Lewicki & Associates
ENGINEERING | GEOLOGY | ENVIRONMENTAL

January 26, 2024

Patrick Lennberg
Colorado Division of Reclamation, Mining, and Safety
1313 Sherman St, Rm 215
Denver, CO 80203

RE: Gold Hill Mill 110D Conversion Application (M-1994-117, CN-1)
Adequacy Response 4

Mr. Lennberg

Colorado Milling Company submits the attached response to the CDRMS adequacy questions posed in your January 24, 2024 letter. Each section is addressed directly, with revised documents referred to as needed. A set of revised exhibits is included to replace the exhibits from the original application in order to maintain a complete single document for reference.

In addition to all hard copies, a PDF of each document is being provided to your office to aid in Laserfiche uploads.

Please contact my office with any further questions or comments on this application.

Sincerely,

Ben Langenfeld
benl@lewicki.biz
(720) 842-5321, ex. 1

Appendix C-2: Sampling Plan

1. *In Section 4, Water Sampling Protocol, the Applicant states the standard operating procedures (SOPs) are attached. The Division did not identify the where the SOPs were within the submittal. Please provide the missing SOPs.*
2. *The submitted Appendix C-2 does not contain information from the Preliminary Adequacy Review Response, specifically the Reporting Protocol and Exceedance Plan and Reporting Schedule are missing. Please update C-2 with the missing information.*

The SOPs have been attached to Appendix C-2. The Reporting Protocol and Exceedance Plan and Reporting Schedule have been returned to Appendix C-2, as their removal had been erroneous.

Please see the attached Appendix C-2.

Appendix C-5: Tailings Storage Facility (TSF):

3. *At this time, the TSF is an Environmental Protection Facility on-site currently containing tailings material and during the October 2023 inspection the Division noted several issues with the liner of the TSF, including, but not limited to, holes in the liner and animal burrows in the embankments. The Applicant's responses to Mr. Cazier's adequacy questions as well as other adequacy items indicate the information requested will be provided during the TSF recertification process.*

   In Exhibit U, Section 1.4.1 EPF Certification Minimum Requirements, page U-9, the Applicant states "The recertification will be submitted to CDRMS in the 2024 calendar year. If the TSF cannot be recertified or insufficient capacity remains for further use, closure will take place.".

   If it is determined the TSF can be recertified, the Applicant shall provide a detailed repair/construction and recertification schedule, through a Technical Revision pursuant to Rule 6.4.21(15) so the Applicant can provide a certification of facility pursuant to Rule 7.3.2. Please note the recertification shall provide a demonstration that impacts to the prevailing hydrologic balance are being minimized pursuant to Rule 3.1.6.

   If the TSF cannot be recertified, a Technical Revision must be submitted to provide the schedule for reclamation of the TSF in accordance with the approved reclamation plan.

   The Applicant shall complete the evaluation and submit the appropriate Technical Revision no later than August 1, 2024.

The Applicant will provide an evaluation of the TSF regarding its recertification by August 1, 2024 as required by CDRMS. Exhibit U, Section 1.4.1 has been revised to reflect the deadline required by CDRMS.

EXHIBIT F – List of Permits and Other Licenses Required (Rule 6.3.6):

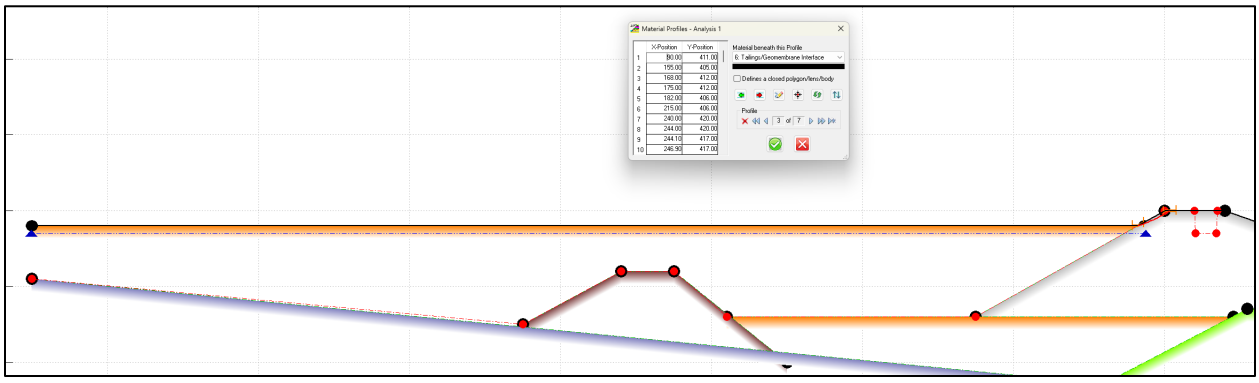
4. *Pursuant to Rule 1.6.2(2), please demonstrate that the Applicant's response to these adequacy issues have been placed with the application materials previously placed with the County Clerk or Recorders Office, and made available for public review*

A county clerk certification will be provided under separate cover once it has been received.

Other Comments:

Stability Model Comparison: The DRMS acknowledges additional stability analyses were performed using the Spencer-Wright method. However, there appear to be some anomalies in the additional analyses: First, the "Tailings/Geomembrane Interface" on all 12 Non-circular, Spencer-Wright analyses appears to be limited to about three feet in length just below the crest of the embankment; second, in the first six analyses, the piezometric surface appears to arbitrarily end three to four feet into the Embankment (proposed). Please explain these apparent anomalies (see screen capture below)

The GALENA slope stability software outputs figures to show the results of slope stability analyses. The profiles do not consistently render all the layers in a manner that is easily visible, particularly thin layers such as the Tailings/Geomembrane Interface. Lewicki & Associates has confirmed that Tailings/Geomembrane Interface is properly modelled in GALENA, as shown in the screenshot below (red dots are vertices of the Tailings/Geomembrane Interface):



Furthermore, the piezometric surface terminates shortly into the embankment as the geomembrane is a water barrier. The piezometric surface is modelled slightly into the embankment to ensure that the model treats the tailings as saturated and the embankment as not saturated.

Freeboard Monitoring: The response states freeboard monitoring will be monitored monthly via inspection. The DRMS deems this adequate as long as the TSF is not actively being used. However, while the site is active and material is being deposited in the TSF, monitoring should occur daily. Please provide a written commitment to monitor the TSF freeboard daily when the mill is operating.

TSF freeboard will be monitored daily when the mill is operating.

Attachments

Appendix C-2

Exhibit U, page U-9.

Appendix C-2 Sampling Plan

1. General

Ground water and surface water will be monitored at the Gold Hill Mill to ensure compliance with Rules 3.1.6, 3.1.7, 6.3.3, and 6.4.21 of the Hard Rock Rules and Regulations. Given that the Gold Hill Mill is a processing facility only and does not involve any mining or mine development, water sampling and analyses typical of an underground metal mine is of no value. There are no mine water discharges to receiving waters nor any groundwater interactions via the extraction or ore or development of ore access. All facilities are already built and have been in place for many decades.

Ore and tailings sampling will be conducted at Gold Hill Mill as well.

The focus of water monitoring is related to the mill tailings storage facility.

Prior to processing of ore at the Gold Hill Mill, five quarters of sampling data from wells W1-W4 and the TSF will be provided to CDRMS as a “pre-operations” data set. Non-processing work, such as EPF installation and other onsite construction will take place during this sampling. Only ore processing will be delayed.

2. Water Sample Locations

Eight sample locations will be used throughout the life of the Gold Hill Mill. All of these sample locations have been sampled in the past as part of existing water monitoring. No new groundwater wells will be established to conduct sampling. Locations can be seen on Figure 1.

