibits I/J

49) This exhibit should include a discussion on wetlands in the project area, including the wash pond and material processing areas. Please state that operations will be conducted to minimize impacts on wetlands or state that no operations will be conducted in wetland areas.
    - ***RM needs to revise Exhibits I/J, and re-submit, with the discussion and statement regarding minimization of impacts. As appropriate, reference other exhibits and reports from other entities (e.g., the US Army Corps of Engineers).***

50) In the Weed Management Plan, the paragraph that mentions the State of Colorado noxious weeds list should state that List A species will be eradicated and List B Species will be controlled. The plan should also describe the efforts that will be made to control List C species, including field bindweed, a focus in Weld County. The Division recognizes that mapping and vector identification can be useful tools for weed control, but these practices should not delay treatment of weeds.
    - ***RM did not address the adequacy item. RM needs to revise Exhibits I/J, and re-submit, with the statements regarding listed species.***

6.4.12 Exhibit L - Reclamation Costs

51) This exhibit should be updated, as necessary, to match any revisions to Exhibits D and E, per the adequacy items for those sections. This includes details on structures.
   - ***In the context of this second adequacy letter, Exhibit L must be updated to reflect revisions to Exhibits D and E.***

52) The cost estimate should include a task for ripping areas that will be topsoiled and vegetated.
   - ***RM did not address the adequacy item. RM needs to revise Exhibit L to include the ripping task.***

53) The Applicant has noted under the Reclamation Plan (page 5) that water shares will be dedicated to the Division of Water Resources (DWR) to cover the liability associated with exposing groundwater. Please be aware that the Division no longer accepts the dedication of water shares to DWR as a bonding mechanism. The Applicant will need to post a financial warranty to allow for backfilling the areas of exposed groundwater or a financial warranty to cover the cost of installing clay liners in the reservoir. Please see additional comments under Item No. 29.
   - *No further response required from RM.*

6.4.13 Exhibit M - Other Permit and Licenses

54) Please commit to providing copies of all required and approved permits and licenses to the Division when available. This should include well permits and documents related to water rights, such as a Substitute Water Supply Plan.
   - *No further response required from RM.*

6.4.14 Exhibit N – Source of Legal Right to Enter

55) This document must show that Raptor Materials LLC (rather than Varra Companies, Inc.) has the legal right to enter lands under this permit.
   - *No further response required from RM.*

6.4.18 Exhibit R - Proof of Filing with County Clerk and Recorder

56) Please provide an affidavit or receipt indicating the date on which the revised application information required to address this adequacy letter was placed with the Weld County Clerk and Recorder for public review, pursuant to Subparagraph 1.6.2(1)(c).
   - *No further response required from RM.*

6.4.19 Exhibit S - Permanent Man-made Structures

57) The Division requires Raptor Materials LLC to demonstrate that they attempted to obtain notarized structure agreements with all owners of the structures within 200 feet of the affected area of the proposed mine site, pursuant to Rule 6.4.19. This attempt must be made prior to the Division's consideration of a stability analysis. Please also indicate what agreements have been obtained.
   - ***RM needs to update Exhibit S with all relevant information including:***
     - ***A list of all structure owners***
     - ***A list of agreements obtained from these owners.***

6.5 Geotechnical Stability Exhibit

58) The Division has reviewed the Slope Stability Analyses (prepared by AWES, LLC), and our comments are provided as an enclosure with this letter. Please review this memorandum and provide responses.
   - *No further response required from RM.*

Please also respond to Division comments related to the dewatering evaluation (AWES LLC, 2020), enclosed with this letter. The Division is still reviewing one of the technical reports associated with this application: "Riverside Berm Failure Analysis and Flood Control Mitigation Plan" (Flow Technologies LLC, 2020). Division comments and questions related to this report will be sent under separate cover.

