STATE OF COLORADO

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

Two Rivers Pit M-1998-038 AM1 Third Adequacy Review

1 message

Carter - DNR, Jocelyn <jocelyn.carter@state.co.us> Mon, Jun 17, 2024 at 12:16 PM
To: Jodi Schreiber <jodi@arycorp.com>
Cc: Amy Eschberger - DNR <amy.eschberger@state.co.us>, John Paul Ary <Jp@arycorp.com>

Good afternoon Jodi,

Please see the attached adequacy letter for this project. The decision date for this amendment is scheduled for June 22, 2024. I recommend that a decision date extension be requested.

Let me know if you have any questions.

Thanks,
Jocelyn

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Jocelyn Carter
Environmental Protection Specialist
Division of Reclamation, Mining, and Safety
1313 Sherman St Suite 215
Denver, CO 80203
cell: (720) 666-1065

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

June 17, 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), Third Adequacy Review

Dear Jodi Schreiber,

The Division of Reclamation, Mining, and Safety (the Division/DRMS) received the amendment application (AM-1) from Fremont Paving and Redi Mix, Inc. (Fremont/FPRM), submitted on January 22, 2024, and completed and filed it with the Division on February 8, 2024. The response to the second adequacy review was received on June 7, 2024. There are remaining items that require clarification. Please address the following adequacy review items and include a cover letter with a response to each of the items listed below.

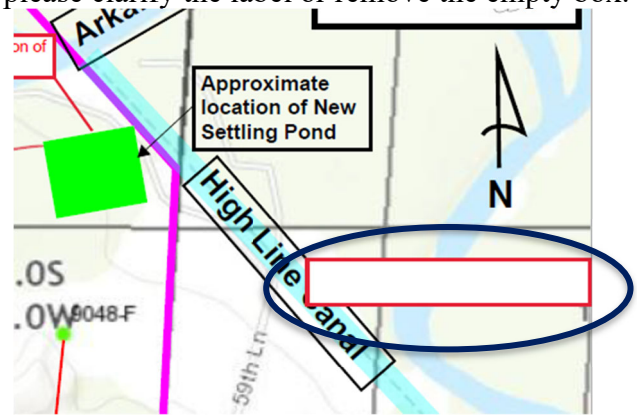
Rule 6.4.2 Exhibit B – Index Map

1. The map titled "ALTA/ACSM LAND TITLE SURVEY" appears to meet the requirement of Rule 6.4.2 and Exhibit B – Index Map. The title added in the upper right corner designates this map as "Exhibit A – Legal Map"; please label this as Exhibit B to satisfy Rule 6.4.2.

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

2. The map titled "Existing Conditions – Land Owners Exhibit C.4" provides information regarding the 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). However, the southern index contour line has two values assigned to it: 4450 feet and 4460 feet. Please revise the map to clarify the correct elevation. See the below image.

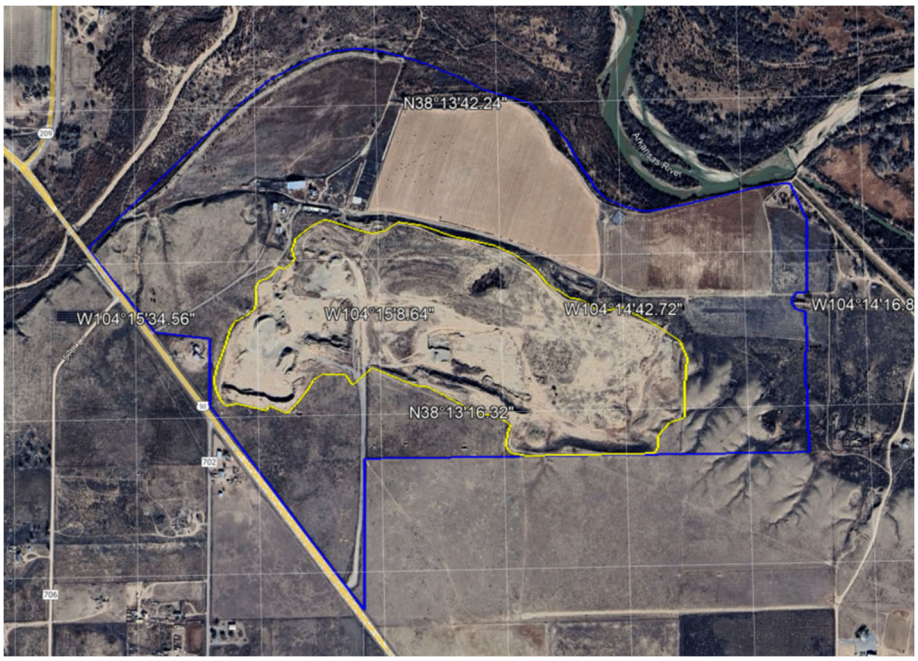
3. The map titled "Two River Pit Existing Conditions – Wells Exhibit C.3" has a red label box that is blank, please clarify the label or remove the empty box. See the below image.