Table 1. Water Monitoring Sample Locations

ID	Location	Water Type	Purpose
TSF	Tailings storage facility	Surface	Monitor the quality of evaporating/recycling water in the tailings
LHC	Left-Hand Creek intake	Surface (stream)	Monitor background stream water quality
WS	Wynona Shaft	Surface/Ground	Monitor quality of CMC’s mill water in Times-Wynona Mine
W1	Downhill of mill	Ground	Monitor for impacts to groundwater from mill activity
W2	Downhill of mill	Ground	Monitor for impacts to groundwater from mill activity
W3	Downhill of TSF	Ground	Monitor for impacts to groundwater from TSF
W4	Downhill of TSF	Ground	Monitor for impacts to groundwater from TSF
MW1	Downhill of mill	Ground	Mill groundwater compliance point

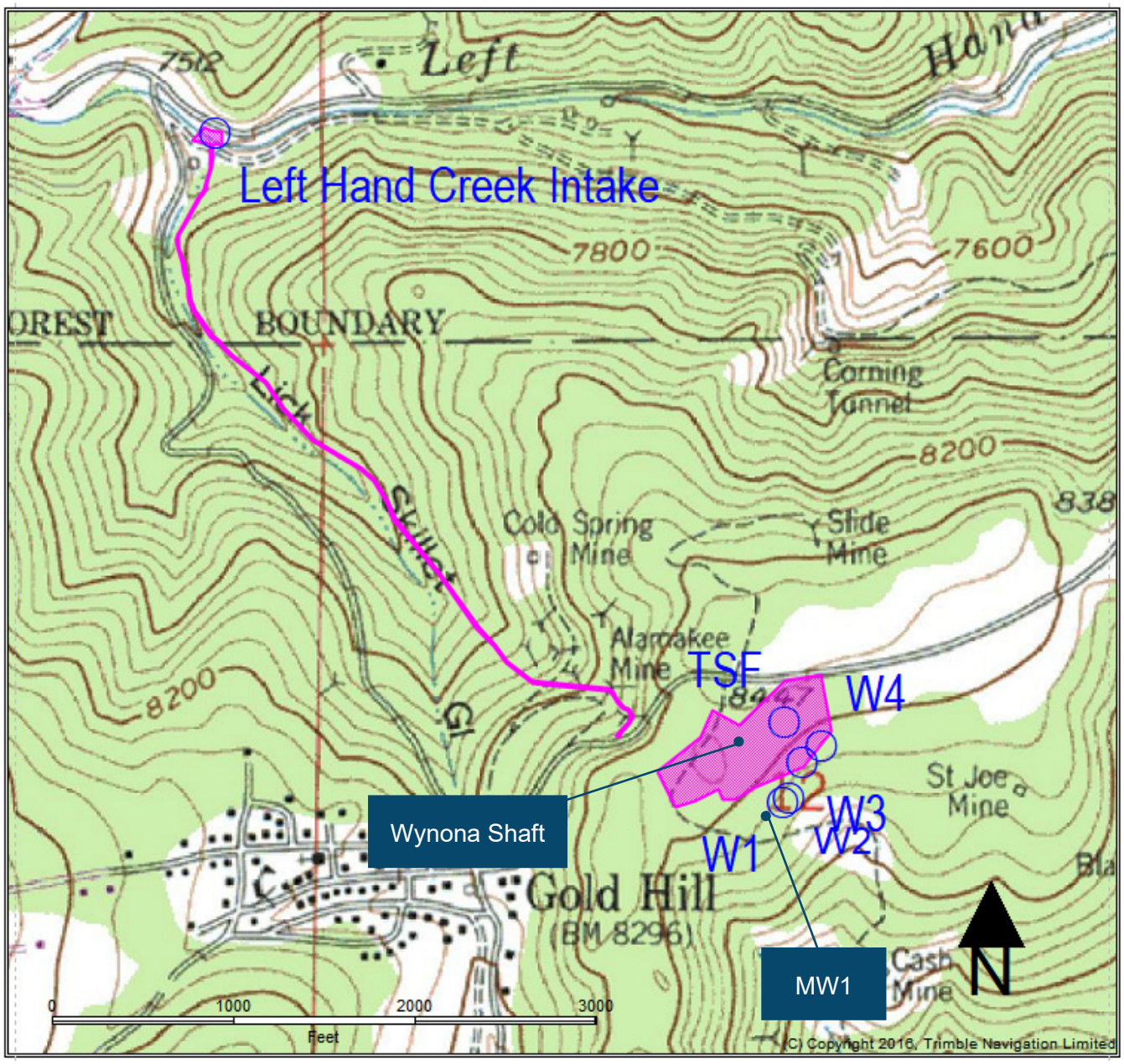


Figure 1. Water Sampling Locations

3. Monitoring Parameters

Table 2 below shows each parameter from the CDPHE Regulation 41 list, whether the parameter will be included in future sampling at Gold Hill Mill, and what sampling has been conducted in the past. For a number of parameters, such as asbestos, they are listed as Not Applicable at Gold Hill Mill. These are parameters that **are** not logically to be found or potentially affected by activity at the mill. There is no asbestos in any of the structures onsite and those would be the only possible source. No radioactive materials are present or will be brought onsite. Phenol, chloropenol, corrosivity, odor, color, and foaming agents are all related to industrial chemical processing such as herbicide production or plastics manufacturing. None of these activities have or will take place at Gold Hill Mill.

Other excluded parameters such as mercury, aluminum, nickel, etc. have been sampled for numerous times in the history of Gold Hill Mill. With so much sampling data gathered and submitted to CDRMS in the past, the presence or lack of presence (in the case of mercury) has been well established and documented (see permit file document 2013-09-23_Revision – M1994117, for example). Sampling for these parameters is redundant and unnecessary. The exception is the Times/Wynona shaft. Since it has not been as thoroughly sampled as the other locations onsite, it will be sampled according to broader parameter list, shown in Table 5.

Table 3 lists the parameters monitored for at Gold Hill Mill at the TSF and the monitoring wells MW-1, W-1, W-2, W-3, and W-4. This list is based on the Colorado Water Quality Control Commissions Regulation 41 groundwater tables 1-4. From the Reg. 41 list, parameters were eliminated from sampling based on two criteria: inapplicability of a parameter to Gold Hill Mill or sufficient existing sampling of a parameter to establish background water quality. Parameters retained from the Reg 41 list are a combination of any previously unsampled parameters and those currently sampled under the Gold Hill Mill permit. This leads to the parameters listed in Table 3. Sampling from the groundwater wells and the TSF will be conducted quarterly. Left Hand Creek will also be sampled (Table 4) with a full suite to track local natural surface water conditions and to inform the mill of the quality of water bring pumped to the mill.

Table 2. Potential Sample Parameters

CDPHE List for Groundwater Sampling	Part of Gold Hill Mill Sampling	Count of Past Samples Taken
pH Field (pH unit)	YES	147
TDS	YES	>150
Antimony – Dissolved	YES	0
Arsenic – Dissolved	YES	427
Barium – Dissolved	YES	0
Cadmium – Dissolved	YES	430
Copper – Dissolved	YES	160
Iron – Dissolved	YES	159
Lead – Dissolved	YES	160
Manganese – Dissolved	YES	504
Molybdenum – Dissolved	YES	0
Nitrate (NO3)	YES	0
Nitrite (NO2)	YES	0
Silver – Dissolved	YES	0
Sulfate – Total	YES	358
Thallium – Dissolved	YES	0
Uranium – Dissolved	YES	0
Zinc – Dissolved	YES	362
Coliforms, Total (30 day ave)	NO	N/A
Asbestos	NO	N/A
Chlorophenol	NO	N/A
Color	NO	N/A
Corrosivity	NO	N/A
Foaming Agents	NO	N/A
Odor	NO	N/A
Phenol	NO	N/A
Aluminum – Dissolved	NO	133
Beryllium – Dissolved	NO	11
Boron – Dissolved	NO	9
Chromium – Dissolved	NO	138
Cobalt – Dissolved	NO	109
Cyanide – Free	NO	N/A
Fluoride – Total F	NO	17
Lithium – Dissolved	NO	110
Mercury – Dissolved	NO	133
Nickel – Dissolved	NO	128

CDPHE List for Groundwater Sampling	Part of Gold Hill Mill Sampling	**Count of Past Samples Taken**
Nitrite + Nitrate as Nitrogen	NO	9
Selenium – Dissolved	NO	139
Vanadium – Dissolved	NO	111
Beta and Photon emitters	NO	N/A
Gross Alpha	NO	N/A