Please be advised that the Two Rivers, Sand, Gravel, and Reservoir Project application may be deemed inadequate, and the application may be denied unless the above-mentioned adequacy review items are addressed to the satisfaction of the Division. If more time is needed to complete the reply, the Division can grant an extension to the decision date. This will be done upon receipt of a written waiver of the Applicant's right to a decision by November 4, 2022 and a request for additional time. This must be received no later than the decision date.

If you have any questions, please contact me at rob.zuber@state.co.us or (720) 601-2276.

Sincerely,

Robert D. Zuber, P.E.
Environmental Protection Specialist

Enclosure: Memorandum from Leigh Simmons regarding the dewatering evaluation

Cc: Michael Cunningham, DRMS

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

Interoffice Memorandum

October 14, 2022

From: Leigh Simmons
To: Rob Zuber

Subject: Two Rivers Sand, Gravel and Reservoir Project (Permit No. M-2022-013) Application

I have reviewed the material submitted in response to my earlier adequacy review memo. My comments on the applicant's response are given below, together with the original comment for reference.

Comments:

1. *The proposed text of Section 6.4.7, Exhibit G, allows for the post-mining lining of the pits but does not commit to it. It is not appropriate for the Division to approve a contingent reclamation plan; the approved text should describe a single reclamation plan. If the decision is made at a later date to change the plan then an amendment application should be submitted at that time.*
   Please revise the text of Exhibit G to describe the post-mining plan for the lining or otherwise of the excavated pits.

The response is sufficient – the plan is to line the pits.

2. *The text also refers to "OMLR" in places, which presumably stands for "Office of Mined Land Reclamation". This office does not exist in Colorado.*
   Please replace any reference to "OMLR" in the text with "DRMS".

The response is sufficient - the applicant has elected to continue to use "OMLR", with justification, despite the fact that the term is deprecated.

3. *Water level data from piezometers P124-1 through P124-12 has been given in the text of Exhibit G but the locations of the piezometers are not shown on Exhibit G: Water Information Map (or Exhibit C-1: Existing Conditions Map).*
   Please add the piezometer locations to Exhibit G: Water Information Map

Piezometer locations have been shown on the updated version of Exhibit G: Water Information Map, however they are labelled using a different naming convention (see figure 1). Please label the piezometers on the map as they are referred to in the text of the AWES study.

