ARTEMIS GOLD INC

Blackwater Mine

Metal Leach and Acid Rock Drainage Management Plan

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Acronyms and Abbreviations

ABA	Acid base accounting
Aboriginal Groups or Indigenous nations	Aboriginal Groups include: Lhoosk'uz Dené Nation, Ulkatcho First Nation, Nadleh Whut'en First Nation, Stellat'en First Nation, Saik'uz First Nation and Nazko First Nation (as defined in Environmental Assessment Certificate #M19-01)
AP	Acid Potential
Artemis	Artemis Gold Inc.
BC	British Columbia
Blackwater	Blackwater Gold Project
BW Gold	BW Gold LTD.
CEMP	Construction Environmental Management Plan
CNP	Carbonate NP
DS	Decision Statement
EAC	Environmental Assessment Certificate
EM	Environmental Monitor
EMLI	Ministry of Energy, Mines and Low Carbon Innovation
EMPR	Ministry of Energy, Mines and Petroleum Resources
ENV	Ministry of Environment and Climate Change Strategy
GM	General Manager
ha	Hectares
ICP	Inductively Coupled Plasma
km	Kilometre
KP	Knight Piésold Ltd.
kV	Kilovolt
LDN	Lhoosk'uz Dené Nation
LGO	Low grade ore
m	Metre
Mt	Million tonnes
MDMER	*Metal and Diamond Mining Effluent Regulations*
ML/ARD	Metal Leaching and Acid Rock Drainage
NAG	Non-acid generating
New Gold	New Gold Inc.

NFN	Nazko First Nation
NP	Neutralization Potential
NPR	Neutralization potential ratio
NWFN	Nadleh Whut'en First Nation
PAG	Potentially acid generating
ROM	Run-of-mine
SFN	Saik'uz First Nation
SOPs	Standard Operating Procedures
StFN	Stellat'en First Nation
t/d	Tonnes per day
The Project	Blackwater Gold Project
TSF	Tailings storage facility
UFN	Ulkatcho First Nation
VP	Vice President
WOL	Whole ore leach
WTP	Water Treatment Plant

1.0 Project Overview

The Blackwater Gold (BW Gold) is constructing the Blackwater Mine (the Mine),which is a gold and silver open pit mine located in central British Columbia (BC), approximately 112 kilometres (km) southwest of Vanderhoof, 160 km southwest of Prince George, and 446 km northeast of Vancouver.

The Mine is presently accessed via the Kluskus Forest Service Road (FSR), the Kluskus-Ootsa FSR and an exploration access road, which connects to the Kluskus-Ootsa FSR at km 142. The Kluskus FSR joins Highway 16 approximately 10 km west of Vanderhoof. A new, approximately 13.8 km road (Mine Access Road) will be built to replace the existing exploration access road, which will be decommissioned. The planned new access is at 124.5 km. Driving time from Vanderhoof to the mine site is about 2.5 hours.

Major mine components include a tailings storage facility (TSF), ore processing facilities, waste rock, overburden and soil stockpiles, borrow areas and quarries, water management infrastructure, water treatment plants (WTP), accommodation camps and ancillary facilities. The Blackwater deposit is an intermediate sulphidation epithermal-style gold-silver deposit with proven and probable mineral reserves totalling 334.0 Mt at 0.75 g/t Au and 5.78 g/t Ag. Anticipated ore processing rates will range from 15,000 to 55,000 tonnes per day (t/d) throughout operations (MMTS 2020). The gold and silver will be recovered into a gold-silver doré product and shipped by air and/or transported by road. Electrical power will be supplied by a new approximately 135 km, 230 kilovolt (kV) overland transmission line that will connect to the BC Hydro grid at the Glenannan substation located near the Endako mine, 65 km west of Vanderhoof.

