

# APPENDIX K

## Physical Monitoring Plan

# REPORT

## Physical Monitoring Plan

### Coffee Gold Mine

**Prepared for:**

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## REVISION TRACKING LOG

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## LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
CDA	Canadian Dam Association
DEM	Digital Elevation Model
GPS	Global Positioning System
HLF	Heap Leach Facility
HLF OMS	Heap Leach Facility Operations, Maintenance, and Surveillance Plan
LDRS	Leak Detection and Recovery System
LOM	Life of mine
Masl	Meters above sea level
ML	Machine-learning
NAR	Northern Access Route
ODF	Overliner Drain Fill
OMS	Operations, Maintenance, and Surveillance
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
ROM	Run-of-mine
SAR	Synthetic Aperture Radar
TDR	Time Domain Reflectometry
TLS	Terrestrial Laser Scanner
WRSF	Waste Rock Storage Facility

## LIST OF SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
m	metre
Mt	million tonnes
t/d	tonnes per day

## 1.0 INTRODUCTION

Construction, operation, and closure of the Project will result in the development of project infrastructure and mine workings whereby any deviation from design intentions may affect the physical performance of key project infrastructure and mine workings. This Physical Monitoring Plan (the Plan) is intended to identify and demonstrate an early detection system of ground movement and performance of Project facilities and structures to help inform management of the potential for any physical stability-related adverse effects to the environment and help identify measures that will be undertaken to control physical stability of Project-related structures and facilities.

This plan describes the physical monitoring for the Coffee Gold Project (the Project). Physical monitoring refers to the monitoring of the physical performance of key mine infrastructure and mine workings. The mine site general arrangement is presented on Figure 1-1. This plan describes physical monitoring across the Construction and Operations phases of the Project. Physical monitoring during the Closure, and Post-closure phases is discussed in the Reclamation and Closure Plan. Data collected by the physical monitoring program will inform management of mine infrastructure and contribute to confirming design assumptions. This plan details three types of physical monitoring: routine monitoring and inspections, annual inspections, and event-driven inspections.

This plan reflects the current understanding of the mine plan, and includes a description of the monitoring methods, locations, and frequency, as well as procedures and Quality Assurance/Quality Control (QA/QC) protocols. In addition, it outlines some key considerations for implementation. This Plan will be updated periodically as mine planning and development proceed.

Reference material used in the preparation of this plan includes:

- Quartz Mining License Application Guide, Yukon Government Department of Energy, Mines and Resources, 2010
- Plan Requirement Guidance for Quartz Mining Projects, Yukon Water Board, 2013.

This plan is subject to regular updates as mine design, construction activities and mine operations progress, and as monitoring results are collected and evaluated.

# COFFEE GOLD MINE

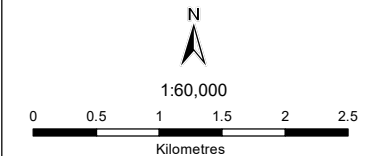
## General Arrangement - Mine Site

### Legend

- Double Double Pit
- Kona Pit
- Latte Pit
- Supremo Pit

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Contains information licensed under the Open Government Licence - Yukon Territory
3. Inset Basemap: ESRI World Topographic Map



NAD 1983 UTM Zone 7N

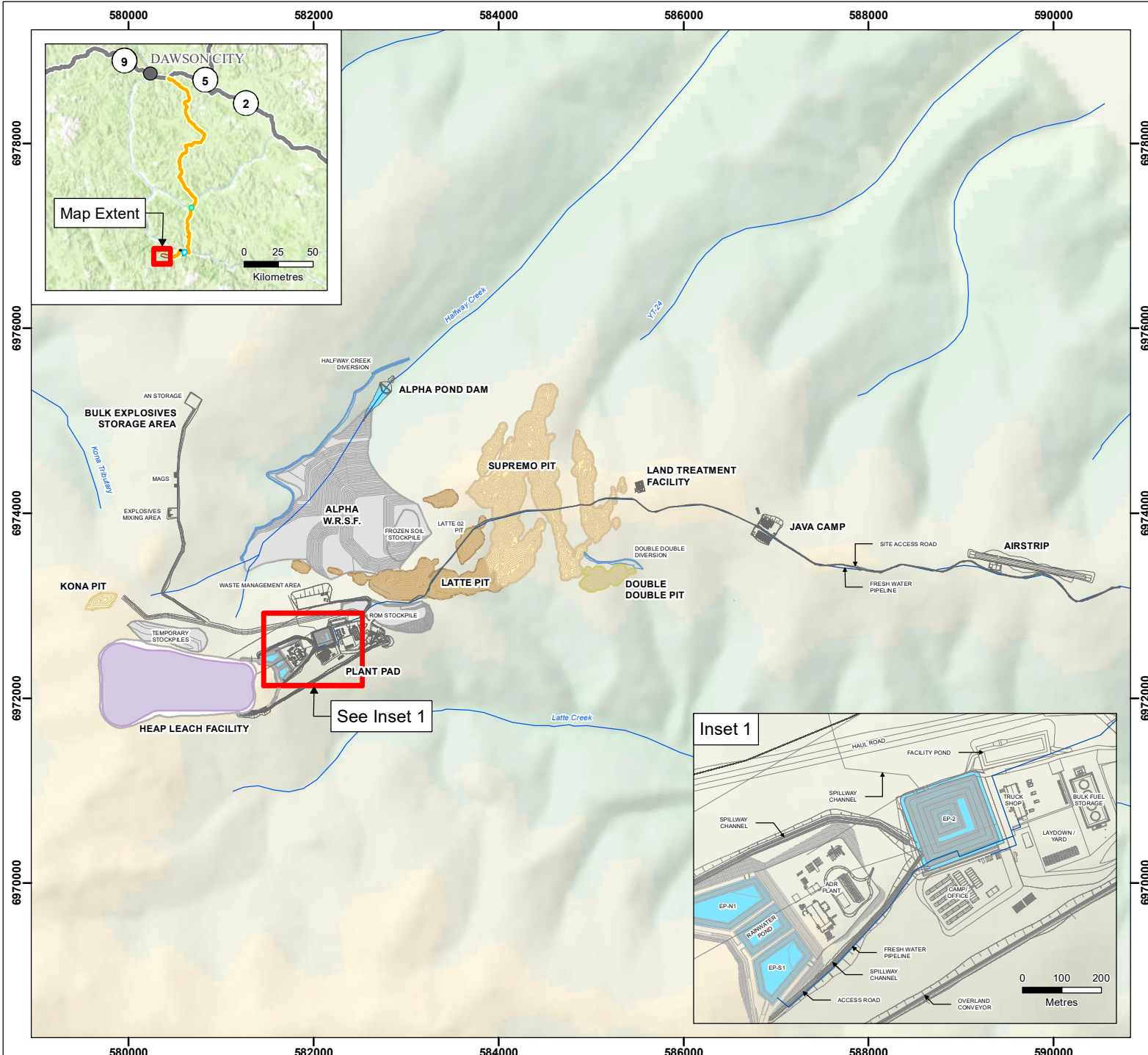
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Figure 1-1