Rule 6.4.4 Exhibit D – Mining Plan

4. The revised "Mining Map Exhibit D" indicates in the Legend that the permit area is 420 acres; there is a label on the map that provides that accurate acreage of 357.2 acres. Please revised the map with only the correct permit acreage.
5. Please update the "Phase Map" to reflect the full extent of the proposed location of the dewatering trench as shown in "Existing Conditions Wells Exhibit C.3" in accordance with Rule 6.4.3(f) and Rule 6.4.4(c).
6. The "Phase Map" shows several areas that are labeled as "Unaffected". Clarify what these areas are in the permit. Note: The area labeled as "Unaffected" located north of Phase 7 has the proposed discharge pipe from the settling pond to the Arkansas River, this land would meet the Division's definition of "Affected land", Rule 1.1(3) and would be subject to all other Rules pertaining to affected land.
7. As required by Rule 6.4.4(d), the plan states "[a]t no time will greater than 100 acres be open for active mining or reclamation." According to the Division's inspection report issued on April 19, 2023, 112 acres have already been affected. Revise the Mining Plan and the maximum disturbed acreage at any one time to account for, at a minimum, the currently affected area. Additionally, please provide a breakdown of the currently

disturbed acres for each phase on the Phase Map. Please see the below map created from observations made during the inspection conducted by the Division on March 28, 2023; the blue polygon is the current permit boundary, and the yellow polygon represents the affected area.



Rule 6.4.5 Exhibit E – Reclamation Plan

8. With respect to the original question posed about reclaiming the land to cropland and needing to back fill pits up to 33 feet, FPRM states that the upper level will not need to be backfilled to this depth because groundwater will not be encountered. A cross section image was provided showing Phase 1 (an upper level phase) and Phase 2 (a lower level phase). Please clearly identify the current surface, the mined surface, and the reclaimed surface in the cross section. In previous adequacy letters, FPRM also provided a calculation of 6,500,000 tons of material being available and 4,875,000 tons needed to backfill and cover exposed groundwater; provide these values in cubic yards. The Division requires that exposed groundwater be backfilled to at a minimum of 2 feet above the groundwater table. Please provide more detailed information about where the groundwater table is in each mining phase and how each phase will be reclaimed accordingly, per Rule 6.4.5(2).
9. The groundwater monitoring plan submitted does not meet the requirements of the DRMS Groundwater Monitoring: Sampling and Analysis Plan Guidance Construction Materials and Hard Rock Sites, attached to this document. The following items are missing:
    i. The site description, providing information about the current land use, the geology to include lithology and stratigraphy and major structural features,

the hydrogeology including the names and characteristics of each underlying aquifer, or at least two maps showing where monitoring wells will be located. See item No. 1.1 of the SAP Guidance for complete required information.

ii. Baseline information as outlined in item No. 1.2 of the SAP Guidance. Five quarters of data is not expected at this time as FPRM is in the process of developing a suitable monitoring plan to obtain 5 quarters of good data to establish baseline groundwater characteristics. However, information to establish the current groundwater table and the flow direct of groundwater should be able to be provided at this time. Additionally, details about the proposed monitoring wells need to be given, the location, land surface elevation, top of casing elevation, and total depth. Note: The Division requires quarterly monitoring for water quality data and monthly monitoring for water quantity data.

iii. The groundwater monitoring plan needs to include points of compliance (POC) in accordance with Rule 3.1.7(6) and item No. 3.1 of the SAP Guidance. The proposed locations of these and their well construction information shall be supplied to the Division. The plan should also include the details about the frequency of sampling.

iv. Information regarding the proposed sampling method as outlined in item No. 4 of the SAP Guidance shall be provided to the Division.

10. It appears that mine Phases 5, 6, and 7 are located within 400 feet of the Arkansas River. In cases of flooding, the mining operation has the potential to capture the river and can lead to off-site damages. In accordance with Rule 6.4.5(2)(c) and Rule 3.1.6(3), please provide details on how the land will be stabilized and protected. According to the DRMS Floodplain Protection Standards, attached to this document, there are several options that can be implemented. FPRM can commit to maintaining a 400-foot buffer from the Arkansas River. If FPRM plans to mine within 400-feet of the Arkansas River, design plans of spillways and/or area stabilization methods should be submitted for approval. FPRM can commit to a future Technical Revision to address the Floodplain Protection Standards requirement.