Table 3. Water Monitoring Parameters & Limits

Wells (MW-1, W-1-W-4) and TSF Parameters	Lowest CDPHE Groundwater Limit (mg/L)
pH Field (pH unit)	6-8
TDS	Varies (see Reg 41)
Antimony – Dissolved	0.0066
Arsenic – Dissolved	0.01
Barium – Dissolved	2
Cadmium – Dissolved	0.005
Copper – Dissolved	0.2
Iron – Dissolved	0.3
Lead – Dissolved	0.05
Manganese – Dissolved	0.05
Molybdenum – Dissolved	0.21
Nitrate (NO3)	10
Nitrite (NO2)	1.0
Silver – Dissolved	0.05
Sulfate – Total	250
Thallium – Dissolved	0.002
Uranium – Dissolved	0.0168
Zinc – Dissolved	2

Table 4. Left Hand Creek Sampling Parameters

LHC Parameters	
Aluminum, dissolved	Magnesium, dissolved
Aluminum, total	Manganese, dissolved
Antimony, dissolved	Manganese, total
Arsenic, dissolved	Mercury, dissolved
Arsenic, total	Mercury, total
Barium, dissolved	Molybdenum, dissolved
Beryllium, dissolved	Molybdenum, total
Bicarbonate as CaCO3	Nickel, dissolved
Boron, dissolved	Nitrate/Nitrite as N
Cadmium, dissolved	Nitrogen, ammonia
Cadmium, total	Phosphorus, ortho dissolved
Calcium, dissolved	Potassium, dissolved
Carbonate as CaCO3	Residue, Filterable (TDS) @180C
Cation-Anion Balance	Residue, Non-Filterable (TSS) @105C
Chloride	Selenium, dissolved
Chromium, total	Silica, dissolved
Chromium, Trivalent Total	Silver, dissolved
Conductivity @25C	Sodium, dissolved
Copper, dissolved	Sulfate
Copper, total	Sulfide as S
Cyanide, total	Sum of Anions
Cyanide, WAD	Sum of Cations
Dissolved Chromium, Hexavalent	Thallium, dissolved
Field Conductivity @25C	Total Alkalinity
Field Dissolved Oxygen	Uranium, dissolved
Field pH	Vanadium, dissolved
Field Temperature	Zinc, dissolved
Field Turbidity	Zinc, total
Fluoride	
Hardness as CaCO3 (dissolved)	
Hydroxide as CaCO3	
Iron, dissolved	
Iron, total	
Lead, dissolved	
Lead, total	

Table 5. Times/Wynona Shaft Sampling Parameters

Times/Wynona Shaft Sampling Parameters	
pH Field (pH unit)	Aluminum – Dissolved
TDS	Beryllium – Dissolved
Antimony – Dissolved	Boron – Dissolved
Arsenic – Dissolved	Chromium – Dissolved
Barium – Dissolved	Cobalt – Dissolved
Cadmium – Dissolved	Cyanide – Free
Copper – Dissolved	Fluoride – Total F
Iron – Dissolved	Lithium – Dissolved
Lead – Dissolved	Mercury – Dissolved
Manganese – Dissolved	Nickel – Dissolved
Molybdenum – Dissolved	Nitrite + Nitrate as Nitrogen
Nitrate (NO3)	Selenium – Dissolved
Nitrite (NO2)	Vanadium – Dissolved
Silver – Dissolved	
Sulfate – Total	
Thallium - Dissolved	
Uranium - Dissolved	
Zinc - Dissolved	

4. Water Sampling Protocol

Water sampling will be conducted each quarter at Gold Hill Mill. Sampling will be conducted in the same manner as that approved for the Cash and Who-Do Mines. The standard operating procedures are attached.

5. Ore and Tailings Monitoring Parameters

Ore and tailings will be sampled for the parameters listed below via SPLP and acid-base analyses. These parameters are similar to those sampled for in the groundwater sampling that has been conducted at Gold Hill Mill for decades. As both the ore and the tailings will be kept within zero-discharge facilities, there are no applicable limits to compare the results to. The data from ore and tailings sampling will be used to compare to groundwater samples downgradient to confirm whether any tailings or ore material is somehow leaving the lined ore pad or the lined tailings storage facility.

Table 6. Ore and Tailings Parameters

Parameter	Lowest CDPHE Groundwater Limit (mg/L)
Arsenic, dissolved	0.01
Cadmium, dissolved	0.005
Conductivity	N/A
Copper, dissolved	0.05
Fluoride	2
Iron, dissolved	0.3
Lead, dissolved	0.05
Manganese, dissolved	0.05
Mercury, dissolved	0.002
Nickel, dissolved	0.1
Nitrate/Nitrite as N	10
pH	6-9
Total Dissolved Solids (TDS)	1800
Sulfate	250
Vanadium, dissolved	0.1
Zinc, dissolved	2
Acid-Base Accounting (ore only)	N/A

6. Ore and Tailings Sampling Protocol

EPA soil sampling procedures, as outline below, will be followed for ore and tailings:

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled, and the gloves should be donned immediately prior to sampling. The gloves should not contact the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample.
- Samples shall be custody sealed during long-term storage or shipment.
- Always sample from the anticipated cleanest, i.e., least contaminated location, to the most contaminated location. This minimizes the opportunity for cross-contamination to occur during sampling.
- Collected samples must remain in the custody of the sampler or sample custodian until the samples are relinquished to another party.

- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished. CoC document copies will be maintained at the Gold Hill Mill.
- Sampling equipment shall be decontaminated:
    1. Wash equipment thoroughly with Luminox® detergent and hot tap water using a brush or scrub pad to remove any particulate matter or surface film.
    2. Rinse equipment thoroughly with hot tap water.
    3. Allow to air dry for at least 24 hours.
    4. Wrap equipment in one layer of aluminum foil. Roll edges of foil into a "tab" to allow for easy removal. Seal the foil wrapped equipment in plastic and label.
- All ore/tailings samples must be thoroughly mixed to ensure that the sample is as representative as possible of the sample media.
- Place the sample into appropriate, labeled containers.
- All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection. Preservatives will be provided by the sampling lab to ensure appropriate amounts.
- Ore/tailings samples will be collected by a small steel shove, long armed dipper, or similar.
- During sample collection, if transferring the sample from a collection device, make sure that the device does not contact the sample containers.
- At least once every 5 years, provide a duplicate sample of both tailings and ore to the lab for a QA/QC check.

7. Standard Operating Procedures – Ore/Tailing Sampling

1) Ensure the appropriate equipment has been acquired and prepared
2) Prepare a work area for sampling equipment and sample containers
3) Use required safety and health equipment, including PPE, as required
4) Fill out field data sheet with the following information: date and time of sample, name of sample, and sample location
5) Prepare sample containers with lab instructions
    a. Site name
    b. Sample ID/location
    c. Date and time of sampling
    d. Analyses requested (if lab requires)
    e. Type of preservative (if any)
    f. Initials of sampler
6) For ore, collect at least 50 pounds of ore from within the ore pad.
    a. Screen ore to lab required size limit
    b. Place ore sample into a clean container for transport.
    c. Secure the samples with packing material and ship to laboratory.
    d. Place all disposable sampling materials (plastic sheeting, disposable samplers, and health and safety equipment) in appropriately labeled containers.
7) For tailings, collect at least 1 gallon of tailings from discharge fan within the Tailings Storage Facility
    a. Tailings must be sampled from the tailings pipe discharge into the Tailings Storage Facility only
    b. Use a long-handled dipper or similar device to retrieve tailings samples
    c. Place tailings sample into a clean container for transport
    d. Leave roughly 10% of the container volume as freeboard
    e. Secure the samples with packing material and ship to laboratory
    f. Place all disposable sampling materials (plastic sheeting, disposable samplers, and health and safety equipment) in appropriately labeled containers.
8) Quality Assurance
    a. Field-derived quality assurance blanks or duplicates will be collected once every ten samples.

