STATE OF COLORADO

Carter - DNR, Jocelyn <jocelyn.carter@state.co.us>

Two Rivers M-1998-038 Amendment Application AM-1 Adequacy Review

1 message

Carter - DNR, Jocelyn <jocelyn.carter@state.co.us> Mon, Mar 25, 2024 at 3:44 PM
To: Jodi Schreiber <jodi@arycorp.com>
Cc: "Ebert - DNR, Jared" <jared.ebert@state.co.us>, John Paul Ary <Jp@arycorp.com>

Good afternoon Jodi,

Please see the attached adequacy review for the amendment application submission for the Two Rivers M-1998-038 operation.

If you have any questions, please let me know.

Thanks,
Jocelyn

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Jocelyn Carter
Environmental Protection Specialist
Division of Reclamation, Mining, and Safety
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Denver, CO 80203
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COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

March 25, 2024

Jodi Schreiber
Fremont Paving & Redi-Mix Inc.
839 Mackenzie Ave.
Canon City, CO 81215

RE: Fremont Paving and Redi Mix, Inc. Two Rivers Pit M-1998-038 Amendment Application (AM-1), Preliminary Adequacy Review

Dear Jodi Schreiber,

The Division of Reclamation, Mining, and Safety (the Division/DRMS) received the amendment application (AM-1), submitted on January 22, 2024. The application was determined to be complete and filed with the Division on February 8, 2024. After the preliminary review, there are issues that need to be addressed and/or clarified. Please address the following adequacy review items. Provide a cover letter with a response to each of the items listed below and provide updated application Exhibits revised to address the adequacy review items.

Application

1. The application identifies the Pre-mining land use and Post-mining land use as cropland for both. This is different from the original permit with both the Pre-mining and Post-mining land use designated as rangeland. Please explain this discrepancy of the pre-mining land use. Is the post-mining land use being changed from rangeland to cropland or general agriculture with AM-1? The reclamation plan and map indicate the post mine land use is "agriculture." Please clarify this discrepancy on the application under item number 12 on page 4 of the application form.

Rule 6.2.1 General Requirements

2. Maps submitted contain the operation name of "2 River Pit", according to Division records the operation name is "Two Rivers Pit." Please correct the operation name on the following maps submitted to reflect the name on file with the Division in accordance with Rule 6.2.1(2).
    a. "ALTA/ACSM LAND TITLE SURVEY"
    b. "Existing Conditions Exhibit C.1"
    c. "Existing Conditions Building Details Exhibit C.2"
    d. "Existing Conditions Wells Exhibit C.3"
    e. "Existing Conditions Land Owners Exhibit C.4"
    f. "Mining Map Exhibit D"
    g. "Phase Map"

h. “Reclamation Map Exhibit F”

3. There appears to be two scales on the map titled “Existing Conditions Wells Exhibit C.3”. Revise map to show one scale that is in accordance with Rule 6.2.1(2)(e).
4. Revise the map titled “Phase Map” to include an appropriate scale as defined by Rule 6.2.1(2)(e).

Rule 6.4.2 Exhibit B – Index Map

5. There are no provided maps that correlate with this exhibit. Please identify the appropriate map that satisfies this requirement and is in accordance with Rule 6.2.1(2)(d) and Rule 6.4.2.

Rule 6.4.3 Exhibit C – Pre-mining Mining and Mining Plan Map(s) of Affected Lands

6. There is only one index contour line on the map for Exhibit C.4, revise the map to include topography with sufficient detail to portray the slope and direction of rate of slope change based on the current site conditions, per Rule 6.4.3(c).
7. Revise the map titled “Existing Conditions Wells Exhibit C.3” to include the names and locations of the Arkansas River and any tributaries, the Highline Canal, where the settling pond will be located, and any known aquifers, per Rule 6.4.3(f), Rule 6.4.7(2)(a), and 6.4.7(2)(b).
8. The “Existing Conditions Exhibit C.1” and the supplemental “Existing Conditions Building Details Exhibit C.2” maps need be updated to include all structures and the owner’s names of the structures located within 200 feet of the affected land in accordance with Rule 6.4.3(g). Include the portions of the fence line that have various owners and the owners of all the structures labeled.

Rule 6.4.4 Exhibit D – Mining Plan

9. The maps titled “Mining Map Exhibit D” and “Phase Map” display cross sections; one cross section view and two cross section views on the maps, respectfully. There are no cross section lines correlating with the direction of the cross sections. Though the cross sections specify that they are ‘typical ...’ sections, there is no indication of the direction to correlate where the sections are in relation to the map. Revise the maps to clarify where these cross sections are in relation to the surface maps.
10. It is mentioned in Exhibit E – Reclamation Plan that there will be a highwall no greater than 1000 feet in length. Include this information in Exhibit D – Mining Plan when discussing the size and areas to be worked at any one time in accordance with Rule 6.4.4(d).
11. Revise Exhibit D – Mining Plan or the Phase Map to provide an estimated timetable of the mining operation to include estimated time periods for each phase, per Rule 6.4.4(e)(i).
12. The “Mining Map Exhibit D” indicates in the Legend that the permit area is 420 acres. Please revised this with the correct permit acreage.

13. Provide a design for the ditches that will transport the mine water to the settling pond. Please demonstrate how the ditch will be constructed to handle the dewater flows and storm water while remaining stable from erosion. Depict the locations of these ditches from the mining phases to the settling pond, per Rule 6.4.4(j).
14. Specify the dimensions of the proposed temporary haul roads, per Rule 6.4.4(j).
15. Update the mining plan to indicate if the 40-foot access road will remain after mining is complete and the site is reclaimed.
16. The current mine plan/reclamation plan indicates there would be 18 inches of subsoil available to be placed below the topsoil. The revised Mining Plan indicated only 4-12 inches or overburden material is available. Please clarify this discrepancy.

Rule 6.4.5 Exhibit E – Reclamation Plan

17. It is stated in Exhibit G that the groundwater is expected to be between 15-45 feet below surface. It is also stated in Exhibit D that mining operations will go as far down as 46 feet (up to 12 inches of overburden + 45 feet mining depth). Given this, the excavated areas will likely fill with groundwater. The proposed post-mining land use is categorized as cropland and no material will be imported during reclamation to backfill the affected lands according to the plan. Provide an explanation of how the pits will be backfilled to address the exposed groundwater to establish the proposed post mine land use. Update Exhibit L to account for the cost of backfilling these pits and provide a description of the source of backfill materials with documentation/justification of their availability.
18. The reclamation plan narrative indicates the affected land will be reclaimed for agricultural land; however, the application form indicates the post mine land use proposed is cropland. Please clarify this and provide a description of why this post mine land use was chosen, per Rule 6.4.5(2)(a).
19. Provide information about how the post-mining land use of cropland compares to the land use in the vicinity of the mining operation, per Rule 6.4.5(2)(b).
20. Irrigation water will be needed to support the post mining land use of cropland. Identify what irrigation infrastructure will be installed to support the post mining land use and provide a demonstration that the landowner/operator has the water rights necessary to support the cropland post mine land use.
21. Per Rule 6.4.5(c), provide a description of how the proposed reclamation plan will be implemented to meet each of the following requirements outlined in Rule 3.1. Update Exhibit E to include this information:
    a. Exhibit G states that groundwater will be encountered, the application also proposes to conduct dewatering operations to facilitate mining. Therefore, the application must address how the groundwater quantity and quality will be protected in accordance with Rules 3.1.6 and 3.1.7.
        i. Commit to obtaining a Well Permit and Temporary Substitute Water Supply Plan from the Division of Water Resources prior to exposing groundwater and initiating dewatering.

ii. "Map Exhibit C.3" shows numerous wells within and adjacent to the proposed affected area. Provide a demonstration of the impact dewatering will have on the wells within 600 feet of the affected area. Show how the uses of these wells will be protected during the mining and reclamation operations.
iii. Provide a groundwater monitoring plan to collect baseline hydrology data and to be implemented during the mining and reclamation operation that meets the requirements outlined in Rule 3.1.7(7). Review the "Groundwater Monitoring Sampling and Analysis Plan Guidance, Construction Materials and Hard Rock Sites" document dated September 2023 on the DRMS website, https://drms.colorado.gov/programs/minerals-regulatory-program/minerals-program-policies-guidance-documents-and-technical. This document is also attached to this adequacy review.
iv. The groundwater monitoring plan needs to include a method to establish groundwater quality standards of the affected areas and will also require point(s) of compliance (POC) in accordance with Rule 3.1.7(6).

22. How will topsoil, overburden, and waste rock stockpiles be stabilized and protected from erosion? If vegetated cover is used, provide information about the seed mix to be used on these piles, per Rule 6.4.5(2)(d).
23. The application proposes to revegetate the affected land with winter wheat, millet, or sorghum, please provide the method and rates of seeding, the estimated availability of viable seeds in sufficient quantities, and the proposed time of seeding; per Rule 6.4.5(2)(d). The applicant can submit an appropriate revision in the future should they wish to revise the seeding plan.
24. Revise Exhibit E to include the estimated schedule for how and when reclamation will occur to include the following details:
    a. Estimated periods of time each phase will require, per Rule 6.4.5(2)(e)(i)
    b. The size and location of each reclamation phase, per Rule 6.4.5(2)(e)(ii)
    c. An outline of the sequence in which each phase of reclamation will be carried out, per Rule 6.4.5(2)(e)(iii).
25. State whether fertilization will be used. If so, provide details about the type to be used, the mixture(s), quantities, and time(s) of application, per Rule 6.4.5(2)(f)(iii).