The Blackwater mine site is located within the traditional territories of Lhoosk'uz Dené Nation (LDN), Ulkatcho First Nation (UFN), Skin Tyee Nation and Tsilhqot'in Nation. The Kluskus and Kluskus-Ootsa FSRs and Project transmission line cross the traditional territories of Nadleh Whut'en First Nation (NWFN), Saik'uz First Nation (SFN), and Stellat'en First Nation (StFN; collectively, the Carrier Sekani First Nations) as well as the traditional territories of the Nazko First Nation (NFN), Nee Tahi Buhn Band, Cheslatta Carrier Nation and Yekooche First Nation (EAO 2019a, EAO 2019b).

Mine construction is anticipated to take two years. Mine development will be phased with an initial milling capacity of 15,000 t/d or 5.5 million tonnes per annum (Mtpa) for the first five years of operation. After the first five years, the milling capacity will increase to 33,000 t/d or 12 Mtpa for the next five-years, and to 55,000 t/d or 20 Mtpa in Year 11 until the end of the 23-year mine life. The Closure phase is 24 to approximately 45 years, ending when the Open Pit has filled and the TSF is allowed to passively discharge to Davidson Creek, and the Post-closure phase is +46 years.

Approximately 584 Mt of waste rock will be produced over the life of mine. Potentially acid generating (PAG) waste rock will be stored in the TSF and submerged within one year, non-potentially acid generating (NAG) mine rock with metal leaching (ML) potential will be submerged within five years, while non-metal leaching and non-acid generating (NAG) waste rock will either be placed in the TSF, stockpiled, or used for construction, depending on the metal leaching potential.

New Gold Inc. (New Gold) received Environmental Assessment Certificate (EAC) #M19-01 on June 21, 2019 under the 2002 *Environmental Assessment Act* (EAO 2019c) and a Decision Statement (DS) on April 15, 2019 under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2019a). In August 2020, Artemis Gold Inc. (Artemis) acquired the mineral tenures, assets and rights in the Blackwater Project that were previously held by New Gold Inc. On August 7, 2020, the Certificate was transferred to BW Gold Ltd. (BW Gold), a wholly-owned subsidiary of Artemis, under the 2018 *Environmental Assessment Act*. The Impact Assessment Agency of Canada notified BW Gold on September 25, 2020 to verify that written notice had been provided within 30 days of the change of proponent as required in Condition 2.16 of the DS, and that a process had been initiated to amend the DS.

BW Gold received *Mines Act* Permit M-246 on June 22, 2021, and *Environmental Management Act* Permit PE-110652 on June 24, 2021, authorizing early construction works for the Mine. These works include clearing, grubbing ditching, and site levelling at the Plant Site location and sediment and erosion controls, including construction of ditches, diversions, and a sediment control pond (SCP). BW Gold received an amended *Mines Act* Permit M-246 on March 8, 2023, approving the Mine Plan and Reclamation Program and superseding the previous version. BW Gold received an amended *Environmental Management Act* Permit PE-110652 on May 2, 2023, authorizing discharge of effluent to surface water and groundwater from the Blackwater mine.

1.1 Purpose and Scope

The scope of this document is the management and monitoring of ML/ARD potential associated with geologic materials that will be excavated or exposed as part of the Mine as well as WTP by-products (or sludges). For the purpose of this document, the term ‘geologic materials’ encompasses waste rock, ore, overburden, and tailings. Overall, the primary objective of the Plan is to minimize ML/ARD and to mitigate potential effects where disturbance of PAG and/or exposed bedrock is unavoidable. The Plan also summarizes the associated record keeping and reporting procedures.

The ML/ARD Management Plan (or Plan) has been developed in accordance with Section 9.5 of the Joint Application Information Requirements for Mines Act and Environmental Management Act Permits (EMPR & ENV 2019).