Rule 6.4.6 Exhibit F – Reclamation Map

11. On the Map titled "Existing Conditions – Land Owners Exhibit C.4" the index contour line 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 4535 ft along the eastern end of the permit area. The reclamation map shows an increase in elevation by approximately 100 feet. Revise the "Reclamation Map Exhibit F" to show the expected reclaimed elevation and topography in compliance with Rule 6.4.6(a).

Rule 6.4.7 Exhibit G – Water Information

12. Specify the expected amounts of water that will be used from the MAGUA and the AGRA for the mining operation and reclamation, in accordance with Rule 6.4.7(4). This can be broken down as expected percentages of each source given FPRM does not have an expected total amount of water needed for the mining operation and reclamation.

Rule 6.4.12 Exhibit L – Reclamation Costs

13. There are still outstanding clarifications that need to be addressed (see items #7, #8, and 10 above) before a complete and accurate reclamation cost estimation can be calculated by the Division. As stated before, the referenced April 2023 reclamation cost estimation is based on observations from an inspection conducted by the Division. The specific details used to calculate the April 2023 bond do not reflect the full extent of the mining plan purposed in the AM-1 application, and vice versa. The Division will need to re-calculate the bond required based on the worst-case scenario outlined in the AM-1 application. The estimate would include 112 acres (the total affected area according to DRMS Inspection reports) needing to be backfilled up to 33 feet of depth, graded, topsoiled, and seeded and a 1000-foot long highwall, at 46 feet in height, being knocked down to a 3H:1V slope.

This concludes the Division third 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 June 22, 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: Amy Eschberger, DRMS
Cc: John Ary, Fremont Paving & Redi-Mix, Inc.

Enclosures: Groundwater Monitoring: Sampling and Analysis Plan Guidance Construction Materials and Hard Rock Sites; September 2023.
Floodplain Protection Standards for Sand and Gravel Pits Adjacent to Rivers and Perennial Streams; February 2024.

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

Contents

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

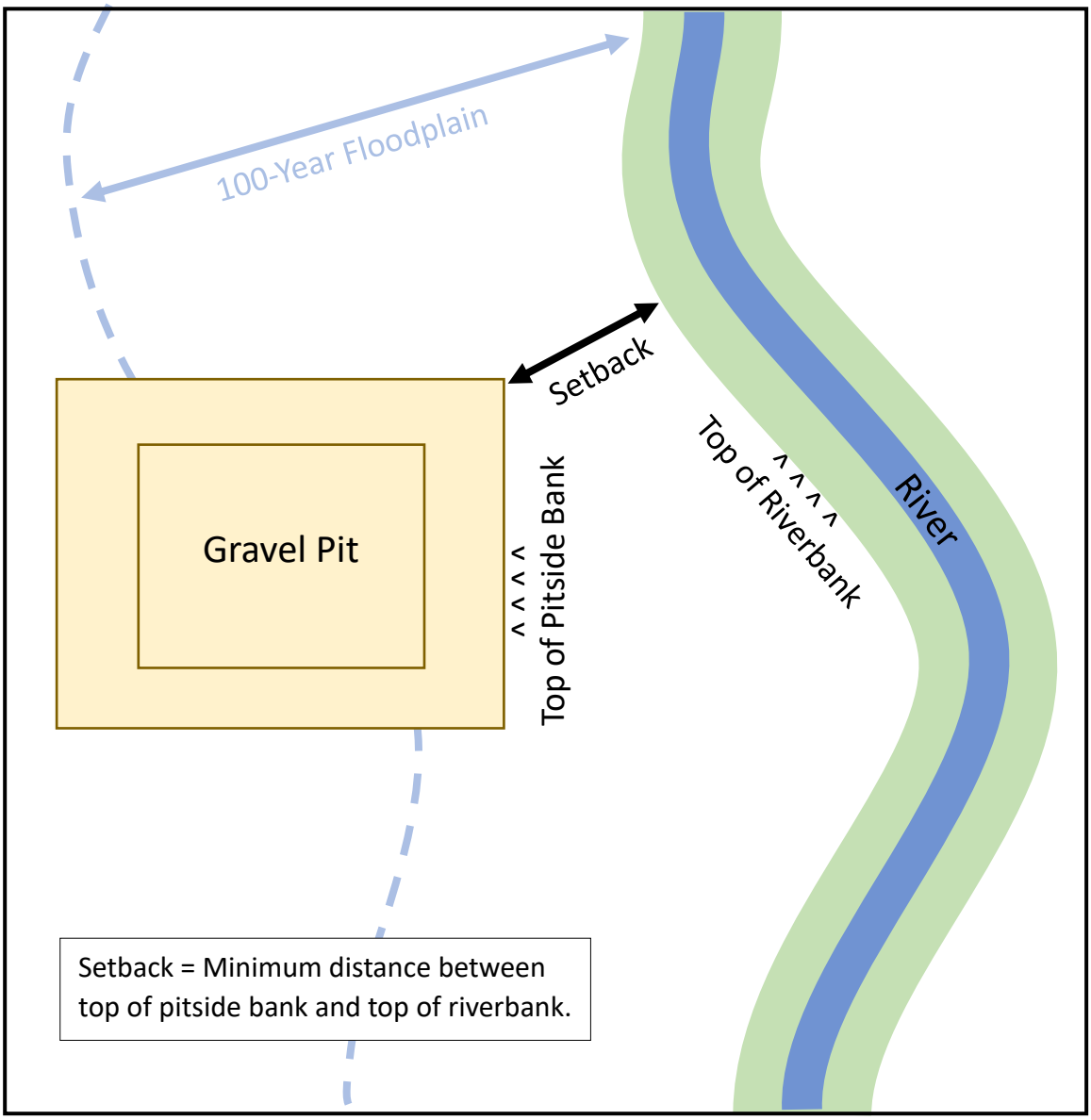
For a new permit application or an application to revise an existing operation to include a new pit adjacent to a river or perennial stream, the Division will require that one of the following options (or a combination thereof) be performed by the Applicant as part of their submittal to the Division:

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/

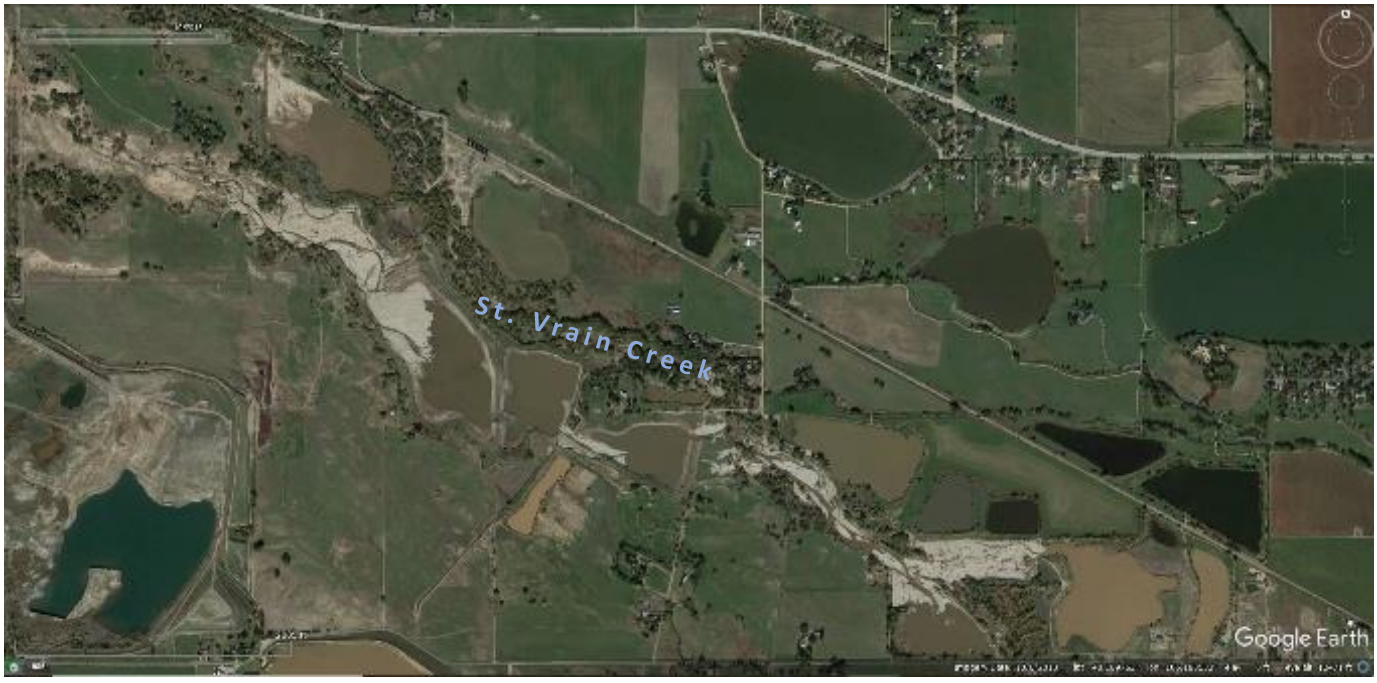
U.S. Army Corps of Engineers. Hydrologic Engineering Center's River Analysis System (HEC-RAS). Information available at: https://www.hec.usace.army.mil/software/hec-ras/

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