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Oct 6, 2023

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CH



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## 1.1 Objectives

The objectives of the monitoring and inspections conducted per this Plan are to:

- Assess/confirm compliance with design parameters and engineering standards.
- Guide management of mine infrastructure in a way that promotes human health and safety and reduce potential adverse effects to the environment.
- Provide opportunities to verify and refine design assumptions for mine infrastructure during the construction and operations phases.

While this Plan can be reviewed in isolation to inform a review of the specific actions for physical monitoring, this plan should be viewed in concert with the following additional management plans in order to attain a holistic understanding of the Project:

- Access Route Construction Management Plan
- Access Route Operational Management Plan
- General Mine Development Plan
- Heap Leach and Process Facilities Plan
- Mine Operations Plan
- Waste Rock and Overburden Management Plan
- Water Management Plan
- Sediment and Erosion Control Plan.

## 2.0 OPEN PITS

Open pit slope monitoring will be conducted to provide a mechanism for early detection of ground movement. Pit slope monitoring results will be used to assist mine management planning, and to indicate when actions are required to minimize the effects of slope failure to the overall mine plan. Early detection of pit slope failure can also help identify and implement follow-up monitoring requirements at targeted locations and can play a substantial role in final pit slope design implementation.

Prior to mining activity, data collected from previous drilling, geologic pit mapping, laboratory testing of rock properties, and any past history of instability will be used to identify areas of adverse geology with risk of slope instability and will be used to inform the pit slope monitoring program. As detailed engineering and pit slope designs progress and as site specific data becomes available, this Plan will be updated to present a comprehensive pit slope monitoring program aimed at managing potential large-scale instabilities and detection of local-scale movements using a combination of sub-surface and surface methods.

### 2.1 Methods

Initial pit slope monitoring will primarily consist of visual inspections that would occur daily during operations, as well as photographic records, provided safe foot access can be maintained to all berms. The visual inspections will be supported by instrumentation that can be operated remotely for areas that cannot be accessed safely by foot to provide a quantitative basis for defining any movement. The selection, location, operation, and maintenance of some of the more advanced monitoring instrumentation will be dependent on site-specific conditions of the mine and will be expected to reflect an understanding of the variation in the performance of various mine slopes and site ground conditions. As such, this plan will be refined as site conditions demand. A brief outline of some examples of common types of pit slope monitoring methods that may be employed at the site are presented in Table 2-1.

Future iterations of this plan will also include details of instrument installation for slope monitoring which will be supported by professional judgment, experience, and technical support. As the monitoring instrumentation is installed, installation records will be kept and will include, at a minimum, the following information:

- Area
- Station ID
- Latitude (°N)
- Longitude (°W)
- Elevation (masl)
- Date Installed.

**Table 2-1 Pit Slope Monitoring Method Examples**

Type of Monitoring	Description
<b>Sub-surface Monitoring</b>	
Inclinometers	Used to detect lateral displacements and shear planes in excavations and slopes.
Time Domain Reflectometry (TDR)	A technique in which electronic pulses are sent down a length of a coaxial cable. When deformation or a break in the cable is encountered, a signal is reflected giving information on the sub-surface rock mass deformation. These devices detect the location, but not the magnitude, of deformation in a drill hole.
<b>Surface Monitoring</b>	
Visual Inspection	Pit perimeter walk occurring daily, inspecting all access methods, high walls and crests, possibly risky working areas; emphasis on identifying new, visible movement or cracks.
Geodetic Surveys	Can be used to determine the absolute position and positional variations of selected points on the surface of a pit slope in one to three dimensions. A combination of instruments can be used to collect field data. Examples of survey instruments include, but not limited to, levels, Theodolites, total stations, GPS receivers, photogrammetric cameras, slope stability radar.
Cross-crack Measurements	Tension cracks at slope crest may be first sign of instability; when cracks first appear, monitor their length, widths, and vertical offsets.
Imaging	Photographic record, photogrammetry, satellite-based positioning techniques, high-resolution drone imagery
Ground-based slope stability radar interferometry	Type of ground radar that can be used to create terrain maps, to yield high class digital elevation models (DEM) and to discover surface disturbances
Satellite-based radar interferometry	Synthetic aperture radar (SAR), which can measure small movements of land masses from satellites
Wireline extensometers	Portable telemetry wireline extensometers can be used to provide real-time monitoring in areas of active instability.
Microseismic emissions	Yields three-dimensional quantitative information about the state of the slope; Seismic movements of known geological structures within the slope can be recorded and potentially used to assess trends in relative stability.
Laser scanning	Terrestrial laser scanners (TLS) provide fast, efficient, detailed, and accurate three-dimensional data. The laser scanner uses laser light to measure the distance from the sensor to the object in a systematic manner. TLS cover a wide range of applications, including topographic mapping, as-built and architectural studies, and monitoring of engineering structures.