1.2 Supporting Documentation

ML/ARD management strategies are based on the Blackwater geochemical characterization study (AMEC 2014), more recent and ongoing studies, and the mine plan described in the Project’s Joint Mines Act / Environmental Management Act Permit Application. Standard Operating Procedures (SOP) were provided in previous versions of this management plan for permitting and review purposes. SOPs are managed on site by the project team and may be subject to more frequent revisions than the management plan to adapt to changing needs at site. However, the SOPs will continue to be aligned with and governed by the mitigations in the management plan. Up-to-date copies of SOP’s can be requested from the site Geology Manager and/or site Environmental Manager or their designates and will be provided upon request.

This Plan is intended to be used in conjunction with other management and monitoring plans pertinent to the protection of the aquatic receiving environment, including the following:

Mine Site Water and Discharge Monitoring and Management Plan, which describes the management and monitoring of PAG-influenced waters.

2.0 Roles and Responsibilities

ML/ARD management will require coordinated action by members of mine engineering, geology, environmental and the plant operations/production teams. Communication and a clear understanding of the roles and responsibilities between the different departments are essential to the successful implementation of this Plan. An overview of the roles and responsibilities relating to tasks outlined herein are provided in Table 2-1.

Table 2-1: Blackwater Roles and Responsibilities

Department	Responsibility
Mine Operations	Responsible for the logistical implementation of the ML/ARD Management Plan. Development of haul sheets and PAG rock deposition tracking. Ensures that adequate resources are available. Implements contingency measures as necessary. Ensures all sampling SOPs are up to date.
Environment	Reviews & reports geochemical data from the laboratory. Maintain data and database on tailings, sludge samples and verification samples from tailings samples. Coordinates alongside geology department for implementation monitoring.
Geology	Collection, recording and submitting ML/ARD related samples for blast hole, grade control, overburden, verification samples of the waste rock stockpile and final pit wall verification. Manages, reviews, reports geochemical data from the laboratory. Responsible for generating predictive ML/ARD modelling for the mined material as data become available. Provides guidance to mine operations with respect to mine rock management and implementation of contingency measures as necessary.
Plant Operations	Collect and submit tailings and sludge samples for analysis. Comply with sample frequencies and other conditions as outlined in the permit conditions and the MLARD management plan. Issue sample data to the designated database administrator
Onsite Lab Facilities	Responsible for onsite preparation and analysis of samples Prepare and ship required samples to independent labs for specified analysis Provide results to Environmental Superintendent/ Geology Superintendent
Health and Safety	Review and audit sampling procedures as outlined in the SOPs Oversee construction activities as necessary

3.0 Geological Setting

The Blackwater Gold Mine area is part of the Intermontane Belt superterrane and is locally underlain by rocks of the Stikine terrane comprising an assemblage of magmatic arc and related sedimentary rocks that span Jurassic to early Tertiary time (MMTS 2020). The deposit represents an intermediate sulphidation epithermal-style gold-silver deposit with mineralization being hosted in felsic to intermediate composition volcanic rocks that have undergone extensive silicification and hydrofracturing in association with pervasive stockwork veined and disseminated sulphide mineralization.

Alteration minerals most commonly identified included muscovite, high- and low temperature illite, ammonium-bearing illite, smectite, silica, biotite, and chlorite. Gold–silver mineralization is associated with a variable assemblage of pyrite–sphalerite–marcasite–pyrrhotite ± chalcopyrite ± galena ± arsenopyrite (± stibnite ± tetrahedrite ± bismuthite). Carbonate minerals are relatively rare and are commonly represented by siderite which does not offer significant neutralization capacity.

4.0 Classification of ML/ARD Potential

4.1 ARD Potential (PAG vs. NAG)

The ARD potential of mine waste is determined by acid base accounting (ABA) testwork, which measures the ratio of acid generating to acid neutralizing minerals. The criteria for determining neutralization potential (NP), acid potential (AP), and defining PAG and NAG material, are described in this section.

