Tailings Geotechnical Investigation
Work Plan for Keystone Mine

Keystone Mine
Gunnison County, Colorado
December 2016
TAILINGS GEOTECHNICAL INVESTIGATION WORK PLAN FOR KEYSTONE MINE

Prepared for
Mt. Emmons Mining Company

December 2016

MWH Project No. 10509929

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1 INTRODUCTION

This Work Plan was prepared by MWH Americas, Inc. (MWH) on behalf of Mt. Emmons Mining Company (Mt. Emmons), describing activities to be performed at the Keystone Mine Site (Site) in Gunnison County, Colorado. Mt. Emmons is evaluating options for addressing long-term performance of the Site.

Mt. Emmons intention is to confirm that the closure of the Site meets current closure requirements and regulations. This investigation will be used to evaluate the stability of the tailings dams.

To supplement the already available information, the proposed activities are aimed at providing updated information about the current subsurface conditions in and under the reclaimed tailings. The investigation will include:

- geologic mapping of the area,
- Cone Penetrometer Testing (CPT),
- soil boring and geotechnical testing of tailings and native material,
- test pitting of the toe drain area,
- installation of direct push vibrating wire piezometers and stand pipe piezometers,
- soil and water sampling of seeps, and
- geochemical testing of upstream spoil piles.

1.1 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

The Keystone Mine is an inactive mine located approximately 4 miles west of Crested Butte in Gunnison County, Colorado (Figure 1-1). The Site is at approximately 9,000 feet (ft) elevation on patented and unpatented claims in the Gunnison National Forest.

Mining has occurred at the Site since the 1880’s. The Keystone Mine was operated between 1948 and 1975 extracting lead and zinc ore. Between 1955 and 1975 tailings was placed in 4 tailings dams. In 1975 a release of tailings towards Coal Creek prompted the mine to shut down. The tailings occupy approximately 60 acres. A buttress and cap were constructed between 1978 and 1979 and a grass cover has since been established on the reclaimed surface. Between 1978 and 1980 the mine water treatment plant was put into operation. Water collected from the surface of the tailings, tailings toe drain and the mine is currently treated on site prior to discharge to Coal Creek.
The main features of the Site are shown on Figure 1-2.
1.2 SUMMARY OF PAST INVESTIGATIONS

After mining operations ceased in 1975, a Geotechnical and Hydrologic Investigation was performed by Woodward Clyde (now AECOM) in 1977 and remedial work was completed by AMAX Mining Company in 1979. Reports on these activities provide background information about the Site.

The 1977 investigation report describes that the tailings dams are underlain by thick, glacial, silty to clayey, boulder sands and gravels over interbedded sandstones and shales dipping at a low angle out of the slope (Woodward-Clyde Consultants (WCC), 1977). At the time of the investigations there were breached areas on Dam 2 and Dam 4 and it was recommended that measures to strengthen the dams be implemented as soon as possible. Strengthening the dams by adding a buttressing fill was recommended (WCC, 1977). Geotechnical investigations included soil borings through the tailings to the underlying foundation. Standard Penetration Tests (SPTs) were performed during drilling to estimate in-situ density of the material. The investigation found that that there was a relatively thin outer “shell” of medium dense, silty sands (man-made fill) along the outside edge of the tailings dams. The tailings “slimes” behind this “shell” were generally composed of very loose to loose, wet silts and sands (WCC, 1977).
1.3 PROJECT ORGANIZATION

The project contact information is shown in Table 1-1. All communications with Mt. Emmons will be through the MWH Project Technical Manager (Andrew Watson) or the designated coordinator/task manager. All Health and Safety issues are to be addressed by the MWH Field Manager (Brandon Coleman).