Rule 6.4.6 Exhibit F – Reclamation Map

26. The reclamation plan states that no material will be brought in for reclamation purposes. On the Map titled "Existing Conditions – Land Owners" the index contour line going from northwest, across the north, then turning towards the south and exiting permit area at the southeast is labeled 4450 ft. In Exhibit F, the reclamation map shows that the approximate elevation of the area will be 4560 ft on the west end of the permit area and sloping to 4540 ft along the eastern end of the permit area. The reclamation plan shows an increase in elevation by approximately 100 feet. The topographic lines do not appear

to be accurate, and it appears the contour interval is 10 feet. Given the scale of the map provided and the assumed contour intervals, the side slopes depicted were found to be about a 1.5:1 horizontal to vertical ratio, not a 3:1 ratio or flatter as labeled on the map. Revise the map to comply with Rule 6.4.6(a).

Rule 6.4.7 Exhibit G – Water Information

27. It is stated in Exhibit G that exposed water will be covered by "existing MAGWA water shares available on the property." Please describe what "MAGWA" is and give details on how the shares are expected to cover exposed water.
28. As stated in item number 7 above, please consolidate water resources onto a map identifying the Arkansas River and any tributaries, wells, the settling pond, and the canals on the affected land and the adjacent lands in accordance with Rule 6.4.7(2)(a) and all known aquifers in accordance with Rule 6.4.7(2)(b).
29. Provide an estimate of the water needs required for development, mining, and reclamation phases in Exhibit G, per Rule 6.4.7(3).
30. Identify the source of water to be used and indicate the estimated amount of water from each water source supplying the project in Exhibit G, per Rule 6.4.7(4).
31. The submitted plans states that groundwater will be discharged into the Arkansas River. The permittee will need to acquire a National Pollutant Discharge Elimination System (NPDES) permit from the Water Quality Control Division at the Colorado Department of Health and Environment per Rule 6.4.7(5). Please commit to obtaining a NPDES permit prior to discharging water.

Rule 6.4.8 Exhibit H – Wildlife Information

32. Describe in Exhibit H the seasonal use of the affected are by game and non-game, per Rule 6.4.8(1)(b).
33. Indicate if there is the presence of threatened or endangered species from either the state or federal lists in Exhibit H, per Rule 6.4.8(1)(c), as these lists have changed since the original application was submitted.
34. Describe the level of impact on the area during and after mining operations in Exhibit H. Provide details of temporary and/or permanent loss of food and habitat, if any migratory routes will be interfered with (i.e. for the pronghorn or ring-necked pheasants), and general impacts of increased human activity in the area including noise, per Rule 6.4.8(1)(d).
35. The submitted plan states that comments were provided by the Colorado Parks and Wildlife, however they were not included with the application. Provide those comments in Exhibit H, per Rule 6.4.8(2).

Rule 6.4.9 Exhibit I – Soils Information

36. The soils report information submitted does not provide the thickness and distribution of soil over the affected land and the suitability of topsoil (or other material) for

establishment and maintenance of plant growth. Update Exhibit I to include this information, per Rule 6.4.9(1).

Rule 6.4.10 Exhibit J – Vegetation Information

37. Provide a description of the estimated cover and height for the principle species in each life form of the affected land, per Rule 6.4.10(1)(a).
38. Provide estimates of average annual production for croplands and carrying capacity for range lands on or in the vicinity of the affected land in accordance with Rule 6.4.10(1)(c).

Rule 6.4.12 Exhibit L – Reclamation Costs

39. The AM-1 application proposes a different post mine land use and implies a different seed mix for revegetation during the reclamation process than what the current reclamation cost estimate is based on. The requested AM-1 also proposes to expose groundwater during mining, and it is unclear how the pits with exposed groundwater will be backfilled. Also, the applicant is proposing a phase mining and reclamation plan that has bearing on the reclamation liability. These items need to be clarified. Please provide a reclamation plan based on the proposed revision to the mining phases and the revised reclamation plan accounting for backfilling the exposed groundwater at the site.

Rule 6.4.19 Exhibit S – Permanent Man-made Structures

40. Please see the attached review and questions/comments provided by Zach Trujillo with DRMS, subject matter expert for engineering evaluations, and address the inadequacies outlined.

This concludes the Division primary adequacy review of the AM-1 application. The Division reserves the right to further supplement this document with additional adequacy items and/or details as necessary.

The decision date for the AM-1 application is May 8, 2024. Please respond with sufficient time to allow the Division to completely review the submitted responses to the above items. If additional time is needed, please submit an extension request to the Division prior to the decision date.

If you have any question or concerns, I can be reached by email at Jocelyn.carter@state.co.us or by phone at (720) 666-1065. Please don't hesitate to contact me.

Sincerely,

Jocelyn Carter
Environmental Protection Specialist

Ec: Jared Ebert, DRMS
Cc: John Ary, Fremont Paving & Redi-Mix, Inc.

Enclosures: DRMS Internal Memo – Adequacy issues regarding Exhibit S
Mining Operations with Exposed Ground water Memo
Groundwater Monitoring and Protection Technical Bulletin
Groundwater Monitoring Sampling and Analysis Plan Guidance
Floodplain Protection Standards

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

Date: March 6, 2024

To: Jocelyn Carter

CC: Jared Ebert
Amy Eschberger

From: Zach Trujillo

RE: Twin Rivers Pit, DRMS File No. M-1998-038
Exhibit S – Engineering Review

Jocelyn,

As requested I have reviewed the provided Exhibit S, Engineering Evaluation Report (Report), conducted by DK Horn Engineering and Design, Inc. (DKH) on behalf of Fremont Paving and Redi-Mix, Inc. (Fremont) regarding the proposed Amendment No. 1 (AM-1) application for the Two Rivers Pit (Mine). The purpose of this memo is to summarize DKH's Report along with their evaluations and recommendations in relation to the Rules and requirements of the Division. Questions and comments regarding the Report to ensure all Rules and requirements are satisfied will be summarized at the end of this memo.

Review

The Two Rivers Pit is located in Pueblo County approximately 5.5 miles east of Avondale, Colorado. The Two Rivers Pit is currently a 339-acre 112c Construction Materials Permit. AM-1 is proposing an increase in the total permitted acreage by 18.2 acres to a total of 357.2 acres. Mining depths are proposed to be approximately 45 feet along 10 total mine phases with a maximum disturbance of 100 acres at one time. Based on projected mineral extraction rate and proposed acreage increase, the life-of-mine will be extended approximately 50 years. Once mining has been completed, mining highwalls will be graded to a 3H:1V slope. Based on the application, there are a total of 14 structures within 200 feet of the site.

Per Rule 6.4.19, [w]here the affected lands are within two hundred (200) feet of any significant, valuable and permanent man-made structure, the applicant shall: (a) provided notarized agreement between the applicant and the person(s) having an interest in the structure, that the applicant is to provide compensation for any damage to the structure; or (b) where such an agreement cannot be reached, the applicant shall provide an appropriate engineering evaluation that demonstrates that such structure shall not be damaged by activities occurring at the mining operation.

Of the 14 structures, the Mine has provided six signed structure agreements from their associated owner's. The other 8 structures were discussed and evaluated within the Report. Each evaluated structure along with location and ownership are summarized on page 2 of the Report.

1313 Sherman Street, Room 215, Denver, CO 80203 P 303.866.3567 F 303.832.8106 http://mining.state.co.us
Jared S. Polis, Governor | Dan Gibbs, Executive Director | Michael Cunningham, Director

During the review, it was observed that no discussion was included regarding pit highwall slopes during active mining operations within the proposed Exhibit D – Mining Plan or the Report. While requirements regarding the active highwall profiles are not specifically outlined within the Rules and Regulations, if highwalls are created along the maximum extent of the proposed disturbed boundaries, structures within the 200 foot boundary could be impacted by slope instability. This is most notable along mining Phase 10 and State Highway 50 which was also not specifically evaluated in the Report. Since Highway 50 is within the 200 foot designation, State Highway 50 will need to be evaluated to ensure it will not be impacted by mining activities or a structure agreement needs to be provided within the AM-1 application to ensure compliance with Rule 6.4.19 and 6.5(1). If the highway is evaluated, this should include potential impacts from slope instability along highwalls during active mining operations.

As part of the Report, a total of three exhibits were provided. Each exhibit is a map showing the general vicinity of the site, structure ownership and projected quantities. However, it appears that during the printing process of the Report, the visibility and clarity of each exhibit has diminished and are partially illegible. Additionally, when reviewing Exhibit 3 of the Report, a profile was included which appears to be associated with the provided map. However, it is unclear as to the location of the profile as there doesn't appear to be an associated transect provided along the aerial map portion of Exhibit 3. It also appears the y-axis of the provided profile was accidentally cutoff from view.

Division's Comments and/or Questions

The following is a summary of the Division's comments/questions discussed and observed during the review of the Report:

- Per rule 6.4.19, please have DKH provide an engineering evaluation of the State Highway 50 or a provided notarized agreement between the applicant and the person(s) having an interest in the structure. If an engineering evaluation is provided, this should include potential impacts, or lack thereof, from slope instability from the active mining operations as well as post-mining reclamation.

- Please have DKH provide updated or a new version of Exhibit 1, Exhibit 2 and Exhibit 3 in the Report to ensure legibility.