4.1.1 Neutralization Potential (NP) Determination

The geochemical characterization program (AMEC 2014) used a variety of methods to measure NP, including Modified (Sobek) NP, siderite-corrected Sobek NP, carbonate NP (CNP) based on total inorganic carbon content. The geochemical characterization program identified a correlation between NP and Ca wt.% measured by aqua regia digestion followed by ICP analysis (ICP-Ca). To integrate the geochemical database with the geologic block model and to make use of a larger dataset across the deposit, a correlation between mod-NP and assay-Ca was developed (AMEC 2016). This relationship is conservative and was defined as:

$$\textit{ICP-NP (kg } CaCO_3\textit{/t)} = 0.396 \times (\textit{wt.\% Ca} \times 24.9) + 3.23 \qquad \textit{Eqn. 4.1}$$

In the absence of direct NP measurements, this formulation of ICP-NP will be used to define the acid generating potential of geologic materials. When both mod-NP measurement and ICP-NP estimates are available, mod-NP will be used to define ARD potential.

4.1.2 Acid Potential (AP) Determination

The acid generating potential of geological material samples is estimated based on its sulphur (S) content. The amount of acidity generated per mass of sulphur depends in large part on the mineralogy and solid phase speciation of sulphur. That is, different sulphide and sulphate minerals produce different amounts of acidity when weathered. The results of the geochemical characterization program show that the sulphur at the Mine occurs primarily as sulphide S. For the extrapolation of geochemical results in the geologic block model, exploration assay sulphur data were found to be a reliable surrogate for AP which can be calculated as follows:

$$\textit{AP (kg } CaCO_3\textit{/t)} = \textit{ICP-S (\%)} \times 31.25 \qquad \textit{Eqn. 4.2}$$

The presence of sphalerite in the deposit adds conservatism to calculated AP values, since sphalerite does not generate acidity upon dissolution.

4.1.3 PAG Definition

The likelihood of a sample to generate acidity can be quantified by the comparison of NP and AP. The neutralization potential ratio (NPR = NP/AP) represents a measure that is commonly used to identify whether a sample is PAG or NAG. Typically, in agreement with recommendations made in Price (2009), a sample can be considered PAG if the NPR falls below a value of 2, while samples with NPR ≥ 2 can be considered NAG. In other words, according to this classification, NP has to be at least twice as high as the AP in order to render a sample NAG.

The Blackwater waste rock classification scheme developed by AMEC (2014) subdivides two categories of PAG rock, namely a higher-risk PAG1 (NPR ≤ 1.0) and a lower-risk PAG2 (1.0 < NPR ≤ 2.0). NAG material has an NPR > 2 and is further divided based on metal leaching criteria with respect to zinc content (see Section 2.2).

Lithology was shown to have a significant influence in determining lag time to ARD, with andesite showing longer lag times compared to fragmental and laminated volcanics. The ARD classification also influences lag times, with PAG1 rock generally becoming acid generating more quickly than PAG2 rock. Proportions of acidic PAG1 and PAG2 are estimated as:

During Operations (assumes 6 months of exposure):

– PAG1 – 29% of andesite and 77% of laminated and fragmental volcanics are estimated to be acidic

– PAG2 – 8% of andesite and 31% of laminated and fragmental volcanics are estimated to be acidic

During Post-Closure:

– PAG1 – 100% assumed to be acidic for all lithologies

– PAG2 – 26% assumed to be acidic for all lithologies

During Post-Closure, the pit high wall will be the only remaining PAG exposure. All waste rock and tailings will be submerged or covered within the TSF (within one year) during operations.

4.2 Acid Generating

Based on the results from the geochemical characterization program (AMEC 2014), it is expected that ARD may develop relatively quickly from PAG rock types. The acid generating status of mine rock and overburden can be defined through paste or rinse-pH tests to identify material that is currently acid generating (AG) acid generating. Acid generating material will be defined as follows:

- Waste rock and water treatment sludge with paste pH or rinse pH <6.5
- Overburden and construction material with paste pH <5.5 or a rinse pH <5.0.