Table 1-1 Project Contacts

<table>
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<th>Organization</th>
<th>Representative</th>
<th>Role</th>
<th>Contact Tel. #</th>
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<tr>
<td>Mt. Emmons Mining Company</td>
<td>David Gosen</td>
<td>Project Manager</td>
<td>(602) 319-0484</td>
</tr>
<tr>
<td>Frank Environmental Services</td>
<td>Todd Marshall</td>
<td>Water Treatment Plant contractor (on-site)</td>
<td></td>
</tr>
<tr>
<td>MWH</td>
<td>Andrew Watson</td>
<td>Project Technical Manager</td>
<td>(303) 505-1134</td>
</tr>
<tr>
<td>MWH</td>
<td>Brandon Coleman</td>
<td>Field Manager</td>
<td>(303) 291-2261</td>
</tr>
<tr>
<td>ConeTEC</td>
<td>Shawn Steiner</td>
<td>CPT Contractor</td>
<td>(801) 973-3801</td>
</tr>
<tr>
<td>TBD</td>
<td></td>
<td>Drilling Contactor</td>
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<tr>
<td>TBD</td>
<td></td>
<td>Geophysics Contractor</td>
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All communications during which decisions are made and/or actions are taken will be documented.

A telephone will be available at the Site in the event of an emergency or should key decisions need to be discussed with the Project Manager or head-office. Two-way radio communications will be used by on-site personnel. This requirement will apply to MWH, Mt. Emmons, and subcontractors.

1.4 DOCUMENT ORGANIZATION

This document is divided into five sections as follows:

Section 1.0: Introduction; includes purpose and the project background.

Section 2.0: Compliance with Applicable Regulations, Rules, and Procedures; includes a discussion of the regulations that will be adhered to during the course of the investigative efforts.

Section 3.0: Field Program; includes the field program rationale and data quality objectives, field documentation, cone penetration testing (CPT) procedures, soil boring procedures, piezometer procedures, test pitting procedures, seeps characterization, mine spoil sample collection and testing, equipment decontamination, and equipment calibration.

Section 4.0: Schedule and Logistics; includes the anticipated schedule for the investigative activities.

Section 5.0: References
2 COMPLIANCE WITH APPLICABLE REGULATIONS, RULES, AND PROCEDURES

Tailings investigation activities described in this work plan and associated permitting will be coordinated with the Gunnison National Forest and no activities will be initiated without formal authorization. Approval of this work plan will be considered formal authorization.

All applicable requirements of the Occupational Safety and Health Administration (OSHA) will be followed as specified under 29 CFR 1910.120. All work will be performed in compliance with the Mt. Emmons Health and Safety Plan, MWH Health and Safety Plan and each subcontractors Health and Safety Plan. In cases where health and safety requirements conflict the more stringent requirement shall govern.

In addition to the regulatory requirements identified in this section, all equipment will be cleaned and inspected for noxious weeds prior to mobilizing to the Site and prior to leaving the Site.

The subcontractors selected for CPT, drilling activities and piezometer installation (direct push and stand pipe) will be registered and licensed in the State of Colorado. The subcontractor will provide a Notification of Intent (NOI) to the Colorado Department of Natural Resources, and will be required to obtain a validation notice from Colorado Department of Natural Resources prior to initiating work. All reports, including logs and abandonment reports will be prepared and submitted as required by the Colorado Department of Natural Resources upon the completion of these field activities.
3 FIELD PROGRAM

3.1 PROGRAM OVERVIEW AND OBJECTIVES

The primary objective of the Tailings Geotechnical Investigation is to collect preliminary geotechnical data to gain an understanding of the Site geologic conditions, phreatic surface, potential perched water, soil properties within the tailings, and functionality of the tailings toe drain. A secondary objective is to install piezometers to collect information on potential piezometric level changes through the wet and dry seasons, and better define locations for further investigations, as required.

Investigation activities will include:

- Geophysics
- CPT and Installation of Vibrating Wire Piezometers by Direct Push
- Geologic Mapping
- Soil Drilling
- In-situ Geotechnical Testing
- Soil Sampling and Laboratory Geotechnical Testing
- Installation of Stand pipe piezometers
- Test Pitting
- Seep Characterization

Proposed locations for CPT, direct push piezometer, soil boring and stand pipe piezometer locations are shown on Figure 3-1. Note that all proposed activities are confined to already-disturbed areas. Locations may be modified based on field conditions and investigation results but will remain on previously disturbed areas.