- Please DKH provide the location of the profile displayed on Exhibit 3 of the Report along the associated aerial map in the form of a transect line along with an adjustment to the profile y-axis where it can be viewed.

This concludes my review of the provided Exhibit S, Engineering Evaluation Report, conducted by DK Horn Engineering and Design, Inc. on behalf of Fremont Paving and Redi-Mix, Inc. regarding the proposed Amendment No. 1 application for the Two Rivers Pit. If you have any questions, feel free to contact me.

Sincerely,

Zach Trujillo
Environmental Protection Specialist
(303) 866-3567 ext. 8164
Zach.Trujillo@state.co.us

STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

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COLORADO DIVISION OF RECLAMATION MINING & SAFETY

April 30, 2010

Kirkland Construction, RLLP
P.O. Box 580
2101 Main Street
Rye, CO 810690000

RE: Mining Operations with Exposed Ground water

To Whom It May Concern:

The Division of Reclamation Mining and Safety is responsible for ensuring that Sand and Gravel mining operators comply with the requirements of the Colorado Land Reclamation Act for the Extraction of Construction Materials (Act) and the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials (Rules). Among these requirements are provisions for the protection of water resources. The Act requires that reclamation plans must ensure minimization of disturbances to the prevailing hydrologic balance, including disturbances to the quantity of water in the area affected by mining and in the surrounding areas. § 34-32.5-116(4)(h). Rule 3.1.6(1)(a) requires compliance with Colorado water laws and regulations governing injury to existing water rights both during and after mining. Permits must specify how the permittee will comply with applicable Colorado water laws and regulations governing injury to existing water right rights. Rule 6.3.3(j); Rule 6.4.5(2)(c). After an extensive review, the Division determined that several operators may not have appropriate permit conditions to address certain reclamation liabilities arising from impacts to water resources.

In September 2009 the Division of Water Resources (DWR) updated its Guidelines for Sand and Gravel Pits. These guidelines provide guidance on achieving compliance with state law regarding replacement of depletions from sand and gravel mining, thus the guidelines provide a benchmark for the protection of hydrologic balance required under the Act and Rules. As noted in the Guidelines, sand and gravel operations which expose groundwater without complying with state law create a reclamation liability by impacting available groundwater.

State law requires that any person exposing ground water must obtain a well permit from the SEO pursuant to § 37-90-137(11). Because exposed groundwater results in out-of-priority water depletions, operations which expose ground water must also eventually obtain a water-court approved augmentation plan. Currently, several operators do not have either an augmentation plan or bonding to provide an alternative method to mitigate injurious stream depletions that result from mining-related exposure of ground water. The Division has a statutory duty to ensure that lands affected by mining are reclaimed in a manner that complies with state law and to ensure that operators have sufficient bonding to achieve reclamation. In order to assist operators in achieving compliance with these requirements, the Division proposes that, by April 30, 2011, operators should contact the Division and agree upon a plan for achieving compliance.

The Division has identified four approaches for operators:

1. File a financial warranty that will ensure backfilling of the pit to cover the exposed ground water to a depth of two feet above the static ground water level or,

2. Obtain a court approved augmentation plan prior to exposing ground water or,

3. File a financial warranty to cover the cost of installing a clay liner or slurry wall that meets the Division of Water Resources requirements for preventing ground water exposure or,

4. Obtain approval from the Division of Water Resources that acknowledges compliance with the SEO's requirements pursuant to § 37-90-137(11).

The Division will work with operators on an individual basis as they move to implement one of these plans. It is likely that options 1 and 3 will require the submittal of a technical revision or an amendment to the existing permit depending on the nature of the current mining and reclamation plan and the proposed changes. Increased financial warranties, as a result of these modifications, may be posted in a phased manner not to exceed three years. Amendments or revisions currently under review will be required to be approved by April 30, 2011 and may use the phased financial warranty approach described above. New applications going forward or presently under review by the Division will be required to meet the requirements of one of the options 1-4 at the time of application approval. Failure of affected operators to initiate contact with the Division and gain compliance as described above could result in an enforcement action being issued by the Division.

If you have any questions, please contact Tony Waldron at 303-866-3567, extension 8150.

cc: M1998038 Two Rivers

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

Groundwater Monitoring and Protection Technical Bulletin

November 19, 2019

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1. Introduction

This document is intended to provide guidance on groundwater monitoring and protection to operators, consultants and regulatory staff concerned with permits issued by the Colorado Division of Reclamation, Mining and Safety (DRMS or Division). The guidance is given in the context of applicable statutes and regulations, and is an attempt to ensure that compliance requirements are clearly and unambiguously stated. This document is not all-inclusive with respect to the requirements, information, and materials needed for a complete groundwater monitoring program, as site specific requirements will vary widely.

This guidance addresses DRMS requirements only. Other divisions, such as the State Engineer's Office Division of Water Resources, have processes, requirements, and timelines that must be met for activities within their jurisdiction. It is recommended that applicants/permittees consult with all appropriate agencies in the planning phase prior to the start of work so that any deficiencies or conflicts can be addressed promptly.

Hyperlinks are embedded within the document text for convenience, but are subject to change or removal without notice and are not intended to be a definitive reference; a list of references is given in section 9.

2. Background and General Statutory Context

The passage of the Colorado Water Quality Control Act (C.R.S. Title 25, Article 8) in 1972 established the Water Quality Control Commission (WQCC), and assigned to it the duty to develop and maintain a comprehensive and effective program for the prevention, control, and abatement of water pollution, and for water quality protection throughout the state of Colorado. Within its general remit, three of the specific responsibilities of the WQCC are to:

- Classify state water
- Promulgate water quality standards
- Promulgate control and permit regulations

The Water Quality Control Division (WQCD) is the agency responsible for implementing and enforcing the standards and regulations adopted by the WQCC. The WQCD also provides staff support to the WQCC. Both the WQCC and WQCD are within the Colorado State Department of Public Health and Environment (CDPHE).

The Act was amended in 1989 with Senate Bill 181 (SB 89-181), to clarify the role of other state agencies, including DRMS, with specific responsibilities in the area of water quality control for certain industries or activities, and to designate them as "implementing agencies". Two Memorandums of

Agreement (MOA) were entered into by the agencies in order to fully implement the amendments made under SB 89-181. The first MOA, pertaining to coal mines, was signed on August 28, 1990; and the second, pertaining to mineral mines, was signed on December 14, 2010.

The MOAs clarify the roles and responsibilities of DRMS, WQCD and WQCC at sites where their jurisdictions overlap, and may be summarized as follows:

- WQCC is solely responsible for the adoption of water quality standards and classifications
- WQCD is solely responsible for issuance and enforcement of permits authorizing all point source discharges to surface waters, as well as enforcing any control or permit regulation adopted by WQCC
- DRMS is responsible for implementing standards and classifications for discharges, other than point source discharges to surface water, through its own regulatory programs after consultation with WQCC and WQCD

In addition to the division-wide responsibility described above, the regulatory programs within DRMS have statutory mandates to monitor groundwater and protect the hydrologic balance during and after mining operations under three separate acts specific to mining: the Colorado Mined Land Reclamation Act (C.R.S. Title 34, Article 32), the Colorado Land Reclamation Act for the Extraction of Construction Materials (C.R.S. Title 34, Article 32.5), and the Colorado Surface Coal Mining Reclamation Act (C.R.S. Title 34, Article 33).

The regulations developed under the acts cited in this section are discussed in greater detail in sections 3 and 4 of this document. Sections 5 through 8 discuss the implementation of the regulations, and include guidance on the permitting process and procedures necessary to ensure effective regulatory compliance.

3. Regulations under the Colorado Water Quality Control Act

Two of the regulations pertaining to groundwater promulgated by the WQCC under the Colorado Water Quality Control Act are relevant to DRMS:

- Regulation No. 41 – The Basic Standards for Groundwater
- Regulation No. 42 – Site-specific Water Quality Classifications and Standards for Groundwater

Reg. 41 establishes five classes of groundwater and the criteria for each; secondly, it establishes statewide water quality standards and the procedures for applying them; thirdly, it defines the term “point of compliance” and the provisions by which such a point should be established. Rule 41.6(B) identifies DRMS as an implementing agency and specifies that such agencies “shall establish the point of compliance for those activities under their control.”

Reg. 42 is the compilation of the actions taken by the WQCC to date in classifying site-specific areas of the state. In other words, it contains a complete description of the groundwater to which the WQCC has specifically assigned use classifications and water quality standards.

It is important to stress that **DRMS does not have the authority to classify groundwater or to set standards for groundwater quality, however it does have the authority and the legal obligation to establish points of compliance at which those standards set by the WQCC must be met**. In order to satisfy this obligation DRMS staff must: (i) determine whether the proposed activity has the potential to negatively impact the quality of groundwater, based primarily on an assessment of the physical characteristics of the site; (ii) if that potential does exist, determine the standards applicable at the site; and then (iii) locate one or more point of compliance where water quality can be measured and assessed against those standards. Although these tasks should be part of a comprehensive groundwater monitoring plan that addresses the requirements of other applicable regulations, it is helpful to consider the general procedure for compliance with Reg. 41 and 42 before examining specific details, (see figure 1).

The simplest situation is where an operator seeks to conduct mining operations in an area of classified groundwater. If the proposed operation is within a classified area, the standards contained in Regulation No. 42 apply. However, due to the very limited overall area that has been classified in Colorado to date under Regulation No. 42, this is not common. It is more likely that activity occurring under a permit issued by DRMS will be subject to the state-wide standards described in Reg. 41. If this is the case, tabulated numeric standards in 41.5(C)(2) and (3) for some radioactive materials and organic pollutants must not be exceeded; radioactive and organic pollutants not included in the tables must be maintained at the lowest practical level. In addition, assuming that the background level of Total Dissolved Solids (TDS) is not in excess of 10,000mg/L, the Interim Narrative Standard applies.