## 2.2 Locations and Frequency

Initial visual pit slope monitoring will be carried out at the Kona, Latte, Double Double and Supremo pits within active mine areas, along high walls, and crests, within high-risk zones, and at all pit access points. Additional monitoring locations may be added as needed based on the conditions encountered in the field as the pit develops as well as to meet the intent of the monitoring. Once photo point locations are established, details for each photo point location will be provided as a visual aid in this Plan.

Frequency of pit slope monitoring will be determined by the geotechnical engineer and will be updated as needed. The required timing and frequency of inspections of areas of instability will be informed by an assessment of geotechnical risk arising from:

- Existing instabilities that continue to expose people, property, or production to potential hazard.
- New instabilities that develop from mining activity and which have the potential to expose people, property, or production to hazard.
- Reactivation of a pre-existing instability after a period of inactivity with the potential to expose people, property, or production to potential hazard.

## 2.3 Data Analysis

Pit slope monitoring results will be gathered in various formats such as logbooks, electronic logbooks, spreadsheets, hardcopy, and database formats. Numeric data will be stored in a numeric database and spatial data will be maintained in a spatial database. Pit slope monitoring results will be incorporated into a structural database for slope stability analysis during open pit mining. Data will be analyzed by a qualified professional and may include, but not limited to, the following:

- Type and location of monitoring stations installed
- Comparison with previous results
- Tabulation or graphical representation of monitoring data
- Trend analysis
- Summaries of data
- General summary monitoring results/concerns/actions taken.

### **3.0 WASTE ROCK STORAGE FACILITY, PIT BACKFILL, AND STOCKPILES**

Ongoing inspection of excavation, transport, and stockpiling of materials will be carried out as part of site-wide monitoring of the performance of all civil works during construction. Monitoring will continue through mine operations and closure, as well as throughout potential temporary closure scenarios. Geotechnical monitoring of the Alpha WRSF, pit backfill, and soil stockpiles will be implemented for early detection of stability issues or identification of conditions outside of design parameters for these facilities that could result in stability issues, and thus allow for early implementation of corrective actions.

In addition, the composition of the materials in the Alpha WRSF, frozen soil stockpile area, and organics and overburden stockpiles will be documented so that the design of the proposed closure cover systems can be advanced to best utilize the actual properties and quantities of available material.

The WRSF and stockpiles geotechnical monitoring program will be implemented in conjunction with the Erosion and Sediment Control Plan and will be updated as detailed designs progress, monitoring methods are refined, and monitoring locations identified.

#### **3.1 Methods**

Geotechnical inspections are completed for active waste dump areas, areas where personnel are required to work on day shift or the following night shift, and upcoming waste dump areas in the monthly plan to ensure that:

- Waste dump performance is assessed
- Areas of potential instability are identified, and remedial actions investigated, assessed, and planned
- Design specifications are met with respect to correct windrow and tip head height
- Observations and actions from the inspections are documented.

The Alpha WRSF, frozen soil stockpile area, pit backfill, and overburden stockpiles monitoring will be primarily conducted via daily visual inspections and will also include various types of instrumentation. Instrumentation monitoring (piezometer readings) will be taken monthly between freshet to the end of the summer season. The threshold warning levels (triggers for action) will be determined following completion of the instrumentation installation and will consider stability analysis results. An overview of the geotechnical instrumentation that may be used is presented in Table 3-1.

**Table 3-1 WRSF, Stockpiles, and Backfill Monitoring Instrumentation Overview**

Instrumentation	Description
Survey hubs	Survey hubs are used to monitor surface movement of structures and are comprised of steel posts cemented into waste rock or bedrock and equipped with a threaded base to which a high precision RTK-corrected GPS instrument is attached. For the Alpha WRSF, the crest and toe of the facility will be surveyed at the completion of each construction lift to compare the as-built geometry to the design surface and to monitor for any deformations within previous lifts. Any significant deviations that could affect dump stability will be brought to the attention of the responsible geotechnical engineer for further evaluation.
Inclinometers	Inclinometers are used to measure lateral, differential ground movement in a borehole. Inclinometer stations consist of grouted, slotted Polyvinyl Chloride (PVC) pipe into which the inclinometer probe is lowered, and deflection is measured at set intervals.
Thermistors	Thermistor strings are used to measure ground temperature profiles in boreholes, and in particular permafrost conditions. Thermistor strings consist of multiple temperature sensor nodes distributed along a single multi-conductor cable, installed within or attached to the outside of grouted PVC pipe.
Piezometers	Vibrating wire piezometer strings are used to measure pore water pressure profiles in boreholes. They consist of multiple vibrating wire sensors installed on PVC pipe in grouted boreholes. For the Alpha WRSF, the piezometers will be installed in natural ground immediately within the toe of the facility. The final location of the piezometers will be determined upon finalization of the dump designs and be determined by a qualified geotechnical engineer.