Geologic field mapping of the area surrounding the four tailings dams will be conducted to better understand and define landslide and geologic features that have been noted in previous investigations. This information will be useful in adjusting soil boring locations that can characterize the native geologic profile underlying and surrounding the tailings dams.

Cone Penetrometer Testing (CPT) is a relatively quick and simple means of determining tailings density and pore pressure within the tailings, but it does not allow for collection of samples for subsequent laboratory analyses or for visual identification of material. Therefore, soil borings will be needed at select locations to obtain the samples for visual identification and laboratory testing. Due to the anticipated timeline to receive permits and the upcoming winter conditions, the intent is to conduct the CPT as soon as possible (Winter 2017) and possibly follow up with the soil borings in 2017. As the CPT's are being pushed into the tailings, a vibrating wire piezometer can be advanced into the tailings and remain in place to provide piezometric level readings after installation. These piezometers will monitor changes in the piezometric surface over time and could record changes due to spring runoff. This information will be important to develop a stability model of the tailings piles.

Soil borings will be used to confirm the results of the CPT investigation and collect undisturbed samples for geotechnical lab testing. Some of the borings will be selected to have stand-pipe
NOTES:
1. FINAL ACCESS TO BE BASED ON FIELD CONDITIONS.
2. EXISTING ROADS WILL BE USED WHENEVER POSSIBLE TO MINIMIZE DISTURBANCE.
3. CONSTRUCTION OF TEMPORARY ROADS IS NOT ANTICIPATED FOR ACCESS TO LOCATIONS OUTSIDE OF THE TAILINGS FOOTPRINT.
4. TEMPORARY ACCESS ROUTES WILL BE LOCATED TO MINIMIZE DISTURBANCE.
5. SNOW REMOVAL MAY BE REQUIRED.
piezometers installed to confirm water levels measured by the direct push piezometers and allow for sampling of groundwater to better estimate seepage flow paths and origins.

Test pitting will be used, were practical, to assess the functionality of the toe drain that was previously installed along the toe of the tailings dams.

Seepage has been identified downstream of the tailings dams and characterization of these seeps and surrounding soil can provide information on the origin of the seepage and functionality of the toe drain system.

In addition to the CPT and soil boring investigation, bulk samples of waste rock will be collected from the spoil piles located on the ground surface, along the existing road that provides access to the various adits. Samples will be collected by hand and transported to a laboratory for geochemical testing.

### 3.2 FIELD INVESTIGATION AREAS

Proposed locations for CPT probes, direct push piezometer installation and spoil-pile sampling are shown on Figure 3-1. Note that all proposed activities are confined to already-disturbed areas. Locations may be modified based on field conditions but will remain on previously disturbed areas.

### 3.3 GEOLOGIC MAPPING

Landslides have previously been mapped in the vicinity of the tailings dams. The depth and extents of the slide area has not been fully defined in the previous investigations. To estimate depth and extents of the slide area geologic mapping paired with soil borings and geophysical investigations are included as part of this investigation.

This portion of the investigation will be conducted by a trained geologist and need to occur when there is minimum or no snow cover. The geologist will confirm previous mapping and identify geologic features that can be used to select locations for additional soil borings and potential geophysics investigations.

### 3.4 GEOPHYSICAL INVESTIGATIONS

Geophysics testing will be used to better delineate geologic features at the Site. Historic landslide areas have previously been mapped, and geophysics may help to better define the depth and extents of these geologic features.

The geophysical program shall include the following investigation techniques:

- **Seismic Refraction Testing:** This non-destructive geophysical testing method shall be used to assess the thickness of overburden soils, the thickness of weak sedimentary deposits, and the depth to relatively sound, intact bedrock.

  Seismic refraction tomography will be used to define the top of rock, P-wave velocities ($V_p$), and multi-channel analysis of surface waves (MASW) will be used to evaluate lateral variations of S-wave velocity ($V_s$). Using results from sampling and laboratory testing, the
Vp and Vs results will be used to produce low-strain elastic moduli values for the soils and bedrock formations.