All AG material will be stored in the TSF where it will eventually be flooded. The presence of AG material within the TSF basin before flooding is anticipated, and this scenario is accounted for in the source term and water quality model.

4.3 Metal Leaching Potential (NAG3, NAG4, and NAG5)

Zinc is a parameter of interest for the Mine and its mobility was found to be correlated with its solid-phase content under neutral pH conditions (AMEC 2014). As such, metal leaching risk criteria were developed for NAG waste rock. There are three NAG categories based on zinc content, all of which have an NPR > 2. NAG3 is considered to have the highest zinc leaching potential amongst NAG rock, while NAG4 and NAG5 have lower zinc leaching potential (Table 4-1). While the difference in Zn leaching potential between NAG4 and NAG5 is small to negligible (AMEC 2014), NAG5 is used preferentially for construction and these units should nevertheless be tracked during mining to further reduce risk of neutral Zn leaching and its effect on downstream water quality.

Table 4-1: ML/ARD Waste Rock Segregation Criteria

Rock Type	NPR	Zinc (mg/kg)
PAG 1	≤1	n/a
PAG 2	1 - <2	n/a
NAG 3	≥ 2	> 1,000
NAG 4	> 2	600-1,000
NAG 5	> 2	< 600

Notes: NPR = Neutralization Potential Ratio, n/a = not applicable.

5.0 Potential Sources of ML/ARD

ML/ARD is caused by contact of geologic materials with water and oxygen. While ML/ARD is a natural geochemical process, reaction rates and associated downgradient effects are commonly accelerated by the disturbance and exposure of such materials during mining activities.

Static and kinetic geochemical test programs were conducted to characterize the different materials to be exposed during mining operations (AMEC 2014). An overview of the sample numbers submitted for each test is given in Table 5-1. The following sections provide a high-level summary of the geochemical results associated with each material type as well as the corresponding production schedules as they pertain to ML/ARD considerations. No in-depth geochemical testwork on WTP sludges has been conducted to date; however, expected geochemical characteristics are discussed in the following section.

Table 5-1: Number of Samples Submitted for Geochemical Testing

Analysis	Exploration Samples	Waste Rock	Ore	Tailings	Overburden	
					Open Pit / TSF / Plant Site	Access Road
Acid Base Accounting	-	890	72	12	76	19
Multi-element Chemistry	285,234	617	72	12	76	19
Mineralogy/Petrography	-	25	48	-	2	-
Shake Flask Extraction	-	58	8	5	14	-
Net Acid Generation Test	-	587	36	8	29	-
Net Acid Generation Leachate	-	78	7	5	5	
Humidity Cells	-	19	2	5	-	-
Modified Humidity Cells	-	3	1	-	-	-
Saturated Columns	-	2	-	-	-	-
Kinetic Field Bins	-	6	2	-	-	-
Oxygen Consumption	-	1	-	-	-	-
Acid Buffering Characteristic Curve	-	12	-	-	-	-
Sequential Net Acid Generation	-	4	-	-	-	-
Kinetic Net Acid Generation	-	6	-	-	-	-
Humidity Cell pH Neutralization	-	5	1	-	-	-
Sequential Extraction	-	10	-	-	-	-
Adsorption Experiments	-	6	-	-	-	-
Scanning Electron and Optical Microscopy	-	5	-	2	-	-
SO_2 Air/Cyanide Destruction	-	-	-	23	-	-

Source: AMEC (2014)
Note: TSF = Tailings Storage Facility

5.1 Waste Rock

5.1.1 Acid Rock Drainage Potential

The total sulphur contents of waste rock range from 0.01% to 3.2% with sulphide minerals comprising the majority of the sulphur inventory (AMEC 2014). The dominant sulphide minerals are pyrite and sphalerite. Since sphalerite produces little or no acid upon dissolution, the stoichiometric derivation of AP using sulphide sulphur content was deemed conservative and appropriate, in particular for Zn-rich samples.