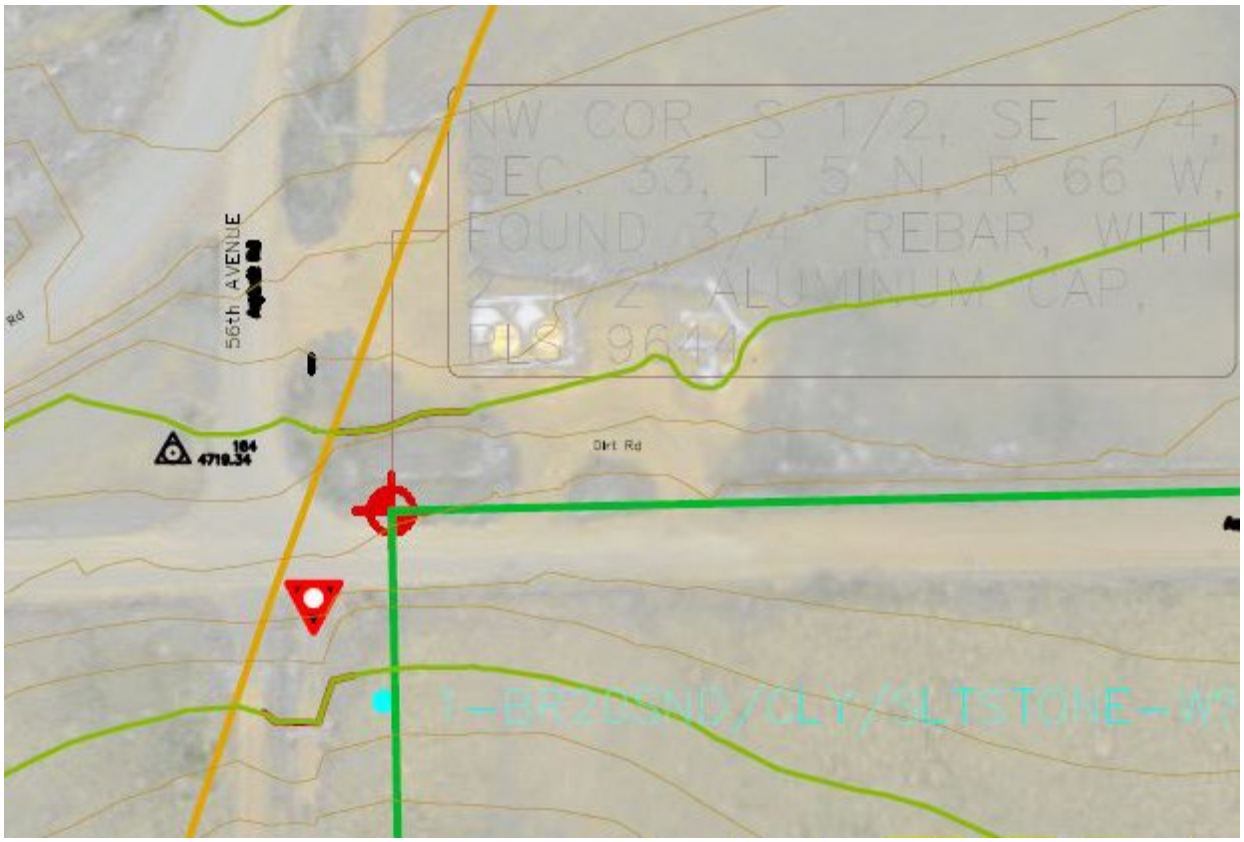

Figure 1: Screenshot of portion of Exhibit G: Water Information Map @ 300% zoom

4. *The key of Exhibit G: Water Information Map shows a symbol for wells, but no wells are identifiable on the map. It's not clear whether they were omitted or are not legible.*
   Please identify all registered wells on Exhibit G: Water Information Map. Please also add a table to section 6.4.7 with details of these wells including their permit IDs, owners, date of construction and registered use.

Water wells have been added to the updated version on Exhibit G: Water Information Map. **No table has yet been provided.**

5. *Exhibit G: Water Information Map shows several symbols that are not included in the map key, and the text in many of the labels on the map is illegible (including what are presumably stream stage elevations).*
   Please revise Exhibit G: Water Information Map to improve its legibility and to provide a complete key for map symbols (it may be helpful to remove the aerial imagery base-map). The revised map should be prepared and signed by a registered land surveyor, professional engineer, or other qualified person, as is required by Rule 6.2.1(2)(b).

(With reference to the updated version of Exhibit G: Water Information Map): When the pdf of the map is viewed at 300% zoom most of the labels are legible (except where they are obscured by other map elements), however this level of zoom makes the map very difficult to use.

Several symbols are used on the map but are not identified in the key or labelled on the map, these include:

- **Inverted red triangles (as shown in figure 1)**
- **Bold red lines and squares (as shown in figure 2)**
- **Yellow highlighting on contour lines (as shown in figure 2)**

- **Dashed brown line (as shown in figure 2)**
- **Yellow polygons (as shown in figure 3)**
- **Blue marks (as shown in figure 3)**
- **Fine dashed red lines (as shown in figure 3)**
- **Light red dots (as shown in figure 3)**
- **Black triangles (as shown in figure 3)**

The map has not been signed, stamped, or otherwise certified by a registered land surveyor, professional engineer, or other qualified person.