- **Electrical Resistivity Geophysical Testing:** This non-destructive geophysical testing technique employs an electrical source and a receiver to measure electrical resistance of the material between two probes. This resistance measurement can then be used to identify groundwater and/or may be correlated to different material types. Typically measurements made with this method should be used in conjunction with other methods to develop the interpretation of the data.

### 3.5 CPT INVESTIGATION

This section presents the equipment, rationale and procedures to be implemented using a Cone Penetration Test (CPT). Data collected during the CPT investigation will include the extent, consistency, moisture content and strength of the materials in and under the reclaimed tailings, and will be used to plan additional characterization work, as necessary.

#### 3.5.1 CPT Equipment and Procedures

A track-mounted rig will be used to advance the CPT probe through the entire tailings profile to native, or refusal. The equipment will measure the in-situ resistance, shear wave velocity which can be correlated to strength and saturation of the tailings and soils. Equipment will include the CPT rig and one support vehicle. The CPT subcontractor will comply with all safety standards and environmental regulations.

The CPT probe will be advanced into the subsurface at a constant rate to obtain a continuous profile of the tailings at each location. If the CPT probe encounters refusal, the rig may be moved 5 feet and the CPT probe advanced again until the estimated depth of tailings or refusal at that location is reached. Pore pressure dissipation tests will be performed as needed during the investigation, if it appears that pore pressures are increasing as the probe is being advanced. Shear wave velocity measurements will be performed using seismic CPT at 3 ft intervals.

CPT drilling displaces the material around the probe as it is advanced and does not generate cuttings or waste at the surface. At the completion of each CPT, any remaining void resulting from the probing will be filled from the bottom of the boring upward using a grout consisting of Portland cement and powdered bentonite, taking care not to disturb the surface. The location of each test will be collected with a GPS and marked with a survey stake.

#### 3.5.2 Proposed CPT Locations and Rationale

The proposed locations for the CPTs are shown in **Figure 3-1**. The locations were selected to represent typical sections through the tailings dams, to estimate the properties of the tailings material, and to identify the potential groundwater level and perched water within the tailings pile, if it is present. To demonstrate that the factors of safety have improved, it is necessary to demonstrate that the materials have consolidated and gained strength since the closure work performed in 1979.

Based on findings of the CPT program, soil borings through the tailings and foundation soils into bedrock may be necessary to fully characterize the Site. The results of this initial program will inform
the extent and location of any subsequent investigation. The results of the CPT program can also be useful during that future soil drilling program to indicate when continuous sampling should begin, where to perform in-situ tests and where to collect undisturbed samples.

3.5.3 CPT Data Collection and Evaluation Procedures
CPTs are used to obtain a continuous subsurface profile based on side friction resistance, cone tip resistance and pore water pressures. The CPT probe contains strain gages that measure friction forces, point forces and pore pressures continuously as the probe is advanced into the soil at a constant rate. Additionally, the CPT probe measures pore pressure dissipation and shear wave velocities at given intervals rather than continuously. Measurements made during pore pressure dissipation tests will be used to estimate permeability in the tailings. Shear wave velocities measured by the seismic CPT will be used to develop material properties for dynamic analysis. Digital information from the probe is transmitted to a computer located on the rig, where it is stored.

The tip and side friction resistance and pore pressure measurements are used to identify the material types encountered during the advancement of the probe. Established correlations will then be used to obtain soil index properties and strengths.

3.6 DIRECT PUSH PIEZOMETER INSTALLATION
Seepage from the drain beneath the buttressing fill along the exterior slopes of the tailings dams is collected in the toe drain and diverted to the mine water treatment plant for treatment. The installation of piezometers will help verify water levels and monitor seasonal fluctuation of groundwater within the tailings. These fluctuations could be the result of seepage through the tailings piles, percolation through the tailings cover, or other sources. The piezometer readings will be used to evaluate the slope stability and understand changes in water levels within the tailings dams.