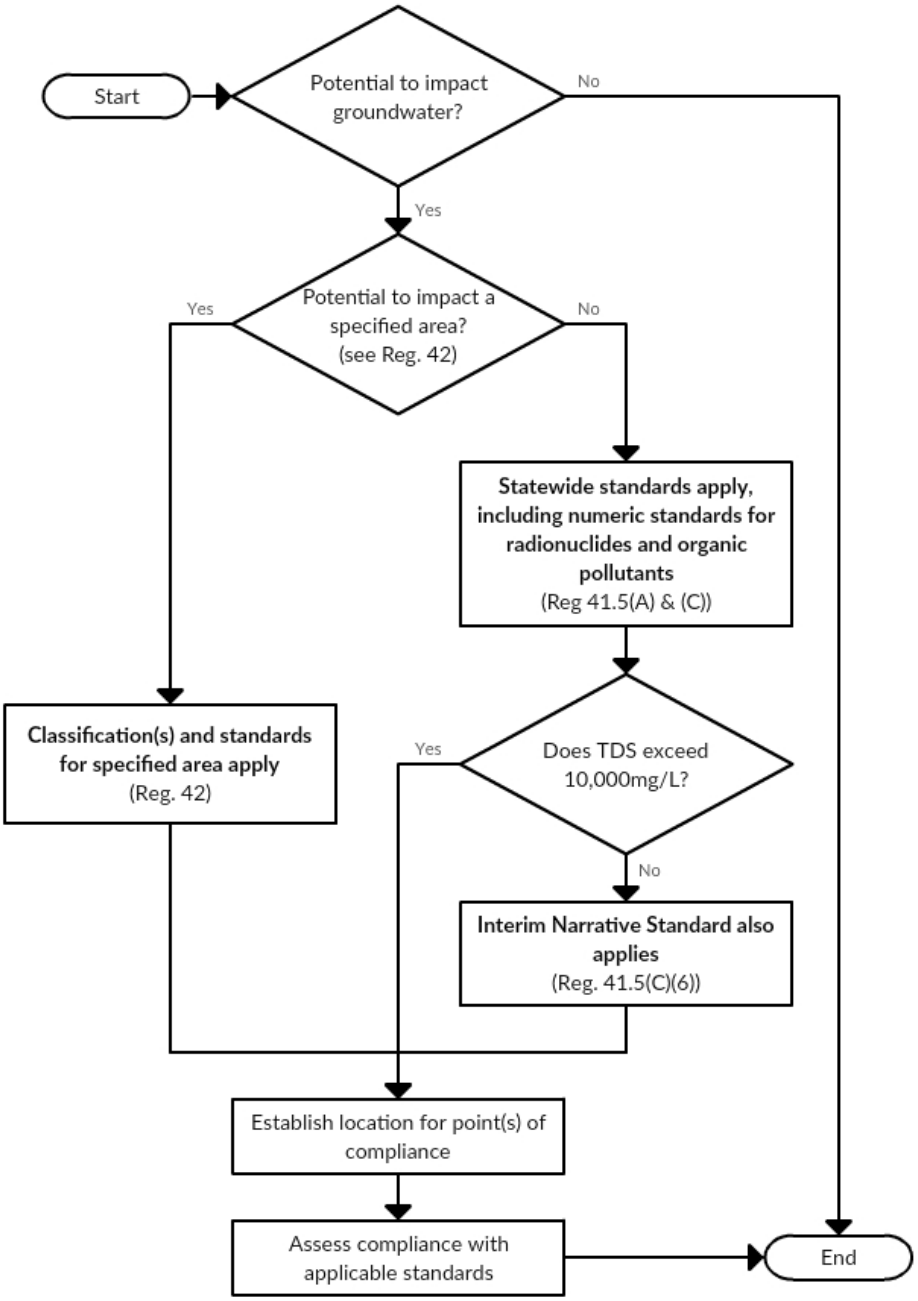

Figure 1: General procedure for compliance with Reg. 41 and 42

4. Regulations under Mining-specific Acts

The Colorado Mined Land Reclamation Act and the Colorado Land Reclamation Act for the Extraction of Construction Materials led to the promulgation of The Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal, and Designated Mining Operations (Hard Rock Rules) and The Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials (Construction Materials Rules) respectively. There are substantial differences between the two sets of rules, but they are structured similarly and, on the subject of groundwater, have similar requirements. Pertinent sections of the rules are:

- 1.4 – Application Review and Consideration Process
- 3.1.7 – Reclamation Performance Standards; Groundwater - Specific Requirements
- 6.4.7 – Water Information
- 6.4.21(8), (9) & (12) – Designated Mining Operation Environmental Protection Plan; Groundwater Information, Groundwater Quality Data & Water Quality Monitoring Plan
- 6.4.22-24 – Description, Baseline Site Characterization and Monitoring Plan for All In-Situ Leach Mining Operations

The Regulations of the Colorado Mined Land Reclamation Board for Coal Mining (Coal Rules) were promulgated under the Colorado Surface Coal Mining Reclamation Act, and have specific requirements pertaining to groundwater. Pertinent sections of the regulations are:

- 2.04.7 – Hydrology Description
- 2.05.6(3) – Protection of Hydrological Balance
- 4.05.13 - Surface and Ground Water Monitoring

It is outside the scope of this guidance to discuss the specific requirements of each of these rules, however general requirements are discussed in section 7.

5. DRMS Implementation of the Interim Narrative Standard

The Interim Narrative Standard is described completely in section 41.5(C)(6) of Reg. 41, and applies to all unclassified groundwater in the state, unless TDS exceeds 10,000mg/L. The standard is simply stated as follows:

> Groundwater quality shall be maintained for each parameter at whichever of the following levels is less restrictive:
>
> (A) Existing ambient quality as of January 31, 1994,
>
> or
>
> (B) That quality which meets the most stringent criteria set forth in Tables 1 through 4 of "The Basic Standards for Ground Water."

The Interim Narrative Standard does not define or limit the potential need for remediation of contaminated groundwater; however it does ensure that even contaminated groundwater is not allowed to be further degraded pending remedial action.

"Existing ambient quality" is a key phrase in the Interim Narrative Standard. Section 41.5(C)(6)(b)(iii) allows implementing agencies, such as DRMS, to exercise their best professional judgment as to what constitutes adequate information to determine or estimate existing ambient quality, taking into account the location, sampling date, and quality of all available data. This gives the Division some discretionary authority, however there are two additional clauses that limit the scope of that authority:

- Data generated subsequent to January 31, 1994, shall be presumed to be representative of existing quality as of January 31, 1994, if the available information indicates that there have been no new or increased sources of ground water contamination initiated in the area in question subsequent to that date.

- If available information is not adequate to determine or estimate existing ambient quality as of January 31, 1994, groundwater quality for each parameter shall be assumed to be no worse that the most stringent levels provided for in Tables 1 through 4 of "The Basic Standards for Ground Water"

The implementation of the Interim Narrative Standard by DRMS is summarized as follows:

The applicable groundwater quality standards for new and permitted mine sites are the most stringent criteria set forth in Tables 1 through 4 of "The Basic Standards for Ground Water"

UNLESS

The permittee/applicant provides to DRMS sufficient data and documentation demonstrating that ambient levels of applicable analytes exceeded table value standards prior to January 31, 1994;

OR

The permittee/applicant provides to DRMS sufficient data and documentation demonstrating that data collected after January 31, 1994, which shows water quality parameters in excess of table value standards, are representative of pre-1994 conditions; and that there have been no new or increased sources of groundwater contamination in the area since.

Note that:

- It is the permittee/applicant's burden to provide substantial evidence and documentation to DRMS to demonstrate to DRMS's satisfaction that any proposed "pre-94" site-specific exemption from table value standards is appropriate for their site.
- If DRMS deems that a "pre-94" exemption from the table value standards is appropriate, the highest documented (valid/non-outlier) ambient value of that analyte shall be used as the numeric limit for that water quality parameter.

The only other way a DRMS permitted site may allowably exceed table value standards would be for the permittee/applicant to obtain a site-specific exemption or variance from the WQCC through the rulemaking process.

6. DRMS Establishment of Points of Compliance

As an implementing agency, DRMS shall establish the point of compliance for those activities under its jurisdiction. It is acknowledged in Reg. 41 that mining activities occur within ground water bodies and that water quality within the disturbed area will change. The point(s) of compliance established outside the area anticipated to be disturbed may protect the water body while allowing the mining activity.

DRMS protocol for establishing points of compliance is given in Section 3.1.7(6) of the Hard Rock Rules and Construction Materials Rules, and in Section 4.05.13(1) of the Coal Rules. There is some variation in the precise terms of those rules, however the following general guidance applies to all sites operating under a DRMS permit.

A point of compliance shall be established for all potentially impacted groundwater; multiple points of compliance may be necessary for a given operation, depending on the hydro-geologic conditions at the site. Compliance with groundwater quality standards must be achieved at points of compliance.