The operator will be trained to identify any signs of cracking at or near the dump crest through daily visual inspections. On a monthly basis, visual inspections will be expanded to include:

- External slopes for any signs of distress
- Dump and bench toes for any signs of sloughing, deformation, or seepage.

Construction QA/QC plans will be developed prior to the commencement of construction to ensure that the parameters used during the design process are achieved, and this plan will be updated accordingly. The site development contractor will prepare a construction QC plan, and Newmont will implement an independent QA inspection and testing program during mine activities that will include, at a minimum, the following components:

- Daily photographic records of construction activities
- Daily field notes documenting the performance of excavations and material types being excavated
- Monitor the visible ice and total moisture content of excavated material
- Determine the particle size distribution of excavated material
- Determine the type of excavated material, and direct excavated material to the appropriate area in the frozen soil storage area or soil stockpiles
- Ensure regular survey control during material placement in the storage areas

- Keep daily records of material volumes that are excavated, transported, and stockpiled
- Conduct a daily visual assessment of the state of the storage areas.

### **3.2 Locations and Frequency**

Specific monitoring and instrumentation locations will be established as determined by a geotechnical engineer and will be provided for the Alpha WRSF, pit backfill, and for all stockpile areas in future iterations of this Plan.

Frequency of monitoring for each instrumentation station and inspection type will be provided in future iterations of this Plan, as mine planning advances. The Alpha WRSF will be inspected at regular intervals, depending on work activities and field observations. All active dump faces will be inspected each shift by operators via a workplace inspection, or more frequently during a shift as conditions change.

### **3.3 Data Analysis**

Engineering, survey, and operational staff within the areas of the WRSF, pit backfill, and soil stockpiles will be trained to look for, and be able to recognize, signs of instability as described in the *Mined Rock and Overburden Piles Operating and Monitoring Manual* prepared by the BC Mine Waste Rock Pile Research Committee (1991). Written records of routine inspections shall be maintained as a permanent record at the Mine Site. Specific methods for data analysis will be provided in future iterations of this Plan.

## 4.0 HEAP LEACH FACILITY

Monitoring of the HLF will be conducted as described in the Heap Leach Facility Operations, Maintenance, and Surveillance Plan (HLF OMS) for the Coffee site and will include but not limited to the heap leach pad and pond liners, stacked leach ore, HLF infrastructure, Events Pond and Leak Detection and Recovery System (LDRS).

Construction and monitoring of the HLF will include a comparison to designs to ensure that the facility is constructed as designed, and to provide early warning of problematic conditions. Any deviations from design or unusual occurrences observed during the completion of the routine surveillance activities will be documented and communicated to the Process Manager and the Process General Foreman for assessment and development of an appropriate course of action. The Process Manager will immediately notify the Engineer of Record of any observation that has the potential to impact the stability of the HLF. If deemed necessary, appropriate procedures will be implemented as outlined in the HLF WMP, HLF Emergency Response Plan, or as directed by the Engineer of Record.

### 4.1 Methods

Regular visual inspections of the HLF will be conducted as described in the HLF OMS. The visual inspections are done for all components of the HLF, including the visible portions of the leach pad liner; leach pad embankment; stacked ore pile; accessible portions of the solution delivery and collection system including pipelines, drip emitters, pumps, tanks, and other support facilities; conveyors, radial stacker; the Events Ponds, Rainwater Pond, and instrumentation as appropriate. The LDRS monitoring sumps are checked daily for the presence of solution.

Regular visual inspections of the event pond embankments will be conducted. The following are items are examined during these inspections:

- evidence of settlement or subsidence on the embankment crest or slope
- evidence of cracks or erosion on the embankment slope
- bulging on the downstream slope which could indicate leakage
- evidence of animal burrows or unusual vegetation patterns on the dam.

Monitoring of the HLF will also include instrumentation for measuring phreatic levels and pore pressures within the heap foundation through installation of horizontal piezometers. Comprehensive details regarding HLF monitoring methods for the HLF components are presented in the HLF OMS, and a summary of the monitoring methods are provided in Table 4-1.

**Table 4-1 Heap Leach Facility Example Instrumentation Locations**

HLF Component	Instrumentation
Heap leach pad	Instrumentation (horizontal piezometers) for measuring phreatic levels and pore pressures
Ponds	Level gauge to allow monitoring of solution levels
LDRS	Flow meter located between the top and bottom liners

## 4.2 Locations and Frequency

Monitoring instrumentation will be installed within the Overliner Drain Fill (ODF) of each stage of the HLF, and surveillance of various additional components of the HLF will be conducted as detailed in the HLF OMS. Routine surveillance areas and frequencies for the HLF are summarized in Table 4-2. During high water times (e.g., spring freshet, high rainfall, and flood events), daily or more frequent surveillance is undertaken to ensure the safe operation of pumping systems and/or spillway operations.