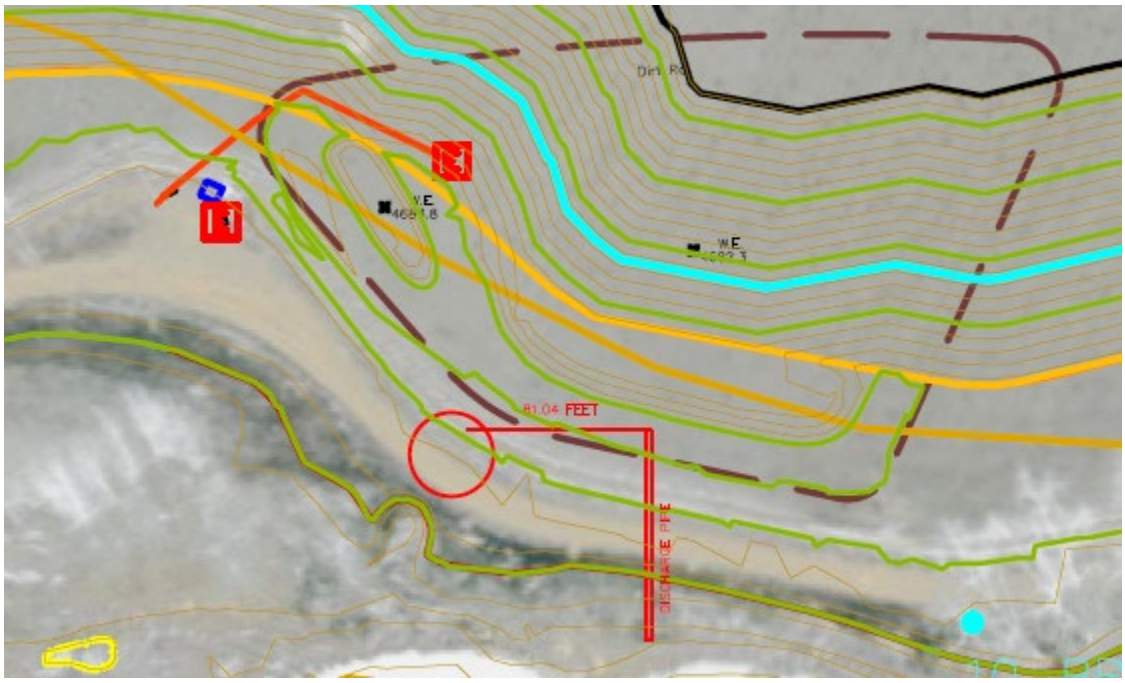

Figure 2: Screenshot of portion of Exhibit G: Water Information Map @ 300% zoom

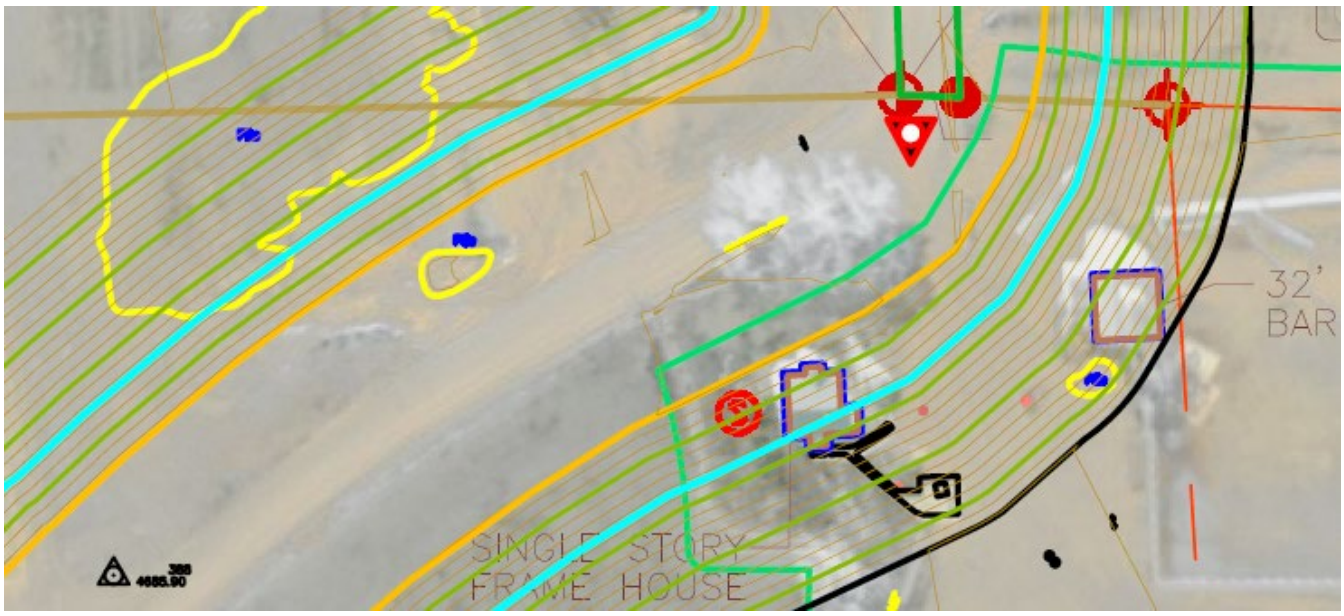

Figure 3: Screenshot of portion of Exhibit G: Water Information Map @ 300% zoom

In 6.4.7(1) the statement is made that "Operations will not adversely affect surface and groundwater systems". In support of the statement, the text refers to a July 27, 2020 study by American Water Engineering Services, LLC of Fort Collins, CO (AWES 2020). American Water Engineering Services, LLC was formed in 2011 and is currently in good standing with the Colorado Secretary of State's office.

The AWES 2020 report presents a hydrogeologic evaluation based on a numerical groundwater flow model built with Visual ModFlow Pro, an industry standard groundwater flow modeling code. Background information is given in the report, followed by assumptions, model parameters, results and conclusions. Figures and plates are appended to the report.

By its nature a numerical groundwater flow model is a simplification of the real system and is built using a series of assumptions and compromises on the part of the modeler, with the goal of answering pertinent questions about the system. The questions that the AWES 2020 model seeks to answer are not specifically defined, but are generally stated as "to estimate the effects of dewatering operations on the surrounding groundwater hydrology". In my review of the AWES 2020 model I have tried to avoid "nit-picking" but to look first at the overall validity of the conclusions that can be drawn from it, and then to evaluate whether those conclusions support the statement that "Operations will not adversely affect surface and groundwater systems". Questions 6 through … below are asked to help the Division better understand the model.