3.6.1 Piezometer Equipment and Procedures
When a saturated zone is encountered during a CPT test, the same track mounted rig will use a special fitting on a mandrel to push a vibrating wire piezometer (VWP) to the desired depth. When the VWP is set at the desired depth, the mandrel is withdrawn leaving the piezometer in place. The void around the cable will be backfilled with a Portland cement and bentonite powder, and the cable will be left exposed at the surface.

The location will be marked by a survey stake, the depth below surface of the instrument noted, and the initial readings established. To minimize the intrusion of these instruments, the exposed cable will be coiled under a temporary protective cover and properly protected from the elements and moisture as required by the instrumentation. Plans for any permanent works would be presented in a subsequent work plan for consideration by the Forest Service.

3.6.2 Proposed Piezometer Locations and Rationale
Proposed locations for piezometers are shown on Figure 3-1. The locations may be modified in the field based on CPT results that identify saturated layers that could be monitored by the proposed piezometers.
3.7 SOIL BORINGS AND PIEZOMETER INSTALLATION

Soil borings will provide information on the in-situ properties of the tailings and underlying native material. Samples collected during drilling will also provide information to confirm the tailings properties from the CPT investigation.

3.7.1 Soil Boring Equipment and Procedures

Following completion of the CPT program, soil borings will be completed and geotechnical samples collected and analyzed in a geotechnical laboratory to confirm the results of the CPT and tailings properties reported during previous investigations. It is anticipated that a tire or track mounted drill rig using mud rotary or hollow stem auger drilling methods will be used to complete ten soil borings on the tailings piles. Equipment will include the drill rig, a pipe/water truck and one support vehicle. At the completion of each soil boring, the boring will be abandoned from the bottom of the boring upward using a grout consisting of Portland cement and powdered bentonite.

The borehole will be cased from the surface of the tailings pile to prevent sloughing or caving of the side walls. Representative disturbed samples will be collected at selected five-foot intervals by driving a split-spoon sampler using a calibrated hydraulic hammer or a wire-line slide hammer. Undisturbed samples will be collected in the native material at selected intervals by mechanically or hydraulically pushing a Thin-Walled Shelby Tube or other specialty samplers (piston samplers). SPT blow counts for the split spoon will be recorded on the soil boring log for each six-inch interval by the on-site geologist or engineer. The soil samples will target the native material that the tailings piles are founded on and any tailings slimes noted during the CPT program.

3.7.2 Proposed Soil Boring Locations and Rationale

Figure 3-1 presents the ten proposed locations of the soil borings for this phase of the investigation. Soil boring locations may change based on field conditions and CPT investigation results, but will remain on previously disturbed areas.

Geotechnical and field data collected from the soil drilling will be used to further characterize the tailings piles and the native material. Laboratory testing of the soil samples will include:

- Moisture Content (ASTM D2216)
- Unit Weight (ASTM D2937, D2216)
- Sieve Analysis (Gradation) (ASTM D 422)
- Atterberg Limits (ASTM D4318)
- Specific Gravity (ASTM D854, C127/C128)
- Triaxial Compression (Rock) (ASTM D2664)
- Direct Shear (ASTM D3080)

3.7.3 Standpipe Piezometer Equipment and Procedures

Standpipe piezometers are anticipated to be installed at selected borings drilled at the Site. Schedule 80 polyvinyl chloride (PVC) with an outer diameter (OD) of 2.5 inches will be used for the standpipe piezometer construction. It is anticipated that each standpipe piezometer will contain a 10 foot screened interval located at the bottom of the hole. However, the final placement and length of the...
The screen will be determined in the field after subsurface conditions have been reviewed. The piezometers will be constructed with 0.010-inch machine-slotted PVC screen and a blank PVC riser to the surface. PVC joints will be fitted with a rubber O-ring to minimize the potential for leakage. Permeable material will be installed using a tremie pipe from the bottom of the hole to approximately 5 feet above the screen to create a permeable envelope around the piezometer screen. The filter-pack grain size will be 20/40 sand. An approximately 5-foot thick bentonite seal, composed of hydrated bentonite chips, will be placed on top of the filter pack. A cement-bentonite grout (containing 2-3% powdered bentonite by weight) will be used to seal the remainder of the annulus above the bentonite seal to approximately 1 foot below ground surface. Surface completions will be a stickup steel casing with a locking lid set in concrete block. The concrete block will be set into the ground surface and the stick up portion of the well will be marked with a high visibility color.