8. Ore and Tailings Reporting Schedule

Ore and tailings will be sampled and tested once every 5000 tons of ore processed. Sample results will be reported to CDRMS within 60 days of sampling to account for lab processing time.

SOP01:
Field Equipment Cleaning and Decontamination

Standard Operating Procedure: Field Equipment Cleaning and Decontamination

I. Scope and Application

This standard operating procedure (SOP) outlines the cleaning/decontamination procedure to be used for non-disposable field sampling equipment that may come in contact with environmental samples. This equipment may include, but is not limited to: shovels, spoons, bowels, bottles, auger sample barrels/liners, well construction materials, well screens, non-disposable tubing, water pumps, etc.

II. Personnel Qualifications

Field sampling personnel will have current health and safety training, including appropriate MSHA training under Public Law 95-164, site supervisor training, and site-specific training, as needed. In addition, field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired fieldwork.

III. Equipment List

- health and safety equipment, as required in the site Health and Safety Plan (HASP);
- distilled water;
- non-phosphate soap (Alconox or equivalent);
- tap water;
- appropriate cleaning solvent (e.g., nitric acid);
- rinse collection plastic containers;
- knife;
- brushes;
- aluminum foil;
- garbage bags;
- spray bottles;
- Ziploc-type bags;
- plastic sheeting; and
- field logbook.

IV. Cautions

Rinse equipment thoroughly and allow the equipment to dry before re-use or storage to prevent introducing cleaning solvents into sample medium.

V. Health and Safety Considerations

1. Review the material safety data sheets (MSDS) for the cleaning solvents to be used in the decontamination.

2. Work in a well ventilated area and stand upwind while applying solvent to equipment during the decontamination process.

3. Application of solvent to the equipment will be completed in a manner that minimizes potential for exposure to workers.

4. Follow Mine health and safety procedures.

VI. Procedure

1. Follow Mine health and safety procedures.

2. Don personal protective equipment (PPE).

3. Cleaning of reusable sampling equipment (e.g., scoops, mixing bowls, spatulas) will follow the decontamination procedures presented below:

   - wash with non-phosphate detergent and distilled water;
   - rinse with distilled water;
   - rinse with solvent (nitric acid);
   - rinse with distilled water; and
   - allow to air dry and wrap in aluminum foil.

4. Cleaning/decontamination will be conducted in labeled plastic containers that will be transported to each sampling location. These containers will have leak-proof covers and will also be used to collect all decontamination rinsate. Plastic sheeting will be placed on the surface beneath the containers.

5. Remove PPE.

Cleaning Procedures for Large Equipment (if applicable)

1. Follow Mine health and safety procedures.

2. Wash all large equipment with a high-pressure water wash, using a brush as deemed necessary to remove any particles.

VII. Waste Management

Equipment decontamination rinsate and disposable materials (PPE, etc.) will be managed as specified in the Mine Health and Safety procedures.

VIII. Data Recording and Management

1. Equipment cleaning and decontamination will be noted in the field logbook.

2. An inventory of the solvents brought on site and used and removed from the site will be maintained in the files.

3. Containers with decontamination fluids will be labeled.

IX. Quality Assurance

Equipment blanks should be considered in the FSP when using this SOP. The need for equipment blanks will depend on the data quality objectives.

X. References

Not applicable.

SOP02:
Water Level Measurement

Standard Operating Procedure: Water-Level Measurement

I. Scope and Application

The objective of this Standard Operating Procedure (SOP) is to describe the procedure to measure and record groundwater elevations. Water levels may be measured using an electronic water-level indicator or a pressure transducer from established reference points (e.g., top of casing). Reference points will be surveyed to evaluate their elevations relative to mean sea level (msl). This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to measure and record groundwater elevations using the aforementioned equipment.

This SOP may be varied or changed, as required, depending on site conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the project work plans or reports.

II. Personnel Qualifications

Field sampling personnel will have current health and safety training, including appropriate MSHA training under Public Law 95-164, site supervisor training, and site-specific training, as needed. In addition, field sampling personnel will be versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work.

III. Equipment List

The following materials, as required, shall be available during water-level measurements:

- Appropriate personal protective equipment (PPE);
- Equipment decontamination supplies (see Field Sampling Equipment Decontamination SOP);
- Electronic water-level indicator;
- Non-phosphate laboratory soap (Alconox or equivalent);
- Deionized/distilled water;
- 150-foot measuring tape;
- Solvent (nitric acid) rinse;
- Portable containers;
- Hacksaw;
- Pliers;
- Monitoring well keys;
- Field logbook; and
- Indelible ink pen.

IV. Cautions

Aquifers stressed by intermittent pumping and aquifers recharged from confined or semi-confined aquifers may demonstrate significant water-level fluctuations.

V. Health and Safety Considerations

Well covers and casings should be carefully removed to avoid potential contact with insects, reptiles, animals, or birds nesting in the well casings.

VI. Procedure

Water-level Indicators

Calibration procedures and groundwater-level measurement procedures for water-level indicators are described below.

1. Calibration

   The water-level indicator will be tested to verify that the meter has been correctly calibrated by the manufacturer. The following steps will be used to verify the accuracy of the water-level indicator:

   A. Measure the length between each 1 foot increment marker on the water-level indicator with a measuring tape. The first 150 feet of the water-level indicator measuring tape will be checked for accuracy.

   B. If the water-level indicator measuring tape is inaccurate, the probe will be sent back to the manufacturer.

   C. Equipment calibration will be recorded in the field logbook.

2. Groundwater-Level Measurement

   Procedures for obtaining water elevations using an electronic water-level indicator are as follows:

   A. Record site and monitoring well number in field logbook using indelible ink, along with date, time, personnel, and weather conditions.

   B. Use safety equipment as specified in the Mine HASP.

   C. Decontaminate the water-level level indicator with an Alconox and water scrub, a distilled water rinse, a solvent rinse, and another distilled water rinse between each well in accordance with Field Sampling Equipment Decontamination SOP.

   D. Unlock and open the monitoring well cover while standing upwind from the well.

   E. Allow the water level in the well to equilibrate with atmospheric pressure for a few minutes. Locate a measuring reference point on the monitoring well casing. If one is not found, create a reference point by notching the inner casing (or outer if an inner casing is not present) with a hacksaw. All downhole measurements will be taken from the reference point. Document the creation of any new reference point or alteration of the existing reference point.

   F. Measure to the nearest 0.01 foot and record the height of the inner and outer casing from reference point to ground level.

G. Decontaminate the instrument with an Alconox and water scrub, a distilled water rinse, a solvent rinse, and another distilled water rinse between each well in accordance with the Field Sampling Equipment Decontamination SOP.

H. Lock the well when measurement activities are completed.

VII. Waste Management

Equipment decontamination rinsate and disposable materials (PPE, etc.), will be managed as specified in the Mine Health and Safety Plan.

VIII. Data Recording and Management

Groundwater-level measurements should be documented in the field logbook. The following information will be documented in the field logbook:

- Sample identification;
- Measurement time;
- Total well depth; and
- Depth to water.

IX. Quality Assurance

The water-level indicator tape may need to be weighted for deeper monitoring wells. The amount of weight added should be sufficient enough to keep the water-level indicator tape straight.

X. References

Not applicable.

SOP03:
Sample Custody, Handling, Packing, and Shipping

Standard Operating Procedure: Chain-of-Custody, Handling, Packing, and Shipping

I. Scope and Application

This Standard Operating Procedure (SOP) describes the chain-of-custody, handling, packing, and shipping procedures for the delivery of samples so that samples are protected from cross-contamination, tampering, mis-identification, and breakage, and are maintained in a controlled environment from the time of collection until receipt by the analytical laboratory.

II. Personnel Qualifications

Field sampling personnel will have current Mine health and safety training. In addition, field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired field work.

III. Equipment List

The following materials, as required, will be available during chain-of-custody, handling, packing, and shipping procedures:

- indelible ink pens;
- polyethylene bags (resealable-type);
- clear packing tape, strapping tape, duct tape;
- custody seal evidence tape;
- appropriate sample containers, labels, and chain-of-custody forms;
- large (30 to 40 gallon) insulated coolers;
- ice;
- cushioning and absorbent material;
- thermometer; and
- field logbook.