**Table 4-2 Surveillance Requirements for the HLF**

Surveillance	Frequency	Responsibility
Pad Liner	Weekly	Process General Foreman or alternate
Stacked Leach Ore	Weekly	Process General Foreman or alternate
Solution Collection and Recovery System	Weekly	Process General Foreman or alternate
Leak Detection and Recovery System Monitoring Ports	Daily	Environmental Superintendent
Heap Leach Pad Vibrating Wire Piezometers	Daily during freshet or when unequal inflow and outflow is present, weekly otherwise	Environmental Superintendent
Monitoring Vault	Weekly	Environmental Superintendent
Event Pond Fluid Levels	Daily if desired storage has been reached and weekly otherwise	Environmental Superintendent
Event Pond Liners	Weekly	Environmental Superintendent
Conveyors and Radial Stacker	Monthly	Crushing and Conveying Supervisor
HLF Inspection by Engineer	Annually	Engineer of Record
Independent Third-Party Physical Stability Inspection	Annually	Engineering Consultant
Event Driven Inspection	Following unusual events (e.g., Freshet, heavy precipitation, earthquake)	Process, Maintenance, Health, Safety, and Environmental Managers
Comprehensive Review	Within 5 years after construction and prior to decommissioning	Engineering Consultant
Instrumentation	Monthly or per Manufacturer Guidelines	Instrumentation Technician
General Visual Inspection of the HLF Components and Event Ponds	Daily during the completion of standard work procedures	Process, Maintenance, Health, Safety, and Environmental Managers

As HLF stages are constructed, monitoring locations will be identified and instrumentation installation details recorded, including, but not limited to:

- Monitoring station ID
- Northing (m)
- Easting (m)
- Elevation
- Azimuth
- Hole Depth (m)
- Installation date.

### **4.3 Data Analysis**

Data analyses will include evaluations of the HLF geotechnical monitoring results using plots of data versus time (e.g., for level gauges, piezometer, monitoring vault readings). The intent of the data analysis will be to examine trends over time and to monitor for HLF adaptive management triggers. The data will continue to be plotted as recorded and documented in monthly and annual reports. Additional details regarding physical monitoring data analysis for the HLF are provided in the HLF OMS.

## 5.0 WATER MANAGEMENT INFRASTRUCTURE

Physical monitoring of the water management infrastructure will be undertaken to verify the integrity and stability of conveyance and storage structures at the mine site. This section discusses the key monitoring locations, frequencies, and reporting methods for water management infrastructure. A detailed physical monitoring program will be developed as the Project progresses.

Water management infrastructure will be inspected upon completion of construction. Results will be compared to design reports to ensure that the structures are consistent with designs and are operating within the expected range of performance parameters. A construction QA/QC plan will be developed as part of detailed engineering and will include considerations for monitoring deformation from permafrost degradation.

It is expected that design reports will be developed for water management infrastructure. Accordingly, this Plan will be updated based on guidance within the design reports. Water management infrastructure at the site will include:

- Alpha Pond
- Halfway Creek Diversion
- Double Double Diversion
- Facility Pond
- Road ditches.

Monitoring of the HLF water management structures is discussed within the HLF OMS.

### 5.1 Methods

Water management infrastructure physical monitoring will follow applicable OMS Manuals developed for specific water management infrastructure. All conveyance structures (drainage ditches, collection channels) and sedimentation ponds and their dams will be inspected for signs of following:

- Stability (slumping or failure)
- Deformation
- Signs of seepage
- Blockage due to ice or foreign debris
- Erosion or damage to any geosynthetic components
- Displacement of riprap.

Preliminary assessment of the dams (including preliminary dam break modelling and inundation mapping) classified these structures as “Significant” under the Canadian Dam Association Dam Safety Guidelines (CDA 2007, Revised 2019). Monitoring of all dams will take place by a qualified professional in accordance with the requirements of the CDA guidelines.

## 5.2 Locations and Frequency

The facilities of interest for water management infrastructure physical monitoring and the parties responsible for monitoring depend on the phase of mine life. Additionally, the frequency with which monitoring is conducted will be determined on an individual facility basis. Table 5-1 presents a summary (high level overview) of all physical monitoring requirements over the life of mine.

**Table 5-1 Physical Monitoring Location and Frequency Summary**

Phase	Year	Facility	Frequency	Responsible Party
Construction	-3 to -1	<b>Sedimentation and Storage Ponds:</b> Alpha Pond and Facility Pond, HLF Event Ponds	Daily- during open water seasons	Engineering & Environmental Departments
		<b>Conveyance Structures:</b> Halfway Creek Diversion Channel, Double Double Pit Diversion, Haul Road Ditches, Access Road Ditches	Daily- during open water seasons	Engineering & Environmental Departments
Operations	-1 to 9	<b>Sedimentation and Storage Ponds:</b> Alpha Pond and Facility Pond, HLF Event Ponds	Weekly- during open water seasons Monthly – survey checks	Surface Superintendent & Environmental Monitoring Staff
		<b>Conveyance Structures:</b> Halfway Creek Diversion, Alpha WRSF Perimeter Ditches, Double Double Pit Diversion, Haul Road Ditches, Access Road Ditches	Weekly - during open water seasons Monthly – survey checks	Surface Superintendent & Environmental Monitoring Staff
Post-mining Closure	10 to 15	<b>Sedimentation and Storage Ponds:</b> Alpha Pond and Facility Pond, HLF Event Ponds	Weekly- during open water seasons for 2 years then monthly for remaining 4 years	Engineering & Environmental Departments
		<b>Conveyance Structures:</b> Halfway Creek Diversion, Alpha WRSF Perimeter Ditches, Double Double Pit Diversion, Haul Road Ditches, Access Road Ditches	Weekly- during open water seasons for 2 years then monthly for remaining 4 years	Engineering & Environmental Departments
Active Closure	16 to 21	<b>Sedimentation Ponds:</b> Alpha Pond and Facility Pond	Monthly- during open water seasons	Engineering and Environmental departments
		<b>Conveyance Structures:</b> Halfway Creek Diversion, Alpha WRSF Perimeter Ditches, Double Double Pit Diversion, Haul Road Ditches, Access Road Ditches	Monthly- during open water seasons	Engineering and Environmental departments

Decommissioning of all water management infrastructure will occur at near the end of the Active Closure Phase. Therefore, the Post-closure Phase will not require any physical monitoring for its duration, which begins in year 21 and continues indefinitely.