Once installation is complete the standpipe piezometer will be allowed to sit for a minimum of 48 hours to allow the grout to cure and reduce the potential of damaging the bentonite seal or contaminating the filter pack with grout during development. The piezometers will then be surged using a surge block to remove fines from the well screen and filter pack. If the well is set in a formation high in clay or sludge, surging may not be performed due to the potential for pulling fine-grained material into the filter pack and plugging the screen. The field geologist will determine if surging will be appropriate after review of the subsurface conditions. Water will be removed from the boring using a downhole pump and groundwater quality measurements (specific conductivity, temperature, and pH) will be recorded at regular intervals, typically every 1 minute. Development will be complete once groundwater quality measurements have stabilized (repeat within 10% after three consecutive readings) and turbidity is recorded at less than 10 Nephelometric Turbidity Units (NTUs) after a minimum of 5 well volumes have been removed. In highly silty formations it may not be possible to achieve a turbidity of less than 10 NTUs during development, in which case development will be considered completed once water quality parameters have stabilized, including turbidity, after 5 well volumes have been removed. The following calculation will be used in determining one well volume:

\[
\text{Well Volume (V)} = \pi \times r^2 \times h \times (7.48 \text{ gal/ft}^3)
\]

Where: \( r \) = the radius of the piezometer PVC casing inner diameter in feet
\( h \) = the height of the water column in the well in feet
7.48 = Conversion factor from cubic feet to gallons.

Development water will be allowed to run-off onto the ground if there is not a risk of the water reaching Coal Creek prior to infiltrating into the subsurface. However, if it appears that development water has the potential of running off into Coal Creek, the water will be containerized and transported to the surge pond for treatment at the MWTP.

The selected soil borings that will be developed as a piezometer are shown on Figure 3-1.
3.8 TEST PITS

It is anticipated that a track mounted excavator capable of excavating to 12 feet below ground surface will be used to complete the test pits. The test pits will be located as close to the toe drain as feasible and proposed locations are shown on Figure 3-1. It is important not to damage the drain pipes during the test pit excavation, so the as-built drawings will be used to survey and stake the location of the pipe prior to trenching, and the presence of trench fill material (gravel) will indicate when the test pits are within the drain.

Material from the trenches will be excavated in approximately 1 to 2 foot lifts using the excavation bucket. Material excavated from the trench will be placed a minimum of 5 feet away from the side of the trench to prevent the trench side walls from caving. The trenches will be backfilled in the approximate order the material was removed. The material placed back in the excavation will be compacted with the excavation bucket to the extent possible. Each trench will be completed in one day and will not be left unattended or open at night. Photographs will be taken to document the trenches, type of material remove and the backfilling of the trenches. The trench sidewall will be logged by a geologist.

Due to the wet and possibly unstable conditions of the toe drain, workers will not be allowed to enter an excavation deeper than three feet unless the excavation is properly supported or the sides laid back.

3.9 SEEPAGE INVESTIGATIONS

Seepage has been observed downstream of the tailings dams. The seeps immediately downstream of the tailings dams will be mapped by an environmental scientist in the spring. Soil may be sampled for pH from adjacent native soil and soil within the seep area. Water samples will be collected from the seepage and tested for water quality. Characterization of these seepage and surrounding soil can provide information about the origin of the seepage and provide details for additional investigations, if needed.

3.10 SURFACE SOIL SAMPLING

Surface samples from the spoil piles at each adit will be gathered using hand tools. The purpose of these samples is to characterize the geochemical properties of spoil material which may act as a source of the contaminants of concern to surface water quality. Approximately 1 kg of material will be gathered from each location taking care to disturb the surface as little as possible. The approximate sample locations will be identified and recorded using a GPS instrument.