Points of compliance shall be located at some distance hydraulically down-gradient from the source of potential contamination. The point shall be at:

The hydrologically downgradient limit of the area in which contamination has been identified

OR

The permit boundary

OR

A specified distance, agreed to by the Division and the permittee/applicant, taking into consideration:

- Applicable water quality standards

- Hydro-geologic conditions at the site

- Toxicity, mobility and environmental persistence of potential contaminants

- Potential of the site as an aquifer recharge area

- Technical and economic feasibility

Note that enforcement action(s) may result from the exceedance of one or more water quality parameters at a Point of Compliance location, or from failure to adhere to the sampling and reporting protocols approved in the Groundwater Monitoring Plan.

7. General Groundwater Monitoring Requirements

Groundwater monitoring and compliance requirements for specific permits and activities vary widely according to the complexity of the activity and the site, but are generally implemented through the following basic process:

A. The permittee/applicant shall conduct a site-wide hydro-geologic characterization prior to disturbance at any given site. This baseline characterization must determine, at a minimum, if the proposed activity has the potential to impact groundwater. If the potential to impact groundwater exists, thorough characterization is essential.

A baseline characterization of existing site groundwater conditions should be completed for both groundwater quality and quantity. Data should be collected in order to locate and construct appropriate monitoring wells and points of compliance, and to fully implement appropriate water quality standards. Revisions to a permit may require new baseline characterization studies. The characterization investigation should be conducted by a qualified

individual, preferably a Professional Geologist (PG), Registered Geologist (RG), or other certified professional experienced in hydro-geologic characterization, and should include:

- A complete description of the geologic setting, including each aquifer above, within and, if potentially impacted, below the lowest unit to be mined.
- Seasonal quantity and quality data for the water in each aquifer, (refer to tables 1 through 4 of Reg. 41 for water quality parameters).
- A description of the recharge, storage, transmissivity and discharge characteristics of each aquifer.
- A complete list of registered wells in the proposed permit and adjacent areas, with locations, completion intervals and reported yields.

B. For the Coal permitting process, a prediction of the Probable Hydrologic Consequences of the proposed activity shall be made. This is not a requirement for minerals or construction materials permits.

C. A Groundwater Monitoring Plan shall be designed so as to allow a determination to be made of the effects of the permitted activity on the quantity and quality of water in groundwater systems in the permit and adjacent areas, and to verify any predictions made in the permit. The plan should include monitoring points up- and down-gradient of any potential sources of contamination, and provision to directly monitor any mine pool as it develops.

D. The locations of Points of Compliance shall be determined in the context of the Groundwater Monitoring Plan. It is advised, but not required, that monitoring wells be located up-gradient of Points of Compliance so as to allow timely remedial action to be taken if necessary.

E. All monitoring wells and piezometers shall be permitted with the State Engineer's Office (SEO) Division of Water Resources (DWR) and constructed and abandoned according to the required SEO standards. Adherence to these standards will protect aquifer integrity and provide representative, defensible data. Failure to follow the applicable permitting and well construction rules could result in unacceptable data; and failure to adequately protect groundwater resources may result in subsequent enforcement action as deemed appropriate by DRMS or the SEO.

F. All wells shall be installed by a licensed contractor, as required by SEO. Appropriate site specific well placement and construction details should be recorded and approved by a qualified professional, before being submitted to DRMS. DRMS may require the installation of additional wells for adequate characterization and/or monitoring.

G. Sampling protocols shall be described in the Groundwater Monitoring Plan and followed during each sampling event.

H. Analysis of samples shall be by an accredited laboratory.

8. Release of Reclamation Liability for Sites with Groundwater Monitoring

It is the permittee's burden to demonstrate to the satisfaction of DRMS, through the data collected for the Groundwater Monitoring Plan, and any other data deemed necessary, that all applicable table value standards, and/or site-specific standards for groundwater quality established in accordance with Reg. 41 and/or Reg. 42 have been met, and that existing and reasonably potential future uses of groundwater have been protected.

9. References

[1] Board of Examiners of Water Well Construction and Pump Installation Contractors. Rules And Regulations For Water Well Construction, Pump Installation, Cistern Installation, And Monitoring And Observation Hole/Well Construction, 2 CCR 402-2 § (2016). Retrieved from: http://water.state.co.us/DWRIPub/Documents/BOE%20Water%20Well%20Construction%20Rules%202%20CCR%20402-2%20_20160901.pdf

[2] Colorado Department of Public Health and Environment, Water Quality Control Commission. Regulation 41 - The Basic Standards For Groundwater, 5 CCR 1002-41 § (2016). Retrieved from: https://www.colorado.gov/pacific/sites/default/files/41_2016%2812%29.pdf

[3] Colorado Department of Public Health and Environment, Water Quality Control Commission. Regulation 42 - Site-Specific Water Quality Classifications And Standards For Groundwater, 5 CCR 1002-42 § (2018). Retrieved from: https://www.colorado.gov/pacific/sites/default/files/42_2018%2806%29.pdf

[4] Colorado Land Reclamation Act for the Extraction of Construction Materials, C.R.S. 34-32.5 §.

[5] Colorado Mined Land Reclamation Act, C.R.S. 34-32 §.

[6] Colorado Mined Land Reclamation Board. Regulations of the Colorado Mined Land Reclamation Board for Coal Mining, 2 CCR 407-2 § (2005). Retrieved from: http://mining.state.co.us/SiteCollectionDocuments/CoalRegulations91405.pdf

[7] Colorado Mined Land Reclamation Board. Mineral Rules And Regulations Of The Colorado Mined Land Reclamation Board For The Extraction Of Construction Materials (2006). Retrieved from: http://mining.state.co.us/SiteCollectionDocuments/Revised-ConstrMatadoptedAug92006indexed.pdf

[8] Colorado Mined Land Reclamation Board. Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal, and Designated Mining Operations (2015). Retrieved from: http://mining.state.co.us/SiteCollectionDocuments/Hard%20Rock%20Rules%20Adopted%20January%2015.pdf

[9] Colorado Surface Coal Mining Reclamation Act, C.R.S. 34-33 §.

[10] Colorado Water Quality Control Act, C.R.S. 25-8 §. Retrieved from: https://www.colorado.gov/pacific/sites/default/files/Act2017.pdf

[11] Memorandum Of Agreement For The Implementation Of SB 181 Amendments To The Colorado Water Quality Control Act (25-8-101, et seq) Pertaining To The Regulation Of Coal Mines. (1990, August 28). Retrieved from: https://www.colorado.gov/pacific/sites/default/files/T1_WQCC_181MOA_Mined-Land-Regarding-Coal-Mines.pdf

[12] Memorandum Of Agreement For The Implementation Of SB 181 Amendments To The Colorado Water Quality Control Act (25-8-101, et seq) Pertaining To The Regulation Of Mineral Mines. (2010, December 14). Retrieved from: https://www.colorado.gov/pacific/sites/default/files/T1_WQCC_181MOA_DRMS.pdf

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

Groundwater Monitoring: Sampling and Analysis Plan Guidance Construction Materials and Hard Rock Sites

September 2023

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Introduction

This document is intended to provide guidance to permittees of Construction Materials or Hard Rock mines, on the typical requirement of a groundwater sampling and analysis plan, where the proposed operation has the potential to adversely impact the prevailing hydrologic balance of the affected land and of the surrounding area, with respect to the quantity and quality of water in groundwater systems. It is intended to supplement the Groundwater Monitoring and Protection Technical Bulletin of November 19, 2019, and is an attempt to provide more detailed and specific guidance to permittees in an area where the Division has found approaches to compliance have varied widely.

Sites where mining will not expose groundwater, e.g., dry sites or sites where mining will not be near the water table, are not required to submit a groundwater sampling and analysis plan.

A Sampling and Analysis Plan should be tailored to the specific site to which it applies, but this guidance document does not take site-specific factors into account.

The remaining sections of this document are organized under the same headings that the Division would expect to see in a typical groundwater sampling and analysis plan.

Hyperlinks are included in the document text for convenience, and a full list of references is given at the end.

1 Background Information

1.1. Site Description

The Site Description should include the following:

- Name of the site or sampling area. Also include the name or abbreviation (e.g., "the Site"), if any, that will be used throughout the plan.

- A general description of the region in which the site or sampling area is located. Include the street address, city, state, and postal code, if appropriate.

- A detailed description of the physical geography of the site or sampling area. Include a description of the topography, land use/surface cover, any relevant physical features, past and present activities, existing structures. Give the area in acres.

- A description of the geology of the area, including lithology and stratigraphy. Give the composition, thickness and extent of each formation. Identify any faults or other major structural features in the area. Diagrams are often a helpful addition to a geologic description.

- A description of the hydrogeology of the area. Identify each aquifer underlying the site. Characterize each aquifer (hydraulic conductivity, isotropy, confined/unconfined, recharge zones, groundwater flow direction) and describe how the characterization was made. Identify aquitards/confining layers.

- At least two maps:
  - A vicinity map that shows the permit area within its geographic region.

  - A Monitoring Well Location map that shows the sampling sites or sampling areas within the local area. Scale criteria need not be followed for this map. The map should include a layer of projected potentiometric contour lines for each identified aquifer, or a groundwater directional flow arrow (if appropriate). All permitted wells within the map extent should be shown – this information is available from the Division of Water Resources (DWR). All sampling locations (historic, active and planned) should be shown. All springs and seeps should be shown. The outcrop of any geologic formations should be shown. Other physical features and man-made structures may be included for clarity.

  All maps should include a title, legend, North arrow, scale bar, date, and section lines/marks. All maps must be prepared and signed by a registered land surveyor, professional, engineer, or other qualified person.