As specific monitoring locations are established, they will be documented and included in future iterations of this Plan.

### **5.3 Data Analysis**

Water management infrastructure monitoring data will be analyzed in accordance with applicable OMS plans. Checks and analyses will be ongoing; however, an overview of the physical data compilation, analysis, and corresponding checks will be documented once a year and included as part of the annual geotechnical inspection reporting.

## 6.0 PERMAFROST

Comprehensive permafrost monitoring and management details are presented in the Permafrost Monitoring Program Report (Tetra Tech 2022) and are summarized in this Plan. Permafrost is delineated based on temperature, whereby ground is perennially frozen, with soil or rock that remains at or below 0°C for at least two consecutive years (NRCC 1988). The permafrost monitoring program is intended to monitor project-related impacts on permafrost.

### 6.1 Previous Work

Numerous geotechnical field investigations and desktop studies have been completed in the Project area since 2011. Programs most relevant to the permafrost monitoring program include but are not limited to the following: (Tetra Tech 2022):

- 2011 Ground Truthing Program (AECOM 2012)
- 2015 Geotechnical Field Investigation Sonic Drilling Program (SRK 2016)
- 2015 Terrain Stability Field Investigation (PECG 2016)
- 2015 Environmental Baseline Study, the Project Area: Surficial Geology, Permafrost and Terrain Stability (Tetra Tech 2016a)
- 2016 Permafrost and Related Geohazard Mapping of the Coffee Mine Site Study Area (Tetra Tech 2016b)
- 2016 Geotechnical Site Investigation: Diamond Drilling with Chilled Drilling Fluid Program (Tetra Tech and SRK 2017)
- 2017 Geotechnical Site Investigation: Diamond Drilling with Chilled Drilling Fluid Program (Tetra Tech 2017)
- 2018 Geotechnical Site Investigation: Diamond Drilling with Chilled Drilling Fluid Program (Tetra Tech and SRK 2019)
- 2018 Testpitting Program, Coffee Gold Project (Tetra Tech 2019a)
- 2019 Permafrost Distribution Mapping Update, Coffee Mine Site Development Area, Coffee Gold Project (Tetra Tech 2019b).

Additional information regarding permafrost monitoring at the Project site is provided in the Permafrost Monitoring Program Report (Tetra Tech 2022).

### 6.2 Methods

Methods of permafrost monitoring are detailed in the Permafrost Monitoring Program Report (Tetra Tech 2022) and are summarized in Table 6-1.

**Table 6-1 Permafrost Monitoring Methods**

Method	Description
Ground Temperature Monitoring	Thermistor cables and single-bead thermistor strings installed in boreholes throughout the project area. Ground temperature data will be collected, reviewed, and analyzed monthly.
Site Inspection	Annual inspections will occur in the fall and will be accomplished by traversing the Project Area on foot, by truck, ATV and/or helicopter.
Drone-Supported Aerial Geospatial Data Collection	Annually, a multirotor drone along with a Light Detection and Ranging sensor package will be used to monitor stability of permafrost terrain features in the Project Area.
Permafrost Distribution Mapping	Permafrost distribution mapping has been on-going for the Project Area using site-specific data since 2015. Additional data collected through the monitoring program will inform mapping updates.
Permafrost Distribution Modelling	Prediction models for permafrost distribution in the Project Area will be utilizing all available data collected. The main training dataset will be provided from the annual permafrost mapping update where factual ground data was collected from boreholes/testpits or field observations. This annual permafrost mapping update will produce algorithms with other key permafrost indicators like based off the terrain and vegetation parameters using machine-learning (ML). Climate variables will be brought in where needed to determine annual freeze/thaw conditions from Environment and Climate Change Canada.
Climate Data Review	Environment and Climate Change Canada data will be reviewed for freezing degree days as historical available information as well as future predicted scenarios. Regression analysis will be conducted to infer upon the climate data for the current year and the effect of climate variables on permafrost distribution will be mapped out. Such study will be helpful as it will provide capabilities to include permafrost distribution effects due to major defined predictions under Canadian Climate Data and Scenarios.

### 6.3 Locations and Frequency

Monitoring activities such as helicopter-supported site inspections and drone-supported aerial geospatial data collection will target areas within and around the Project site, along areas of proposed and existing infrastructure and other areas that could affect the safety or performance of the Project, as well as areas of interest identified by a permafrost specialist. Existing ground temperature monitoring instrumentation installations are located at various proposed infrastructure locations at the site.

Ground temperature monitoring will be collected at least monthly. Information collected on a minimum annual basis will include site inspection, aerial geospatial data, as well as detailed permafrost mapping updates. As the Permafrost Monitoring Program is further developed, frequency of permafrost monitoring will be further refined.