3.10.1 Sample Frequency, Designation, and Analyses

Three samples will be collected from each major spoil pile and logged, including ASTM D 2488-06. Each sample will be assigned a unique identifier, labeled and bagged. A photograph of each sample as well as the sample location and setting will be saved for the report.

Each sample will be examined to identify the predominant rock type(s) and shipped to the laboratory for Synthetic Precipitation Leaching Procedure analysis in accordance with ASTM D 6234.
3.11 FIELD DOCUMENTATION

Observations and documentation of field activities made during the field investigation will be entered directly into field logbooks and on project-specific field forms. Field forms applicable to this project include: Tailgate Safety Meeting Forms and Daily Field Reports. Sample field forms are provided in Appendix A in this work plan. The field logbook will be maintained throughout all field activities and will be a weatherproof, bound survey-type book, with non-removable, numbered pages. All data generated during the investigation and any deviations from the work plan will be recorded in detail in the field logbook. All field documentation shall be accurate, legible and written in indelible black or blue ink. Incorrect entries in the field books, logs, or on forms that need to be deleted will be crossed out with one line, initialed, and dated. At a minimum, the date, weather conditions, personnel on site, type of activities being performed, and any unusual conditions encountered during the investigation will be recorded in the logbook.

In addition to written records, the investigative efforts will be documented with photographs. Photographs will be taken as necessary to supplement written descriptions of field activities entered in the field logbook and on field forms.

Each CPT and soil boring location will be marked using a hand held GPS unit and a wooden lathe labeled with the corresponding location identification number. At the completion this investigation, CPT, Vibrating Wire Piezometer, soil boring, stand pipe piezometer, test pit soil sample locations’ northing, easting and elevations will be surveyed.

Daily Field Reports (DFR) will be prepared by the MWH field coordinator each day that field work is performed. DFRs will summarize daily activities and note work performed, the individuals performing the work, problems encountered and corrective actions taken. The report form is included in Appendix A.

3.12 MOBILIZATION / DEMOBILIZATION

All personnel and equipment will be mobilized to the Site by each contractor. The primary equipment utilized to complete the tasks associated with this work plan includes the following:

- GPS equipment and associated marking and flagging tools;
- CPT equipment, consisting primarily of the CPT rig;
- Direct Push Piezometers and associated cables;
- Drilling equipment, mud rotary or hollow stem auger drill rig;
- Stand-pipe piezometer equipment; and
- Miscellaneous tools and supplies.

Specific requirements may be modified for equipment, supplies, personnel, and/or materials used to complete each of the tasks described below, based on actual conditions encountered.
3.12.1 Equipment Decontamination Program

The CPT and soil boring equipment will be thoroughly decontaminated by the subcontractors prior to mobilization to the Site and before demobilization from the Site at the end of the investigative efforts.

If needed, a portable steam-cleaner will be used to decontaminate the excavation and drilling equipment during the project and at the end of the investigative efforts. Water for the steam-cleaner will be obtained from the water treatment plant or an approved potable water source. All fluid generated during decontamination will be discharged to the existing storage pond for treatment.

3.13 SUMMARY REPORT

After the field activities have been completed a Report will be prepared including CPT logs, soil boring logs, piezometer development logs, field notes, photographs, laboratory results and a summary of findings and recommendations. This report will be submitted to Mt. Emmons.
4 SCHEDULE AND LOGISTICS

The anticipated schedule for the tailings investigation is to begin with geophysics surveys one week in early February 2017, pending USFS approval and weather permitting. The CPT investigation would be completed concurrently or immediately following the geophysical surveys. The track-mounted rig can negotiate snow-covered terrain should the conditions at the Site require it. Drilling activities and stand pipe piezometer installation would be planned after the completion of the CPT investigation. This activity would be scheduled based on weather and site access. Geologic mapping, test pitting and seep characterization will occur in the spring after the Site is clear of snow, potentially late June or early July 2017.