IV. Cautions

If methanol preservation is used in soil samples, shipping containers must not exceed 500 mL total volume of methanol and must be labeled **"This package conforms to 49 CFR 173.4."**

V. Health and Safety Considerations

Follow Mine health and safety procedures.

VI. Procedures

Chain-of-Custody Procedures

1. Prior to collecting samples, complete the chain-of-custody record header information by filling in the project number, project name, and the name(s) of the sampling technician(s). Please note it is important that chain-of-custody information is printed legibly using indelible ink.

2. After sample collection, enter the individual sample information by filling in the following chain-of-custody fields:

    1. **STA. NO.** Indicates the station number or location that the sample was collected from. Appropriate values for this field include well locations, grid points, or soil boring identification numbers (e.g., MW-3, X-20, SB-30).

    2. **Date.** Indicates the date the sample was collected. The date format to be followed should be mm/dd/yyyy (e.g., 03/23/2005).

    3. **Time.** Indicates the time the sample was collected. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

    4. **Comp.** This field should be marked with an "X" if the sample was collected as a composite.

    5. **Grab.** This field should be marked with an "X" if the sample was collected as an individual grab sample.

    6. **Station Location.** This field should represent the complete sample name; although in some instances, it may be similar to the "STA. NO." field. An example of a complete sample name is "SB-3 (0.5-1.0)," where the 0.5-1.0 represents the depth interval in feet from where the sample was collected. Please note it is very important that the use of hyphens in sample names and depth units (i.e., feet or inches) remain consistent for all samples entered on the chain-of-custody form. Sample names may also use the abbreviations "MS/MSD," "FB," "TB," and "DUP" as prefixes or suffixes to indicate that the sample is a matrix spike/matrix spike duplicate, field blank, trip blank, or field duplicate, respectively.

    7. **Number of Containers.** This field represents the number of containers collected at the sampling location to be submitted for analysis.

    8. **Analytical Parameters.** The analytical parameters that the samples are being analyzed for should be written legibly on the diagonal lines to the right of the "number of containers" column. As much detail as possible should be presented to allow the analytical laboratory to properly analyze the samples. For example, polychlorinated biphenyl (PCB) analyses may be represented by entering "PCBs" or "Method 8082." Multiple methods and/or analytical parameters may be combined for each column (e.g., PCBs/VOCs/SVOCs or 8082/8260/8270). These columns should also be used to present project-specific parameter lists (e.g., Appendix IX+3 target analyte list or MADEP SW-846). Quality assurance/quality control (QA/QC) information may also be entered in a separate column for each parameter (e.g., PCBs - MS/MSD) to identify a sample that the laboratory is to use for a specific QA/QC requirement. Each sample that requires a particular parameter analysis will be identified by placing an "X" in the appropriate analytical parameter column.

9. **Remarks.** The remarks field should be used to communicate special analytical requirements to the laboratory. These requirements may be on a per sample basis such as "extract and hold sample until notified," or may be used to inform the laboratory of special reporting requirements for the entire sample delivery group (SDG). Reporting requirements that should be specified in the remarks column include: 1) turnaround time; 2) contact and address where data reports should be sent; 3) name of laboratory project manager; and 4) type of sample preservation used.

10. **Relinquished By.** This field should contain the signature of the sampling technician who relinquished custody of the samples to the shipping courier or the analytical laboratory.

11. **Date.** Indicates the date the samples were relinquished. The date format should be mm/dd/yyyy (e.g., 03/23/2005).

12. **Time.** Indicates the time the samples were relinquished. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

13. **Received By.** This field should contain the signature of the sample courier or laboratory representative who received the samples from the sampling technician.

3. Complete as many chain-of-custody forms as necessary to properly document the collection and transfer of the samples to the analytical laboratory.

4. Upon completing the chain-of-custody forms, forward two copies to the analytical laboratory and retain one copy for the field records.

Handling Procedures

1. After completing the sample collection procedures, record the following information in the field logbook with indelible ink:

   - project number and site name;
   - sample identification code and other sample identification information, if appropriate;
   - sampling method;
   - date;
   - name of sampler(s);
   - time;
   - location (project reference); and
   - any comments.

2. Fill in sample label with the following information in indelible ink:

   - sample type (e.g., surface water);
   - project number and site name;
   - sample identification code and other sample identification information, if applicable;
   - analysis required;
   - date;
   - time sampled;
   - initials of sampling personnel;
   - sample type (composite or discrete);

- tissue preparation procedure (biota; e.g., fillets, whole body), if applicable; and
- preservative added, if applicable.

3. Cover the label with clear packing tape to secure the label onto the container.

4. Check the caps on the sample containers to seal them tightly.

5. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. Place a signed custody seal label over the cap such that the cap cannot be removed without breaking the custody seal. Alternatively, if shipping several containers in a cooler, custody seal evidence tape may be placed on the shipping container as described below.

Packing Procedures

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler being used for sample transport.

2. Place each container or package in individual polyethylene bags (resealable-type) and seal. If a cooler temperature blank is supplied by the laboratory, it should be packaged following the same procedures as the samples. If the laboratory did not include a temperature blank, do not add one since the sample temperature will be determined by the laboratory using a calibrated infrared thermometer.

3. Place 1 to 2 inches of cushioning material at the bottom of the cooler.

4. Place the sealed sample containers upright in the cooler.

5. Package ice or blue ice in small resealable-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent the addition of sufficient cushioning material. Samples placed on ice will be cooled to and maintained at a temperature of approximately 4°C.

6. Fill the remaining space in the cooler with cushioning/absorbent material. The cooler must be securely packed and cushioned in an upright position and be surrounded by a sorbent material capable of absorbing spills from leaks or breakage of sample containers. (Note: to comply with 49 CFR 173.4, filled cooler must not exceed 64 pounds).

7. Place the completed chain-of-custody record(s) in a large resealable-type bag and tape the bag to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with packing tape.

9. Wrap strapping tape around both ends of the cooler.

10. Mark the cooler on the outside with the following information: shipping address, return address, "Fragile, Handle with Care" labels on the top and on one side, and arrows indicating "This Side Up" on two adjacent sides.

11. Place custody seal evidence tape over front right and back left of the cooler lid and cover with clear plastic tape.

Note: Procedure numbers 2, 3, 5, and 6 may be modified in cases where laboratories provide customized shipping coolers. These coolers are designed so the sample bottles and ice packs fit snugly within preformed styrofoam cushioning and insulating packing material.

Shipping Procedures

1. All samples will be delivered by an express carrier within 48 hours of sample collection. Alternatively, a laboratory courier may be used for sample pickup. If parameters with short holding times are being analyzed (e.g., VOCs [EnCore™ Sampler], nitrate, ortho-phosphate [dissolved], and BOD), sampling personnel will take precautions so that the maximum holding times for these parameters will not be exceeded.

2. The following chain-of-custody procedures will apply to sample shipping:

   - Relinquish the sample containers to the laboratory via express carrier or laboratory courier. The signed and dated forms should be included in the cooler. The express carrier will not be required to sign the chain-of-custody forms.

   - When the samples are received by the laboratory, laboratory personnel will complete the chain-of-custody by recording the date and time of receipt of samples, measuring and recording the internal temperature of the shipping container, and checking the sample identification numbers on the containers to ensure they correspond with the chain-of-custody forms.

VII. Waste Management

Not applicable.

VIII. Data Recording and Management

Copies of chain-of-custody forms will be maintained in the project file.

IX. Quality Assurance

Chain-of-custody forms will be filled out. A copy of the completed chain-of-custody form forwarded with the samples to the laboratory will be sent to the project file.

X. References

Not applicable.

SOP06:
Groundwater Sampling

Standard Operating Procedure: Groundwater Sampling from Monitoring Wells

I. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures to be used to collect groundwater samples using traditional purging and sampling techniques. Monitoring wells must be developed after installation and prior to groundwater sample collection. During precipitation events, groundwater sampling will be discontinued until precipitation ceases or a cover over the sampling area and monitoring well has been erected.