The AWES report was updated on August 31, 2022.

6. *Key assumptions of the model are that the aquifer is unconfined, homogenous and anisotropic, with a horizontal hydraulic conductivity (K_h) of 125 ft/day and a vertical hydraulic conductivity (K_v) of 12.5 ft/day. The K values are at the lower end of the expected range of 2000-100 ft/day (Robson, 1989).*
   Please justify the assumption of anisotropy and the chosen K values for the sand and gravel aquifer.
7. *The piezometers referred to in (3) are described as monitoring wells in AWES 2020.*
   Please describe how these wells were used for pre-mining aquifer characterization (besides the collection of water level data).

The response to 6 and 7 is sufficient - the author has assumed aquifer properties based on his prior experience of similar geologic settings. Although the assumed hydraulic conductivity values seem reasonable with respect to the literature, it is a notable weakness of the AWES study that the opportunity wasn't taken to use the constructed monitoring wells to conduct any field tests of aquifer properties.

There are many published equations linking hydraulic conductivity and grain size of the form "K is proportional to d_{10}" since it was first proposed in the 1890s, but they are of doubtful validity, are generally only employed when other methods of estimating hydraulic conductivity are not available, and the value of the proportionality constant is usually empirically derived – I'm not aware of any justification for assuming a proportionality constant of 1, and none has been presented, (Hazen, 1892; Eggleston, 2001; Carrier, 2003).