All equipment will traverse the Site in a manner that minimizes surface disturbance. Personnel will be housed in commercial accommodation in Crested Butte or nearby. Water, sanitation and waste disposal services will be provided from the existing water treatment plant by Mt. Emmons.

The MWH Field Task Manager and the Project Manager may stop the work at any time based on weather and/or safety considerations. The Field Task Manager and the Project Manager will coordinate with Forest Service, so that project objectives are met in an expeditious manner while following all health and safety protocols.
5 REFERENCES


APPENDIX A

FIELD FORMS
**SOIL BORING / LITHOLOGY FORM**

**SOIL BORING**
- Total Boring Depth (feet):
- Depth Refusal:
- Borehole Diameter (inches):
- Borehole Angle Drilled:
- Borehole Azimuth (degrees on compass):
- Cumulative Feet Drilled:
- Drill Method:

**BORING LOCATION**

**LOCATION DESCRIPTION**

**LITHOLOGIC DESCRIPTION**

(USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)
<table>
<thead>
<tr>
<th>DEPTH (Ft)</th>
<th>Grain Size</th>
<th>LITHOLOGIC DESCRIPTION</th>
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<td></td>
<td>(USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)</td>
</tr>
</tbody>
</table>
MONITORING WELL DEVELOPMENT

DATE: ____________________    WEATHER: ____________________
WELL DESIGNATION: ________________    PROJECT NO: ________________
FIELD PERSONNEL: ________________    SUBCONTRACTOR: ________________

WELL SUMMARY:
Depth to NAPL: ____________________
Depth of water: ____________________
Total well depth: ____________________
Construction: ____________________

Start Time ___(a)    End Time ___(b)
Total Time ___(b-a)

LOCATION MAP

Location Map

INSTRUMENTATION
pH meter (model): ________________    Calibrated with buffers: ___4 ___7 ___10
SC meter (model): ________________    Calibrated with standard solution: _________ μmhos/cm
Turbidity meter (model): ________________    Calibrated with: ________________

DEVELOPMENT SUMMARY:
Development method: Bailier _______    Pump (type) _______    Surge Block (type) _______

5 purge volume calculation: ________________

<table>
<thead>
<tr>
<th>Time</th>
<th>pH</th>
<th>SC (μmhos/cm)</th>
<th>Temp (°C)</th>
<th>Turbidity (NTU)</th>
<th>Pumping Rate</th>
<th>Gals. Evacuated</th>
<th>Visual Appearance/Comments</th>
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Final

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<th>pH</th>
<th>SC (μmhos/cm)</th>
<th>Temp (°C)</th>
<th>Turbidity (NTU)</th>
<th>Pumping Rate</th>
<th>Gals. Evacuated</th>
<th>Visual Appearance/Comments</th>
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**Date**  
Click here to enter a date.

**PROJECT:**  
**JOB NO:**  
**CLIENT:**  
**CONTRACTOR:**  
**PROJECT MANAGER:**

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<tr>
<th>Weather</th>
<th>☐ Bright Sun</th>
<th>☐ Sunny</th>
<th>☐ Over-cast</th>
<th>☐ Rain</th>
<th>☐ Snow</th>
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</thead>
<tbody>
<tr>
<td>Temp. °F</td>
<td>☐ &lt;32</td>
<td>☐ 32-50</td>
<td>☐ 50-70</td>
<td>☐ 70-85</td>
<td>☐ 85-100</td>
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<tr>
<td>Humidity</td>
<td>☐ Dry</td>
<td>☐ Moder.</td>
<td>☐ Humid</td>
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### Onsite Personnel

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<tr>
<th>Name</th>
<th>Company</th>
<th>Position</th>
<th>Remarks</th>
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### Equipment

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<tr>
<th>Item</th>
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<th>Op Hrs</th>
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<tbody>
<tr>
<td>None</td>
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### Safety:

No incidents reported

### Activities Summary:

List activities performed, tasks started/completed, production, etc

By: ___________________________  Title: ___________________________