1.2. Baseline Groundwater Characterization

A Sampling and Analysis Plan will be informed by a baseline characterization of groundwater at the site, but may also need to include a plan to collect the data that will allow the initial characterization to be made. Applicants are encouraged to utilize information available from the public domain literature

and private sector data in developing their baseline groundwater characterization. These data sources will not require a Notice of Intent (Rule 5) to perform exploration operations. Private sector sources will likely include environmental site assessments performed as part of land acquisition.

Baseline sampling should be sufficient to allow the Division to assess the impacts of the future mining operation on the prevailing hydrologic balance. Sampling locations should be established upgradient and downgradient of the proposed operation, the number of sampling locations is not specified since it depends greatly on the site, (a minimum of three data points are needed to establish groundwater flow direction). Unless otherwise approved by the Division, all groundwater monitoring wells should be within the permit area. The screened intervals of groundwater monitoring wells should be sufficient to monitor each identified aquifer. Samples should be taken with sufficient frequency to capture site-specific temporal variability. The duration of the sampling period should be sufficient to identify seasonal trends. The minimum sample location, frequency and duration requirements for baseline groundwater characterization are summarized below:

- Upgradient and downgradient sampling locations in each identified aquifer
- Samples taken quarterly
- Five consecutive quarters of data

A table should be included with a row for each sampling location. Each point should have a unique identifier. The table should include the location (Lat/Long), land surface elevation, top of casing elevation, total depth, screened interval, and completion date. The latitude/longitude could be shown in decimal degrees showing five places to the right of decimal, e.g., 39.73934, -104.98486.

Upon request the Division is available for consultation during development of a Sampling and Analysis Plan.

1.2.1. Monitoring Well Installation

All monitoring wells should be:

- Permitted with the State Engineer's Office (SEO) Division of Water Resources (DWR); and
- Constructed (and later abandoned) according to the required SEO standards (see 2 CCR 402-2 Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Hole/Well Construction)

The well construction standards are designed to protect aquifer integrity and to ensure that constructed wells serve their purpose; in this case to provide representative, defensible data. Failure to follow the applicable permitting and well construction rules could result in unacceptable data; and failure to adequately protect groundwater resources could result in subsequent enforcement action as deemed appropriate by DRMS or the SEO.

All wells should be installed by a licensed contractor, as required by SEO. Site specific well placement and construction details should be recorded and approved by a qualified professional,

before being submitted to DRMS.

1.2.2. Baseline Groundwater Quantity

Baseline water level data should be recorded in a table, and a narrative description of how the data was collected should be provided. A graph of the water level against time at each monitoring point should also be included. In most cases a static water level can be measured using a depth gauge from the top of the casing, however if the aquifer is under confined conditions, and the pressure is such that the well is flowing, an alternative method will be necessary (for example: https://www.usgs.gov/media/videos/measuring-water-levels-a-flowing-well).

The potentiometric head at the well can be readily derived from the depth to water measurement and the casing elevation. Head measurements from three or more points may be interpolated to give a groundwater flow direction and an approximation of the potentiometric surface in the aquifer. In many cases it will be necessary to collect more data points to adequately characterize the pre-mining conditions.

Often a numerical model (for example: Modflow) will be an appropriate tool to characterize the hydrogeology of the site. In other cases, the Division acknowledges, routine one-dimensional groundwater equations may be appropriate to evaluate potential offsite hydrologic impacts. If a numerical model is used, it should be thoroughly documented, with all assumptions explicitly stated. The documentation should include:

- An explanation of the conceptual model, with assumptions explicitly stated
- A detailed description of the model grid, with figures
- A list of parameter values for boundary conditions and initial conditions
- Details of the model calibration

1.2.3. Baseline Groundwater Quality

A table should be provided with a complete list of water quality parameters to be measured. This will comprise both field parameters and laboratory analytes. The full parameter list should be based on Tables 1-4 from Regulation 41: The Basic Standards for Groundwater (Reg. 41). Parameters from these tables have been compiled in Appendix A for Construction Materials sites and Appendix B for Hard Rock sites.

The Division will entertain variances from the Reg. 41 list on a case-by-case basis, but any proposed variance must be justified.

Baseline groundwater quality data should be recorded in a table, with the sampling date. Minimum, maximum and average values for each parameter should be given.

2 Predicted Impacts to Hydrologic Balance

Following the characterization of baseline conditions a prediction should be made as to the possible impacts of the proposed mining operation on groundwater quantity and quality.

The prediction of likely impacts to groundwater quantity should include a prediction of the maximum spatial extent of drawdown caused by dewatering, or of mounding caused by impermeable cell liners/slurry walls, and the time-scale over which it will be observed. The extent and time to recovery to a steady-state following reclamation should also be predicted.

The prediction of impacts to groundwater quality should include a discussion of water quality parameters that may be elevated as a result of the proposed operation, and the likely spatial and temporal extent of the impact. It is noted here that HB 19-1113, which applies to Hard Rock Sites only and was signed into law on April 4, 2019, requires most reclamation plans to demonstrate, by substantial evidence, a reasonably foreseeable end date for any water quality treatment necessary to ensure compliance with applicable water quality standards.

If a numerical model is used to inform any of the hydrologic predictions the model should be thoroughly documented, as discussed in Section 1.2.2.

3 Groundwater Monitoring Plan

A monitoring plan sufficient to verify the predictions of hydrologic impacts should be proposed. The locations of sampling points, and the frequency at which they will be sampled should be specified. A complete list of groundwater quality parameters to be sampled for should be given. A description of sampling methods should be included in sufficient detail to ensure that the procedure can be replicated throughout the life of the permit (Sampling Methods are discussed in more detail below).

A commitment should be made as to how the monitoring data will be reported to the Division. Typically monitoring data will be compiled into a report, to be submitted by a specified date, e.g. annually or quarterly.

The groundwater monitoring report will include:

- Tabulated data for all parameters
- Graphs/plots for selected parameters
- A narrative analysis of the data, with trends and anomalies identified
- A comparison of the observed data to the predictions **and** to the groundwater quality standards (see below)

The requirements of the groundwater monitoring plan may continue to apply until final bond release and termination of jurisdiction. Changes to the groundwater monitoring plan will require a Technical Revision to the permit.

3.1. Groundwater Points of Compliance

It is likely that one or more Groundwater Points of Compliance (POC) will be established, these are locations at which compliance with the applicable standard will be assessed. Detailed guidance on POCs has been given in the Groundwater Monitoring and Protection Technical Bulletin of November 19, 2019, and will not be repeated here. POCs should be identified in the groundwater monitoring plan.

3.2. Groundwater Quality Standards

As is discussed in detail in the Groundwater Monitoring and Protection Technical Bulletin of November 19, 2019, the Division does not have the authority to set groundwater quality standards, but it does have both the authority and the obligation to apply the standards set by the Water Quality Control Commission, (in practice, this often involves the determination of how the Interim Narrative Standard from Reg. 41 should be applied at a site). For the sake of clarity, the numerical values for groundwater quality parameters that represent the applicable standard should be agreed and recorded in a table at the same time the POCs are established.

4 Sampling Methods

The goal of sampling is to make accurate, repeatable field measurements and to collect representative groundwater samples for laboratory analysis. There is no single correct method to conduct groundwater sampling, however there many incorrect methods. Follow accepted best industry practices to ensure that a representative sample is collected and analyzed. Applicable references include those from the US Environmental Protection Agency, and the US Geological Survey.

It is likely that the contracted analytical laboratory will supply detailed instructions for sample collection and handling.

Best practices for sampling:

- Details of sampling events should be recorded – documentation is critical for Quality Assurance
- All samples should be collected on the same day, if possible
- Sampling should occur in a progression from upgradient to downgradient wells
- Depth to water should be measured first
- Field instruments should be calibrated according to manufacturer's specifications prior to use
- Field parameters (temperature, pH, conductivity, dissolved oxygen) should be measured and recorded before and after each purge of the well
- A well should be purged at least three times before samples are collected for lab analysis; if field parameters vary by >10% between consecutive purges, purging should continue up to six times

- Samples should be collected in the appropriate container and handled in a manner appropriate for the analysis
- Manufacturer's instructions for the correct use and disposal of equipment should be followed
- Ship samples well before the holding time is up; ideally, within 24 hours of sample collection
- Do not leave sampling devices in monitoring wells for reuse

References

DRMS Groundwater Monitoring and Protection Technical Bulletin: November 19, 2019
https://drive.google.com/file/d/121Uc_KmuAx7xhc8heQcROPnK_u-kcG-J/view?pli=1

Well Construction Rules
https://dwr.colorado.gov/services/well-construction-inspection

Modflow Documentation
https://www.usgs.gov/mission-areas/water-resources/science/modflow-and-related-programs

Water Quality Control Commission regulations
https://cdphe.colorado.gov/water-quality-control-commission-regulations

EPA Groundwater Sampling Methodology
https://www.epa.gov/sites/default/files/2015-06/documents/Groundwater-Sampling.pdf

USGS National Field Manual for the Collection of Water-Quality Data
https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm#overview

HB 19-1113: Protect Water Quality Adverse Mining Impacts
https://leg.colorado.gov/bills/hb19-1113

Appendix A: Full parameter list for Construction Material Sites (with Table Value Standards) from Regulation 41, Tables 1-4