## 6.4 Data Analysis

A permafrost specialist will lead the analysis and interpretation of permafrost monitoring data and prepare an annual Permafrost Monitoring Data Analysis Report. The analysis report will include, but not be limited to, the following:

- Updated ground temperature profiles with summary of data analysis and interpretation
- Results of annual site inspection of permafrost conditions throughout the Project area
- Drone-collected geospatial data
- Updated permafrost map of the Project area
- Permafrost distribution model of proposed development area(s) with no available field data
- Summary of annual climatic data review.

## 7.0 GENERAL MONITORING METHODOLOGY

This section describes the general physical monitoring inspections applicable to all components described within this Plan, including:

- Routine inspections
- Annual inspections
- Event-driven inspections.

An example general inspection record is provided in Appendix A.

### 7.1 Routine Inspections

Facility operators will complete routine visual inspections at least weekly (unless otherwise noted), and more frequently when operational conditions dictate. Conditions which require more frequent inspections are described in Section 7.3. Equipment will be inspected monthly or as otherwise recommended by the manufacturer or geotechnical engineer to verify functionality. Equipment will be calibrated according to the manufacturer's recommendations. Data will be collected and reviewed at a minimum of once per week from all instrumentation or as otherwise specified by the geotechnical engineer. Increased frequency will be necessary if or when concerns are identified.

Engineering, survey, and operational staff that conduct the routine visual inspections will be trained to look for, and be able to recognize, signs of instability. Personnel designated as responsible for conducting routine inspections will also be familiar with the triggers for an event-driven inspection. Written records of routine inspections shall be maintained as a permanent record at the Mine Site and stored digitally on an off-site server. Any deviations from normal or expected conditions shall be immediately reported to the geotechnical engineer and operational management.

### 7.2 Annual Inspections

Annual inspections will be performed by an independent professional engineer experienced with construction and operation of such facilities in cold climates. Annual inspections are to be at a date providing sufficient time before the end of the open water season to allow any resulting action plans to be implemented in a timely manner. These inspections are to include all of the elements within the routine inspection program, plus the following:

- Review recommendations from the prior annual inspection and verify that they have been implemented
- Review all instrumentation and monitoring systems and all related data for the prior year
- Review the Routine inspection reports
- Review the information gathered on the geotechnical properties and verify that these are consistent with the current design assumptions. Revise this monitoring plan as indicated
- Prepare a photographic log of findings
- Verify the design basis relative to current regulations, industry and engineering standards, and operating practices
- Verify the adequacy of the inspection programs and this Plan
- Review the mine plans and verify that they are consistent with the design.

The inspecting geotechnical engineer shall prepare a report of annual inspection and this report shall be kept as a permanent record at the Mine Site and stored digitally on an off-site server. Any deviations from normal or expected conditions shall be immediately reported to the geotechnical engineer and operational management.

### **7.3 Event-Driven Inspections**

Special inspections shall be carried out if and when any of the following events occur. Inspections shall be performed by a qualified person licensed to practice in the Yukon. Inspections are to be completed as soon as possible after the subject event which could include the following:

- Unusually large precipitation, freshet or seismic events. The following can be used as a guideline when special inspections are required under this criteria:
  - Unusually high amounts of rainfall or snowmelt
  - Precipitation or freshet in excess of the 25-year / 24-hour event
  - Ground acceleration in excess of 0.08 g (as estimated from earthquakes recorded by the regional seismograph network).
- Significant increase in excavation rates
- Deformation (heaving or bulging) of toes or slope faces
- Excessive settlement or surface cracking above or on slopes
- Seepage coming from slope faces or toes
- Significant changes in material geotechnical material properties
- Unusual operating conditions including any material damage to the sedimentation dams (i.e., damage that can adversely affect the serviceability of the particular component)
- Any other operational changes which could affect slope stability.

Event-driven inspections, which require follow-up action, shall include a detailed description of such action with timelines and compliance criteria. Any deviations from normal or expected conditions shall be immediately reported to operational management.

## 8.0 DATA INTERPRETATION AND QA/QC

Once data has been collected from the instrumentation and/or during inspections, data will be entered by the responsible site personnel into a standardized database. The database will be the primary record, and any adjustments or corrections that are performed on this data will be saved as separate files to ensure that the original data records remain unaltered. All physical monitoring data and associated field notes will be stored in standard electronic format and backed up to a secondary server.

The post-processing of physical monitoring data will typically be done in an excel-style format. Secondary processing steps will be undertaken for some of the analyses and may require the use of additional software or another statistical software package.

Physical monitoring data will be archived on site computers and backed up to an external secondary server on at least a monthly basis. The data collected by the physical monitoring program will be the property of Newmont but will be distributed as required by relevant permit and license conditions, in tabular, graphical and figure format, as required.

### 8.1 Quality Assurance and Quality Control

The primary objective of data QA/QC program is to ensure that the data collected by the site monitoring programs is both accurate and precise, and properly represents the parameters that the monitoring programs are intended to measure. This provides regulators, First Nations, the public, and mine staff with confidence in the data collected by the monitoring programs, and thus in the conclusions and actionable responses drawn from these data.

The QA/QC program encompasses a range of actions, including:

- Regular checks and calibration of the instrumentation
- Automated error trapping and flagging for review in databases and spreadsheets
- Review of collected data by site environmental and/or engineering staff
- Periodic review, as necessary by external review by qualified professionals.