8. *No information is presented about the vertical extent of the model.*
   How many vertical layers are used in the model? What are the layer thicknesses?

The response is sufficient - there are two vertical layers in the model, with the upper layer representing unconsolidated alluvial deposits and the lower layer representing bedrock.

9. *No information is presented about recharge from precipitation.*
   Is recharge from precipitation accounted for in the model, or is its impact assumed to be negligible?

The response is sufficient – a 1.5 inch recharge rate was assumed.

10. *The Mine Area Map presented as Figure 2 shows a different pit configuration from that presented elsewhere in the permit application packet (PAP) – it shows three pits, whereas Exhibit G: Water Information Map, for example, shows just two. The Model Boundary Conditions presented as Plate 1 reflect the configuration shown in Figure 2.*
    Please discuss the validity of the model boundary conditions in the light of the final pit configuration (which is assumed to be that shown on maps in the PAP).

The response is sufficient – the model boundary conditions were updated to correspond more closely to the two pit configuration shown elsewhere in the mine plan.

11. *According to the literature, water table gradients in the alluvial aquifers of the region are typically in the range 0.002 to 0.007 (Arnold, Langer & Paschke, 2003). The water table contour map presented as Plate 3 shows a generally easterly gradient of 0.002 across the center of the proposed permit area. A single data point (MW-1, which is presumably the same as P124-1) exists north of the Big Thompson River, with a significantly higher water level. This distorts the water level contours in the north of the study area, suggesting a far steeper gradient (0.01) and a south-easterly flow direction.*
    Please discuss the characterization of the pre-mining water table. How reliable is the data from MW-1? How do you account for the steeper gradient? Are there any other data points in the north of the study area to improve the characterization?

The response is sufficient – the author has used the available data to characterize the site as thoroughly as possible.

12. *The model was calibrated using model-assigned observation wells outside of the proposed excavations, (presumably the points shown with green and white symbols on Plates 6 and 7). The first two sentences of the final paragraph on Page 3 of the AWES 2020 report suggest that water levels were measured at these locations, but I think that these are simulated wells.*
    Plates 5 and 5A show the calibration results. They appear to show identical data.
    Water level contours showing initial conditions in the calibrated model are presented as Plate 4. The contours suggest a gradient of 0.06 to the SSE in the north of the study area.
    Please clarify the initial calibration process. Please discuss the validity of the model in the north of the study area.

The response is sufficient – the author thoroughly described the model calibration process

13. *The results of the dewatering simulation are presented as Plate 6. This is presumably a steady state simulation. It simulates dewatering of the central and north-west pits only.*
    Please simulate the dewatering of the full extent of the mined area. Please estimate the time to achieve steady state conditions.

The steady state drawdown scenario is presented on Plate 7. In the Conclusions section of the report the author states: "The predicted drawdown associated with the mine dewatering represents the worst case scenario and a substantial amount of time will be required before maximum drawdowns will occur". Please estimate the amount of time, based on model results, for maximum drawdowns to occur.

14. *Table 1 presents the predicted water levels at the 4 simulated wells before mining and following the lining of the mined pits.*
Please add a column to Table 1 showing the predicted water levels under the pit de-watering scenario. The table should show the fullest extent of the potential drawdown caused by the mine operation.

The response is sufficient – Table 1 shows maximum predicted drawdowns at the 4 simulated wells, as well as the predicted post-pit-lining water elevation.

15. *In the conclusions section on Page 4 of the report, the statement is made that "The results of analytical and numerical solutions indicate…" however no analytical solutions are presented. Please update the report to present any relevant analytical solutions that support the conclusion.*

The response is sufficient – analytical solutions are used earlier in the report.

I have not addressed the requirements for water monitoring in this memo, but I note that you discussed it in item 46 of your preliminary adequacy review letter. Water monitoring data will be important to validate model predictions in the future.

No water monitoring program has yet been proposed.

References:

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