Analyte	Table Value Standard (mg/L, unless other units given)	Reg. 41 Table Reference (1-4)
pH Field (pH unit)	6.50 - 8.50	2 and 3
TDS	400 mg/L, or 1.25X background	4
Chloride - Dissolved	250	2
Fluoride - Dissolved	2	3
Nitrate (NO3)	10	1
Nitrite (NO2)	1.0	1
Nitrite + Nitrate as Nitrogen	10	1
Sulfate - Dissolved	250	2
Aluminum - Dissolved	5	3
Antimony - Dissolved	0.006	1
Arsenic - Dissolved	0.01	1
Barium - Dissolved	2	1
Beryllium - Dissolved	0.004	1
Boron - Dissolved	0.75	3
Cadmium - Dissolved	0.005	1
Chromium - Dissolved	0.1	1 and 3
Cobalt - Dissolved	0.05	3
Copper - Dissolved	0.2	3
Iron - Dissolved	0.3	2
Lead - Dissolved	0.05	1
Lithium - Dissolved	2.5	3
Manganese - Dissolved	0.05	2
Mercury - Dissolved	0.002	1
Molybdenum - Dissolved	0.21	1
Nickel - Dissolved	0.1	1
Selenium - Dissolved	0.02	3
Silver - Dissolved	0.05	1
Thallium - Dissolved	0.002	1
Uranium - Dissolved	0.0168 to 0.03	1
Vanadium - Dissolved	0.1	3
Zinc - Dissolved	2	3

- These analytes, at a minimum, will be tested for during the five (5) quarters of baseline monitoring. It will be up to the Operator/Permittee to submit a Technical Revision with proper justification to reduce the analyte list.

Appendix B: Full parameter list for Hard Rock Sites (with Table Value Standards) from Regulation 41, Tables 1-4

Analyte	Table Value Standard (mg/L, unless other units given)	Reg. 41 Table Reference (1-4)
pH Field (pH unit)	6.50 - 8.50	2 and 3
TDS	400 mg/L, or 1.25X background	4
Chloride - Dissolved	250	2
Fluoride - Dissolved	2	3
Nitrate (NO3)	10	1
Nitrite (NO2)	1.0	1
Nitrite + Nitrate as Nitrogen	10	1
Sulfate - Dissolved	250	2
Aluminum - Dissolved	5	3
Antimony - Dissolved	0.006	1
Arsenic - Dissolved	0.01	1
Barium - Dissolved	2	1
Beryllium - Dissolved	0.004	1
Boron - Dissolved	0.75	3
Cadmium - Dissolved	0.005	1
Chromium - Dissolved	0.1	1 and 3
Cobalt - Dissolved	0.05	3
Copper - Dissolved	0.2	3
Iron - Dissolved	0.3	2
Lead - Dissolved	0.05	1
Lithium - Dissolved	2.5	3
Manganese - Dissolved	0.05	2
Mercury - Dissolved	0.002	1
Molybdenum - Dissolved	0.21	1
Nickel - Dissolved	0.1	1
Selenium - Dissolved	0.02	3
Silver - Dissolved	0.05	1
Thallium - Dissolved	0.002	1
Uranium - Dissolved	0.0168 to 0.03	1
Vanadium - Dissolved	0.1	3
Zinc - Dissolved	2	3
Cyanide - Free	0.2	1
Beta and Photon emitters	4 mrem/yr	1
Gross Alpha	15 pCi/L	1

- These analytes, at a minimum, will be tested for during the five (5) quarters of baseline monitoring. It will be up to the Operator/Permittee to submit a Technical Revision with proper justification to reduce the analyte list.

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

Floodplain Protection Standards for Sand and Gravel Pits Adjacent to Rivers and Perennial Streams

February 2024

Introduction

Sand and gravel are necessary commodities for construction that must be mined where they exist. Many gravel deposits exist in the floodplains of rivers and streams. Historically, gravel was extracted directly from streams and rivers via in-stream mining methods. Today, floodplain mining (occurring adjacent to the main channel of a river or stream) is considered a safer and less impactful method of extracting this material.

However, floodplain mining can cause significant impacts to the surface water environment and associated infrastructure if its risks are not properly addressed. Mining operations that occur within or adjacent to floodplains have the potential to significantly impact the prevailing hydrologic balance of affected land within the boundary of a mine site, as well as the surrounding area. These operations also have the potential to cause significant damage off-site during flood events. One common example of this is when a river or stream cuts through an adjacent pit during a flood event (referred to as "stream capture"), which can lead to off-site impacts to river water diversions and other structures.

Potential damage from mining within or adjacent to floodplains can include:

- Damage to property and infrastructure
- Reduction in water quantity for water users
- Degradation of water quality for water users
- Destruction of riparian vegetation and habitat
- Short- and long-term changes to channel morphology and river behavior
- Cumulative impacts from multiple mines in a floodplain

To limit these impacts, the Colorado State Legislature and the Mined Land Reclamation Board (MLRB) have promulgated the following Statutes and Rules (citations in References section) pertaining to the extraction of construction materials.

- C.R.S. 34-32.5-116(4)(c):

  > An operator shall demonstrate that . . . all affected areas to be reclaimed as part of the approved application will not result in any unauthorized release of pollutants to the surface drainage system.

- C.R.S. 34-32.5-116(4)(h) and Rule 3.1.6(1):

  > Disturbances to the prevailing hydrologic balance of the affected land and of the surrounding area and to the quantity or quality of water in surface and groundwater systems, both during and after the mining operation and during reclamation, shall be minimized.

- C.R.S. 34-32.5-116(4)(i):

  > Areas outside of the affected land shall be protected from slides or damage occurring during the mining operation and reclamation.

- Rule 3.1.5(3):

  > All grading shall be done in a manner to control erosion and siltation of the affected lands, to protect areas outside the affected land from slides and other damage.

- C.R.S. 34-32.5-116(4)(j) and Rule 3.1.6(3):

  > All surface areas of the affected land . . . shall be stabilized and protected so as to effectively control erosion.

- Rules 6.3.3(l) and 6.3.4(1)(e):

  > [The operator must] . . . describe what measures will be taken to minimize disturbance to the hydrologic balance, prevent off-site damage, and provide for a stable configuration of the reclaimed area consistent with the proposed future land use.

The Division of Reclamation, Mining and Safety (Division) is the implementing agency to enforce the Legislative Statutes and the MLRB's Rules through permitting actions, inspections, and enforcement.

This document is intended to provide guidance related to floodplain protection for sand and gravel pits located adjacent to rivers and perennial streams. The guidance presented in this document sets the standard for review of new permit applications and for applications submitted to revise existing permits or expand mining operations into the floodplain of a river or perennial stream.

The Division will be working with operators of existing permits on a case-by-case basis to determine what permit revisions, if any, are needed to comply with these standards.

The standards below are largely based on review of guidelines developed for the Mile High Flood District (MHFD; formerly the Urban Drainage and Flood Control District), which oversees floodplain management in the Denver Metropolitan area: *"Technical Review Guidelines for Gravel Mining and Water Storage Activities Within or Adjacent to 100-Year Floodplains."* (This document is heretofore referred to as the MHFD Guidelines.) The MHFD is considered a national leader in stormwater and floodplain management, and their guidelines are broadly accepted. The Division has determined that the principles of the MHFD Guidelines are based on sound engineering, professional judgment, and decades of experience in floodplain management, and it is appropriate to apply these principles to sites located outside of the MHFD boundaries.

The Division has extensive experience regulating sand and gravel pits in floodplains, and significant lessons were learned after the extensive flooding that occurred in 2013 and 2015. Currently, approximately 25 percent of Division permits are located within a 100-year floodplain.

The extent of damage that can be caused by mined pits subjected to river flooding is illustrated in the Google Earth aerial imagery presented in Appendix A.

While this guidance document pertains to mining operations located within 400 feet of a river or perennial stream, all mining operations are responsible for preventing off-site impacts, including operations located more than 400 feet from a river or perennial stream. Accordingly, based on the details of a particular floodplain mining operation proposal, the Division may require additional or more stringent protection measures than what is presented below in this guidance document. For example, more stringent measures may be implemented for applications proposing new pits in an area with multiple existing pits, as these sites are at a higher risk of causing significant flood damage.