As the physical monitoring data is collected, it will be subject to several levels of review. The first will be done by site engineering staff and will involve checks for values that are indicative of unexpected conditions and/or anomalies. These will be flagged and noted in the original file, and all corrections will be saved to a secondary file with an appropriate label. Data QA/QC will consist of several steps:

- Upon download of the data from dataloggers, include any error codes and note the condition of instrumentation.
- Make note of site conditions that could affect the data.
- Photocopy field notes once back in the office and transcribe all notes into the database.
- Plot all parameters, and in a different file remove false readings, flag anomalous readings for follow-up and note any changes made.
- Flag missing data, and if possible, infill the missing data using relationships developed with other site stations. Note that this data is estimated.

- As an additional check, the data will be cross-referenced between sources to confirm that accurate data is being collected, including:
  - Compare monthly precipitation totals between rainfall gauges
  - Compare cumulative winter precipitation from the climate station gauge to corresponding snow water equivalent data from snow survey station(s)
  - Compare temperature data between all site stations.

Any anomalies or errors that are unresolved will be noted in the monthly and annual reports, as this will provide context for any findings resulting from the monitoring program that may appear anomalous.

The second level of review will be undertaken by qualified professionals to produce annual reports and any updates to the physical monitoring plan. This review will initially compare the original data file to the corrected one provided by site staff to ensure consistency and accuracy in the QA/QC process. The second step will involve a comparison to past estimates, seasonal averages, etc. generated for site. The third and final step will involve the comparison of the site data to at least two regional climate stations/snow courses to confirm that the meteorological data collected at site is generally consistent with the regional values.

## 9.0 REPORTING AND ANNUAL REVIEW

Reporting of the data collected by the Physical Monitoring Plan will be required for both site operational tracking and monitoring program refinement, and as conditions of the various operational permits and licenses.

Annual interpretive reports will summarize data from the physical monitoring program as well as data collected for the previous year in tabular and graphical format. The annual report will provide summary statistics. Any significant changes to the monitoring network including instrumentation, location of monitoring points, etc. will be noted along with a rationale for the changes.

## 10.0 ROUTINE EVALUATION AND ADAPTIVE MANAGEMENT

In general, if observations made through the physical monitoring program are outside the expected range, further evaluation may be completed to determine if remedial action is necessary. Any deviations from normal or expected conditions shall be documented and immediately reported to the mine manager and geotechnical engineer. Such deviations will be considered in future monitoring activities, as well as implementation of remedial actions.

If remedial action is deemed necessary, this may range from a minor adjustment to implementation of adaptive management actions, depending on the severity and nature of the deviation from expected performance. Additional monitoring and/or inspections may be required as part of the adaptive management response based on an assessment of the geotechnical risk.

HLF definitive trigger levels and responses as well as reporting protocol are provided in the HLF OMS. Trigger thresholds and corresponding adaptive responses for permafrost are provided in the Permafrost Monitoring Program Report (Tetra Tech 2022). Adaptive management actions for Open pits, as well as for the Alpha WRSF and stockpiles will be advanced as mine planning progresses and will be provided in future iterations of this Plan. Adaptive Management for the water management infrastructure will be developed as part of the water management infrastructure OMS Manual. Activities expected to be included in the adaptive management approach are as follows:

- Stabilization of channel sections where erosion protection measures are displaced, such as increasing thickness and rock size in local areas of riprap.
- Inclusion of a low permeability layer on upstream face of dams where seepage rates persist and could put the dam at risk of internal erosion failure.
- Removal of blockages from ice or debris and clearing of vegetation or other potential debris sources in advance of spring freshet.
- Stabilization of downstream dam faces with additional rock placement.
- Addressing sediment accumulation within ponds via sediment removal methods.

## 11.0 REFERENCES

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- Palmer Environmental Consulting Group Inc. (PECG). 2016. Terrain Stability and Hazard Mapping for the Coffee Gold Project, PN 13103. Prepared for: Kaminak Gold Corporation, dated March 19, 2016, 74 pp.
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- Tetra Tech EBA Inc. 2016b. Technical Memorandum No.: 2 (Issued for Use – Revision 2): Permafrost and Related Geohazard Mapping within the Coffee Mine Site Study Area. Submitted to: Kaminak Gold Corporation, dated May 3, 2016.
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- Tetra Tech Canada Inc. 2019a. Fall 2018 Testpitting Program Data Report (Issued for Use), Coffee Gold Project. Submitted to: JDS Energy & Mining Inc., dated January 9, 2019, 26 pp.
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- Tetra Tech 2022. Permafrost Monitoring Program – Coffee Mine Project (DRAFT). June 17, 2022.
- Tetra Tech Canada Inc. and SRK Consulting (Canada) Inc. 2017. Fall 2016 Geotechnical Investigation Data Report (Issued for Use), Coffee Mine Site, Coffee Gold Project. Submitted to: Goldcorp Inc., dated March 20, 2017.

Tetra Tech Canada Inc. and SRK Consulting (Canada) Inc. 2019. 2018 Geotechnical Investigation Data Report (Issued for Use), Coffee Gold Project. Submitted to: JDS Energy & Mining Inc., dated March 26, 2019, 38 pp.

# APPENDIX A

## Inspection Record

## OPEN PIT INSPECTION



<b>SECTION 1: DETAILS</b>	Open Pit: Date: Inspected By:	Has a change occurred?      Yes    No  Detail:  Were photos taken?                      Yes    No
<b>SECTION 2: DESCRIPTION</b>	Additional Remarks / Comments: _____ _____ _____ _____	<b>ASPECTS - COMMENTS</b>
<b>Ramp / Road</b>		
<b>Slope Crest</b>		
<b>Benches</b>		
<b>Benches</b>		
		<b>Previous Failures / Cracks</b>