Both filtered and unfiltered groundwater samples may be collected using this SOP. Filtered samples may be obtained using a 1.0-, 0.45-, or 0.1-micron disposable filter.

II. Personnel Qualifications

Field sampling personnel will have current Mine health and safety training. In addition, field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired field work.

Personnel conducting groundwater sample collection activities should have previous groundwater sampling experience or a degree in environmental sciences, engineering, hydrogeology, or geology.

III. Equipment List

The following materials shall be available, as required, during groundwater sampling:

- site plan of monitoring well locations and site Field Sampling Plan (FSP);
- appropriate health and safety equipment, as specified in the Mine Health and Safety Plan (HASP);
- monitoring well construction logs or tables and historical water level information, if available;
- decontaminated pumps, tubing, and other equipment necessary for purging;
- generator or battery for operation of pumps, if required;
- pump, if required, in accordance with the FSP or Work Plan (parameter-specific [e.g., submersible, bladder, peristaltic]);
- polypropylene rope;
- buckets to measure purge water;
- water-level well probe;
- water-quality meter;
- appropriate analytical method water sample containers with preservative, as needed (parameter-specific);
- filter, as needed, in accordance with the analytical method and parameter;
- appropriate blanks (trip blank supplied by the laboratory), as specified in the FSP;
- Ziploc-type freezer bags;
- appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- appropriate groundwater sampling log (example attached);
- chain-of-custody forms;

- indelible ink pens;
- site map with well locations and groundwater contour maps;
- keys to wells and contingent bolt cutters for rusted locks and replacement keyed-alike locks;
- field logbook; and
- groundwater containers, if needed.

IV. Cautions

If heavy precipitation occurs and no cover over the sampling area and monitoring well can be erected, sampling must be discontinued until adequate cover is provided. Rain water could contaminate groundwater samples.

Do not use permanent marker or felt-tip pens for labels on sample container or sample coolers – use indelible ink. The permanent markers could introduce volatile constituents into the samples.

It may be necessary to field filter some parameters (e.g., metals) prior to collection, depending on preservation, analytical method, and project quality objectives.

Check monitoring well logs for use of bentonite pellets. Make note of potential use of bentonite pellets on the groundwater sampling log. Coated bentonite pellets have been found to contaminate monitoring wells.

Store and/or stage empty and full sample containers and coolers out of direct sunlight.

To mitigate potential cross-contamination, groundwater samples are to be collected in a pre-determined order from least impacted to impacted based on previous analytical data. If no analytical data are available, samples are collected in order of upgradient, then furthest downgradient to source area locations.

Be careful not to over-tighten lids with Teflon liners or septa (e.g., 40 mL vials). Over-tightening can impair the integrity of the seal.

V. Health and Safety Considerations

Groundwater sampling field activities will be performed in accordance with the HASP, a copy of which will be present on site during such activities.

VI. Procedure

The procedures to sample monitoring wells are as follows:

1. Review equipment list (Section III above) to confirm that the appropriate equipment has been acquired.

2. Record site and monitoring well identification on the groundwater sampling log, along with date, arrival time, and weather conditions. Also identify the personnel present, equipment utilized, and other relevant data requested on the log.

3. Label all sample containers with indelible ink.

4. Don safety equipment, as required in the HASP.

5. Remove lock from well and if rusted or broken, replace with a new brass keyed-alike lock.

6. Unlock and open the well cover while standing upwind of the well.

7. Obtain a water-level depth and bottom-of-well depth using an electric well probe and record on the groundwater sampling log using indelible ink. Clean the well probe after each use in accordance with the Field Sampling Equipment Decontamination SOP.

Note: Water levels may be measured at all wells prior to initiating any sampling activities.

8. Calculate the number of gallons of water in the well using the length of water column (in feet). Record the well volume on the groundwater sampling log using indelible ink.

9. Pump the well, to remove the required purge volume of water. Measure the purge water volume in measuring buckets.

10. Monitor the produced water for pH, electrical conductivity, temperature, and any other parameters required in the Sampling Plan. Monitor and record these parameters at the end of production of each well volume.

11. Continue pumping from the well until a minimum of three well volumes have been produced, and the field parameters have stabilized, as follows:
    a. pH: ±0.1 s.u.
    b. Electrical conductivity: ±3%
    c. Turbidity, ±10%

12. In the event that the well runs dry during purging, the water that subsequently comes into the well will be sampled (USEPA, 1996).

13. Purge water from the wells shall be allowed to infiltrate into the ground surface downgradient from the monitoring well after the well is sampled.

14. After the appropriate purge volume of groundwater in the well has been removed, or if the well has been pumped dry and allowed to recover, obtain the groundwater sample needed for analysis. Transfer the groundwater directly from the sampling device into the appropriate container, minimizing contact with the atmosphere. The order for sample parameter collection, is presented below:
    a. Metals; and
    b. Wet chemistry.

15. A filtered and unfiltered sample will be collected as required in the Sampling Plan, with filtration being conducted in the field by pumping the sample through an in-line filter (i.e., a new 0.45-micron filter). Allow 100 mL (or manufacturer recommended amount) of groundwater through the filter before sample collection. Dispense the filtered liquid directly into the pre-preserved laboratory sample bottles.

16. Place the custody seal around the cap of the sampler container, if required. Note the time on the sample label. Secure with packing material and maintain at approximately 4°C on wet ice contained in double Ziploc-type freezer bags during storage in an insulated, durable transport container.

17. After all sampling containers have been filled, remove an additional volume of groundwater for field parameter monitoring per the FSP or Work Plan. Record the physical appearance on the groundwater sampling log. Other field parameters may include pH, temperature, conductivity, turbidity, dissolved

oxygen, and oxidation reduction potential using pre-calibrated equipment. SOPs for field parameters are provided separately from this groundwater sampling procedure. Record measurements in a field logbook using an indelible ink pen.

18. Replace the well cap and lock well, or install a new lock if needed.

19. Record the time sampling procedures were completed on the appropriate field logs (using indelible ink).

20. Place all disposable sampling materials (plastic sheeting and health and safety equipment) in appropriate containers.

21. Complete the procedures for chain-of-custody, handling, packing, and shipping.

22. If new locks were installed, forward copies of the keys to the Project Manager (PM) at the end of the sampling activities.

VII. Waste Management

Purge water, decontamination liquids, and disposable materials (tubing, PPE, etc.), will be managed as specified in the Sampling Plan.

VIII. Data Recording and Management

Initial field logs and chain-of-custody records will be retained by the sampler until the completion of the sampling round. Copies of all documents will be transmitted to the project file at the end of the sampling round.

IX. Quality Assurance

Field-derived quality assurance blanks will be collected as specified in the Sampling Plan, depending on the project quality objectives. Typically, field rinse blanks will be collected when non-dedicated equipment is used during groundwater sampling. Field rinse blanks will be used to confirm that decontamination procedures are sufficient and samples are representative of site conditions.

X. References

USEPA. 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document (September 1986).

USEPA. 1991. Handbook Groundwater, Volume ii Methodology, Office of Research and Development, Washington, DC. USEPN62S, /6-90/016b (July, 1991).

U.S. Geological Survey (USGS). 1977. National Handbook of Recommended Methods for Water-Data Acquisition: USGS Office of Water Data Coordination. Reston, Virginia.

SOP07:
Surface Water Sampling

Standard Operating Procedure: Surface-Water Sampling

I. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures to be used to collect surface-water samples in streams associated with mining projects, which are generally steep, shallow, and rapidly flowing. The sampling technique to be used to collect surface-water samples is the bailer method.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to collect surface-water samples using these two sampling techniques.

This SOP may be varied or changed, as required, dependent on site conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in reports.

Both filtered and unfiltered surface-water samples may be collected using this SOP. Filtered samples will be collected using the peristaltic pump method and a 1.0-, 0.45-, or 0.1-micron disposable filter.

II. Personnel Qualifications

Field sampling personnel will have current Mine health and safety training and site-specific training, as needed. In addition, field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired field work.