Standards for New Applications

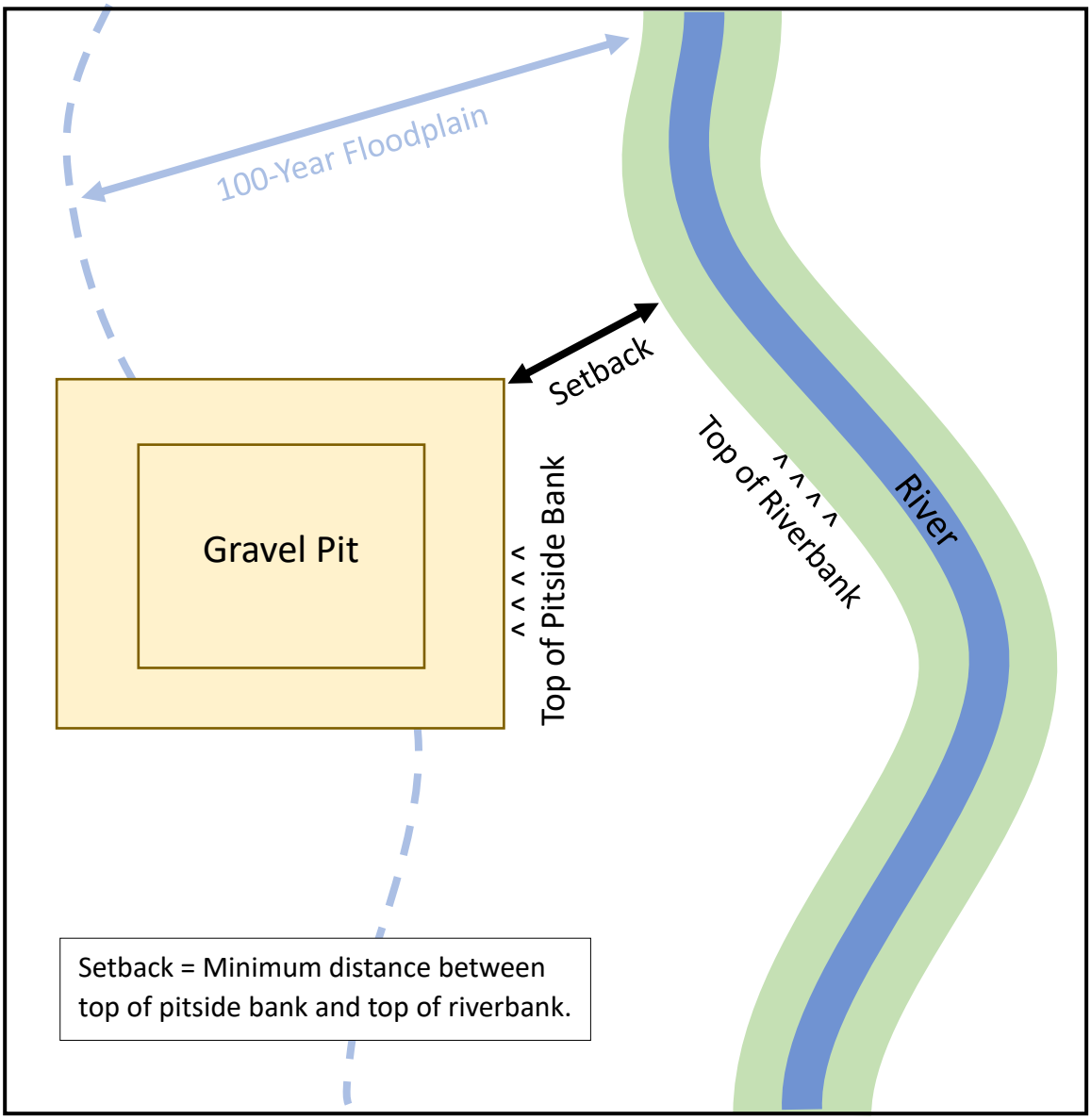
For a new permit application or an application to revise an existing operation to include a new pit adjacent to a river or perennial stream, the Division will require that one of the following options (or a combination thereof) be performed by the Applicant as part of their submittal to the Division:

1) Propose an appropriate mining setback from the banks of the river or stream. The standard setbacks presented in Table 1 below are based on the MHFD Guidelines. *Note that in the scenario where no pitside bank or riverbank protection is provided, the standard setback from the river or stream is 400 feet.* See Figure 1 below with sketch showing how setback is measured.

Table 1 - Standard Setbacks from River (Based on MHFD Guidelines)

Area Stabilized	**Minimum Setback (feet)**
None	400
Pitside Bank Only (armoring internal to the pit)	300
Riverbank Only (armoring external to the pit)	250
Riverbank and Pitside Bank	150

Figure 1 - Sketch Showing How Setback from River is Measured



2) Provide detailed designs of proposed structures (e.g., riprap, grouted boulders, side-channel spillways) to be installed on pitside banks and/or riverbanks to allow flood waters to safely flow in and out of the pit during the 100-year flood event while minimizing significant erosion of the banks. The design for these structures must be based on guidelines from a recognized authority and/or a detailed hydrology and hydraulics analysis. Guidelines could be stabilization measures presented in the MHFD Guidelines, bank protection designs presented in county drainage criteria manuals, or other applicable documents. Detailed analysis could include a hydrology and hydraulics model.

Note that in the scenario (in Table 1) where both pitside bank and riverbank protection is provided, the standard setback from the river or stream is 150 feet.

3) Provide a detailed analysis of the 100-year flow in the river or stream during the worst-case conditions of the proposed mining and reclamation scenarios. This analysis must sufficiently demonstrate that the proposed pit banks during mining and after reclamation will not be significantly eroded by the flood event. This could be done using appropriate hydrology and hydraulics models. Examples of acceptable models include the Hydrologic Modeling System (HMS) and River Analysis System (RAS) developed by the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC). These models are commonly referred to as HEC-HMS and HEC-RAS. Links to information on these models are provided in the References section of this report.

If another regulating agency or local city or county government has developed more protective standards than those presented in this guidance document, such standards shall supersede those set by the Division. These standards would also need to be incorporated into the mine permit approved by the Division.

Upon request, the Division is available for consultation during development of an application that proposes a sand or gravel operation adjacent to a river or perennial stream.

For proposals to install riverbank protection, Applicants should be aware that additional requirements may be imposed by local governments, State agencies, and/or the U.S. Army Corps of Engineers.

References

Colorado Land Reclamation Act for the Extraction of Construction Materials, C.R.S. 34-32.5 §. Available at: https://drive.google.com/file/d/1nWs3Y_2wm8fp4eApFjUhZC2IyHxKKCM8/view

Colorado Mined Land Reclamation Board. Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials (2019). Available at: https://drive.google.com/file/d/1l5U8fOVjQ7VyB3GC7DGv6Gkczz7PwuRl/view

U.S. Army Corps of Engineers. Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS). Information available at: https://www.hec.usace.army.mil/software/hec-hms/

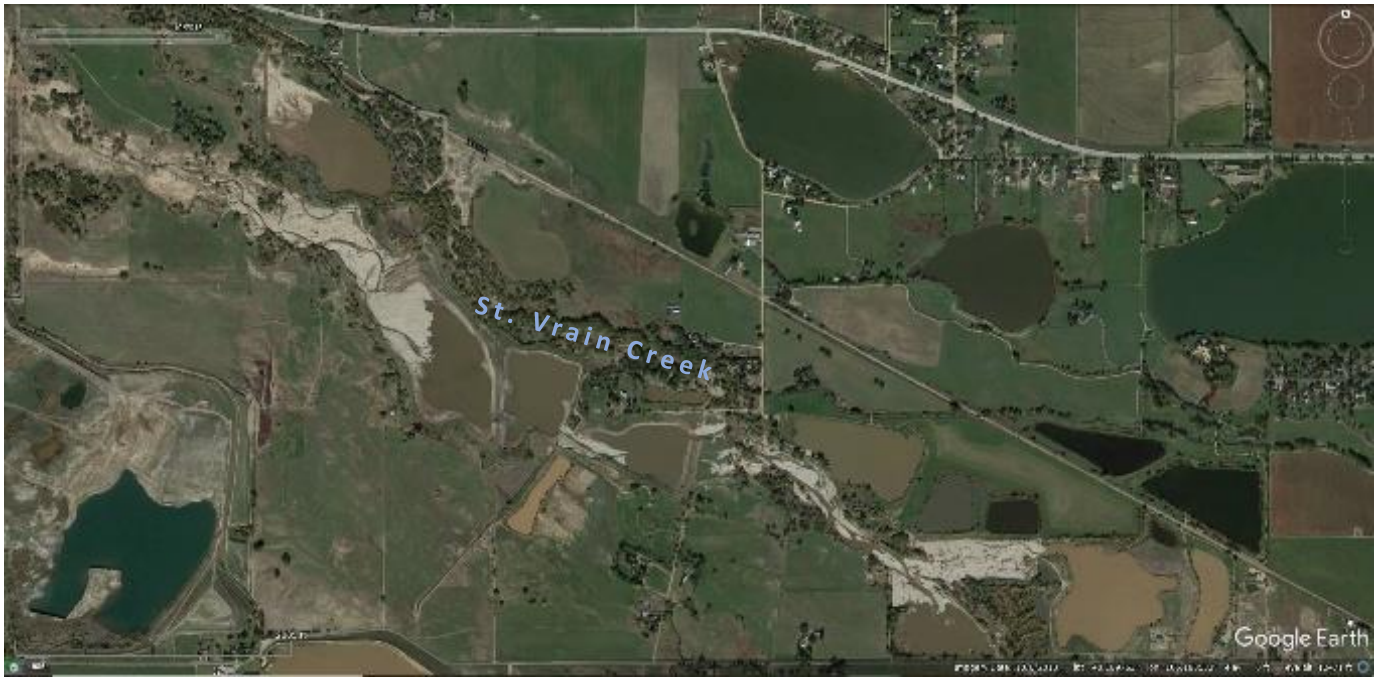
U.S. Army Corps of Engineers. Hydrologic Engineering Center's River Analysis System (HEC-RAS). Information available at: https://www.hec.usace.army.mil/software/hec-ras/

Wright Water Engineers, Inc. Technical Review Guidelines for Gravel Mining and Water Storage Activities Within or Adjacent to 100-Year Floodplains (2013, January). Available at: https://mhfd.org/wp-content/uploads/2019/12/Technical_Review_Guidelines_for_Gravel_Mining_and_Water_Storage_Activities_2013.pdf

APPENDIX A

Google Earth Aerial Imagery Showing Before (1A) and After (1B) Conditions in Boulder County After the 2013 Flood (Multiple Permits).

1A



1B

Google Earth Aerial Imagery Showing Before (2A) and After (2B) Conditions in Larimer County After the 2013 Flood (Single Permit).

2A

2B