Personnel conducting surface-water sample collection activities should have a minimum of 6 months of related experience or a degree in environmental sciences, engineering, hydrogeology, or geology.

III. Equipment List

The following materials shall be available, as required, during surface-water sampling:

- site plan of sampling locations and site Sampling Plan (SP);
- appropriate health and safety equipment, as specified in the Mine Health and Safety Plan (HASP);
- equipment decontamination supplies;
- graduated beaker;
- tape measure;
- combination water quality meter (Horiba U-10, or equivalent);
- transport containers (i.e., coolers) and packing, labeling, and shipping materials;
- ice;
- filters and filtering apparatus (if necessary);
- sample containers and forms;
- field logbook; and
- surface-water sampling device (bailer).

IV. Cautions

Do not use permanent marker or felt-tip pens for labels on sample container or sample coolers – use indelible ink. The permanent markers could introduce volatile constituents into the samples.

It may be necessary to field filter some parameters (e.g., metals) prior to collection, depending on preservation, analytical method, and project quality objectives.

Sample containers should be packed on ice and stored in a cool, shaded place, if possible, to maintain a sample temperature of approximately 4°C. Ice must be double-bagged to prevent leakage.

Surface-water samples are to be collected in a downstream to upstream direction.

Be careful not to over-tighten lids with Teflon liners or septa (e.g., 40 mL vials). Over-tightening can impair the integrity of the seal.

V. Health and Safety Considerations

Surface-water sampling field activities will be performed in accordance with the Mine HASP, a copy of which will be present on site during such activities.

Entering surface water bodies for sample collection involves risks, including drowning, injury by submerged hazards, and hypothermia. Entry into water should not be performed alone.

VI. Procedure

Laboratory-decontaminated bailer method procedures will be as follows:

1. Review equipment list (Section III above) to confirm that the appropriate equipment has been acquired.
2. Identify sampling location in field logbook along with other appropriate information.
3. Don health and safety equipment (as required by the HASP).
4. Clean the sampling equipment, if necessary, in accordance with the procedures in the Field Equipment Cleaning/Decontamination SOP.
5. Locate the sampling position.
6. Measure the total depth and width of the stream with a tape measure.
7. Measure the surface flow velocity using the floating object method.
8. Take a water sample with the bailer, causing minimal disturbance to the streambed.
9. Remove the cover from the appropriate sample container(s) and slightly tilt the mouth of the container below the sampling device. Fill the appropriate sample containers directly from the bailer for each sample collected.

10. After sampling containers have been filled, take in-situ meter readings for pH, temperature, conductivity, dissolved oxygen, and turbidity, and record results in the field logbook.

11. Secure all sample jar caps tightly.

12. Label all sample containers.

13. Place filled sample containers on ice in a cooler.

14. Follow procedures for preservation of samples and packing, handling, and shipping with associated chain-of-custody procedures of samples as set forth in the Field Sample Handling, Packing, and Shipping SOP.

15. Record required information on the appropriate forms and/or field logbook.

VII. Waste Management

Purge water, decontamination liquids, and disposable materials (tubing, PPE, etc.), will be managed as specified in the Sampling Plan.

VIII. Data Recording and Management

Initial field logs and chain-of-custody records will be retained by the sampler until the sampling round is completed. At that time a copy of the relevant field log book pages and the chain-of-custody records will be placed on the project file.

IX. Quality Assurance

Field-derived quality assurance blanks will be collected as specified in the FSP, depending on the project quality objectives. Typically, field rinse blanks will be collected when non-dedicated equipment is used during surface-water sampling. Field rinse blanks will be used to confirm that decontamination procedures are sufficient and samples are representative of site conditions.

X. References

Not applicable.

SOP09:
Single Well Pumping Test

Standard Operating Procedure: Single Well Pumping Test

I. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures to be used to perform a single well pumping test for the purposes of establishing the yield of the well and the hydraulic conductivity of the formation in which the well is completed. The test can be combined with well development (during the test), and well sampling (at the end of pumping), which are presented in separate SOPs.

II. Personnel Qualifications

Field sampling personnel will have current Mine health and safety training. In addition, field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired field work.

Personnel conducting single well pumping testing should have a minimum of 2 years previous groundwater hydrology experience, or a degree in environmental sciences, engineering, hydrogeology, or geology.

III. Equipment List

The following materials shall be available, as required, during groundwater sampling:

- appropriate health and safety equipment, as specified in the Mien Health and Safety Plan (HASP);
- monitoring well construction logs or tables and historical water level information, if available;
- decontaminated pumps, tubing, and other equipment necessary for pumping;
- generator or battery for operation of pumps, if required;
- decontaminated pump, if required;
- buckets to measure water flow;
- water-level well probe;
- water-quality meter (as specified in the Sampling Plan);
- well testing logging sheet (example attached);
- site map with well location;
- keys to wells and contingent bolt cutters for rusted locks and replacement keyed-alike locks; and
- field logbook.

IV. Cautions

Electrically powered well pumping equipment can cause injury or death due to electrical malfunction or problems during installation and removal of the pump from the well.

Working with water can present hazards of freezing, hypothermia, or drowning. Exercise care when working around water production systems.

V. Health and Safety Considerations

Single well pumping test activities will be performed in accordance with the HASP, a copy of which will be present on site during such activities.

VI. Procedure

The procedure to perform a single well pumping test is as follows:

1. Review equipment list (Section III above) to confirm that the appropriate equipment has been acquired.
2. Locate well to be tested, and record site and monitoring well identification on the groundwater sampling log, along with date, arrival time, and weather conditions. Also identify the personnel present, equipment utilized, and other relevant data requested on the log.
3. Don safety equipment, as required in the HASP.
4. Remove lock from well and if rusted or broken, replace with a new brass keyed-alike lock.
5. Unlock and open the well cover while standing upwind of the well.
6. Install a suitable pump in the well. Equipment shall be decontaminated consistent with SOP-01: Equipment Cleaning and Decontamination prior to use.
7. Attach a discharge hose to the well to convey water to ground surface at least 50 ft from the pumping well.
8. Measure and record the physical dimensions of the bucket to be used for flow measurement.
9. Obtain a water-level depth and bottom-of-well depth using an electric well probe in accordance with SOP-02: Water Level Measurement. All downhole equipment will be decontaminated prior to first use using the procedures indicated in SOP-01: Equipment Cleaning and Decontamination.
10. Monitor the water level in the well each five minutes for 15 minutes before pumping begins.
11. Pump the well at a constant rate of approximately 10 gallons per minute ("gpm") for 30 minutes, or such rate as maximizes the available drawdown at the well.
12. Monitoring the flow rate by the bucket and stop-watch method no less frequently than each 5 minutes during the pumping period.
13. During pumping, water level shall be monitored each minute for the first 5 minutes and each 5 minutes thereafter.
14. After termination of pumping, water level shall be monitored for 15 minutes: each minute for the first 5 minutes and each 5 minutes thereafter.
15. Remove pump and other fittings from well, and decontaminate them pursuant to SOP-01: Equipment Cleaning and Decontamination.
16. Replace the well cap and lock well, or install a new lock if needed.
17. Record the time sampling procedures were completed on the appropriate field log (using indelible ink).
18. Place all disposable sampling materials (plastic sheeting and health and safety equipment) in appropriate containers.
19. If new locks were installed, forward copies of the keys to the Project Manager (PM) at the end of the sampling activities.

VII. Waste Management

Water pumped from the well during the test shall be discharged to the ground surface no closer to the well than 50 feet.

Other waste materials, including decontamination liquids and disposable materials (tubing, PPE, etc.), will be managed as specified in the Sampling Plan.

VIII. Data Recording and Management

Information recorded in the field logbook for each well test will include, but not be limited to the following:

- Date of field activity;
- Objective of field activity;
- Weather conditions;
- Names of personnel present and conducting activities;
- Start and finish times of well testing; and
- Record of location of well testing results.

The results of the well test will be recorded on a standard well test form, a copy of which is attached to this SOP. This form shall be completed in indelible ink during the test, and signed by the team leader. The original of the form shall be forwarded to the Project Manager after completion of the test.

Initial field logs and chain-of-custody records will be transmitted to the PM at the end of each day unless otherwise directed by the PM. The groundwater team leader will retain copies of the groundwater sampling logs.

IX. Quality Assurance

None.

X. References

None.

SINGLE WELL PUMPING TEST

Well:		*Depth:*		*Start:*		*Meter:*	
Date:		*Casing:*		*Finish:*		*Serial:*	
Staff:		*Volume:*	*gal*	*Bucket:*	*gal*	*Calib:*	

Pumping Test Results

Test	Time	Total	DTW	Flow*	Color	pH	Cond	Turb	DO	Temp	ORP
Phase	min	min	feet	mm:ss		s.u.	uS	NTU	mg/L	C	mV
Pre-Test	0	0									
	5	5									
	10	10									
	15	15									
Pumping Period	1	16									
	2	17									
	3	18									
	4	19									
	5	20									
	10	25									
	15	30									
	20	35									
	25	40									
	30**	45**									
Post-Test	1	46									
	2	47									
	3	48									
	4	49									
	5	50									
	10	55									
	15	60									

***Flow:** Timed volume method. Record time to fill bucket volume specified in header.

****Sample:** Metals, Nitrate, Hardness, Alkalinity, TDS, TSS, Sulfate, Chloride.

Metals: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, Va, Zn

NOTES:

Bucket inner dimensions Height (in): Base Diameter (in): Top Diameter (in):

SOP11:
Measuring Field Water Parameters

Standard Operating Procedure: Measuring Basic Water Quality Parameters

I. Scope and Application

Water quality parameters (e.g. specific conductivity, pH, and temperature) of natural waters are usually measured in the field. The parameters required in the Sampling Plan will be measured at the well site with a combination water quality meter (Horiba U-22 or equivalent).

II. Personnel Qualifications

Field sampling personnel will have current Mine health and safety training. In addition, field sampling personnel will be versed in the relevant standard operating procedures (SOPs) and possess the skills and experience necessary to successfully complete the desired field work.

III. Equipment List

The following materials, as required, shall be available during field measurement of water quality:

- health and safety equipment, as required by the Mine Health and Safety Plan (HASP);
- cleaning equipment;
- combination water quality meter;
- standard solutions for calibration;
- distilled/deionized water;
- extra batteries for the meter; and
- appropriate forms and field notebook.

IV. Cautions

Follow health and safety procedures outlined in the HASP.

V. Health and Safety Considerations

Follow health and safety procedures outlined in the HASP.

VI. Procedures

1. Standard Procedures

   A. Calibration

      The meter will be calibrated following the manufacturer's instructions daily. Calibration information will be recorded in the field notebook. Calibration procedures are as follows:

pH

1) Switch on the instrument.
2) Rinse probe in distilled/deionized water.
3) Place probe into pH 4.00 solution and allow reading to stabilize.
4) Record temperature and pH readings.
5) Adjust the pH reading to the correct value.
6) Record the final pH reading.
7) Rinse probe in distilled/deionized water.
8) Repeat steps for pH 7.00 and pH 10.00 buffer solutions.

Conductivity

1) Switch on the instrument.
2) Rinse probe in distilled/deionized water.
3) Place probe into 1.413 µS/cm potassium chloride solution and allow reading to stabilize.
4) Record temperature and conductivity readings.
5) Adjust the conductivity reading to the correct value.
6) Record the final conductivity reading.
7) Rinse probe in distilled/deionized water.

Turbidity

1) Switch on the instrument.
2) Rinse probe in distilled/deionized water.
3) Place probe into 100 NTU turbidity solution and allow reading to stabilize.
4) Record temperature and turbidity readings.
5) Adjust the turbidity reading to the correct value.
6) Record the final turbidity reading.
7) Rinse probe in distilled/deionized water.

B. Operation

The meter will be operated following the manufacturer's instructions. Water-quality parameters including, pH, conductivity, turbidity, DO, temperature, and ORP will be measured and recorded in the field logbook. Two different methods may be used depending on sample-specific criteria: flow-through cell and open container.

Flow-through cell method:

1) Switch on the instrument.
2) Rinse probe in distilled/deionized water.
3) Connect polyethylene tubing to flow-through cell intake.
4) Switch on purging device.
5) Allow flow-through cell to completely fill with water.
6) Record all water-quality parameters in field logbook or purge sheet.
7) Continue recording parameters at specified intervals according to the FSP.
8) Switch off purging device and disconnect tubing.
9) Detach flow-through cell and rinse probe in distilled/deionized water.

10) Switch off the instrument.

Open container method:

1) Switch on the instrument.
2) Rinse probe in distilled/deionized water.
3) Fill open container with sample water.
4) Allow water-quality parameters to stabilize.
5) Record all water-quality parameters in field logbook or purge sheet.
6) Discard sample water and rinse probe in distilled/deionized water.
7) Switch off the instrument.

C. Maintenance

The meter will be maintained according to the manufacturer's instructions. Maintenance information will be recorded in the field notebook. A replacement meter and probes will be available onsite or ready for overnight shipment, as necessary. All necessary tools (e.g., various size screwdrivers, and pliers) and backup batteries will be available onsite.

VII. Waste Management

Equipment decontamination rinsate and disposable materials (PPE, etc.), will be managed as specified in the Work Plan or FSP.

VIII. Data Recording and Management

All readings taken, calibration procedures, calibration checks, and adjustments will be documented in the field logbook. In addition, a calibration log will be completed for each day in which these procedures were conducted. These logs will be filed in the laboratory calibration logbook.

All readings taken and adjustments made during calibrations and calibration checks will be recorded in the field logbook, along with the date and time at which the procedure was completed. The serial number of the meter and calibration solutions shall be recorded if applicable.

IX. Quality Assurance

Groundwater quality parameters should be measured prior to sample collection. If down-hole water quality meters are used, they will be decontaminated as specified in the SOP for Field Sampling Equipment Decontamination (SOP-01).

X. References

None.

1.4.1. EPF Certification Minimum Requirements

Prior to use, each EPF will be certified via a technical revision with the minimum requirements outlined below.

Mill Facility: As the Mill Facility is already constructed, its EPF certification technical revision shall include a proposed list of upgrades needed to bring the mill into production, detailed designed drawings including the proposed upgrades, detailed information regarding the dosing per ton of each reagent, proposed construction schedule including stop lock testing, and test runs. Additionally, an updated comprehensive volumetric demonstration of containment capacity as compared to operational volumes of Designated Chemicals, ore, water, slurry and Tailings will be included in the design.

Reagent Storage Area: Though the Reagent Storage Area exists within the Mill Building, and partially outside of the mill building, for all intents and purposes it will be considered a separate EPF. This EPF certification shall include finalized volumes of reagents to be stored in each separated area within the facility, dosing, mixing and delivery into the mill system information.

Tailings Storage Facility: The TSF EPF certification will consist of a recertification of the TSF. The recertification will include confirmation of liner integrity, embankment condition and material stability evaluation, determination of available storage volume, diversion ditch capacity and maintenance schedule, updated water balance, and a TSF standard operating procedure manual.

The TSF will be evaluated for recertification and the results of that evaluation submitted to CDRMS as a technical revision by August 1, 2024. If the TSF cannot be recertified or insufficient capacity remains for further use, closure will take place.

Tailings Delivery Line: The EPF certification for the Tailings delivery line shall include all maps and drawing related to the upgrading of the delivery line, including specifications for the sections requiring double walled piping. Also details including flow rate and deposition location within the TSF.

Surface Ore Stockpile Facility: This EPF certification shall include all maps and drawings of the proposed facility, detailed information regarding subgrade preparation and dirt work, liner specifications and installation as well as all finish grading and compaction testing as needed.

1.5. EPF Construction

For all EPFs that have not been built at the time of this application, it is anticipated that they will be built in the summer of 2024, when weather facilitates construction. As-builts for new facilities certified by a professional engineer will be provided to CDRMS following construction. Minimum standard construction steps for liners and pipes installed at Gold Hill Mill are outlined below. These are applicable to any new liner or pipe installation at Gold Hill Mill.