Modified NP was found to be relatively low across the deposit, with a median value of 10 kg $CaCO_3$/t. Carbonate minerals represent the largest contributor to NP, with calcite identified to be the dominant carbonate phase in NAG samples. Siderite, which provides reduced or negligible neutralization capacity, was found to be a common carbonate phase in PAG waste materials.

Humidity cell testing conducted on a range of waste rock samples showed that all PAG1 samples became acid generating within 10 weeks and some PAG2 samples (three of six) produce acidic drainages within 30 weeks. Acid generating reactions would proceed at a slower rate under field conditions, however, the rapid onset of ARD in the laboratory tests shows that ARD generation will be a risk even with relatively short exposure duration (weeks to months). As expected, none of the NAG materials studied produced net acid during this test. Results for field-scale kinetic testing were consistent with the humidity cell program; however, lag times to onset of ARD were generally longer in the field.

Supplementary Net Acid Generation testing conducted on a subset of waste rock samples (n = 587 samples) showed that an NPR threshold of 2.0 to discern between PAG and NAG materials is conservative (AMEC 2014).

5.1.2 Metal Leaching Potential

Metal enrichment is determined via the comparison of the aqua regia digestible solid-phase composition with average crustal concentrations (Price 1997). Elements with a concentration of greater than ten times the corresponding crustal abundance were flagged. Using this screening approach, the following elements were elevated in more than 60% of the samples: As, Bi, Cd, and P. Silver and Bi were elevated in at least 50% of the samples while zinc was elevated in 49%.

PAG1 and PAG2 waste rock classes have the highest metal leaching potential for two reasons:

1. By definition, these material classes are expected to produce acidic drainage in the long-term if exposed to atmospheric conditions. pH is a dominant variable that governs the solubility of many solutes and metal leaching rates generally increase significantly as pH drops.
2. PAG waste rock units tend to have a higher sulphide content. These minerals are often the main host for metals that are of environmental relevance in mine drainage. As such, the solid-phase abundance of such metals is higher in PAG materials.

Humidity cell testing confirmed that the highest metal release rates are associated with low-pH leachate with an array of species showing relatively high mobility (e.g., Cd, Cu, Fe, Pb, Zn). Under neutral pH conditions, metal loading rates were reduced significantly; however, some neutral metal leaching was observed for As, Sb, Cd and Zn, especially in samples with higher solid-phase contents of these species.

Saturated column testing conducted to investigate the acid generating and metal leaching properties of select samples in an oxygen-deplete environment demonstrated circum-neutral pH and a strong reduction in metal leaching potential (AMEC 2014).

5.1.3 Material Schedule

Approximately 584 Mt of waste rock will be produced over the life of mine (Table 5-2). The majority of the waste rock is classified as PAG1 (58%) and PAG2 (17%). NAG3 and NAG4 are relatively minor rock types, each representing approximately 4% of the total waste rock. NAG5 (16 %) is the dominant rock classification of the three NAG rock units. Undefined waste material represents zones that could not be reliably delineated based on environmental block model output. For the purpose of mine planning, undefined waste rock is conservatively considered to be PAG1.

Table 5-2: Waste Rock Production Schedule

Year	PAG1 Waste	PAG2 Waste	NAG3 Waste	NAG4 Waste	NAG5 Waste	Undefined Waste	Total Waste Rock
LOM	338,642	97,231	24,300	22,518	94,354	7,113	584,158
Y-2	0	9	0	7	197	111	324
Y-1	282	502	17	433	3,792	322	5,348
Y1	5,179	1,860	761	476	1,011	959	10,246
Y2	6,855	1,537	743	876	2,380	259	12,650
Y3	5,048	1,134	423	425	852	381	8,263
Y4	9,391	4,056	1,620	287	3,316	530	19,200
Y5	8,739	5,224	1,708	2,525	8,295	598	27,089
Y6	20,291	4,648	487	1,348	2,898	31	29,703
Y7	21,062	2,498	222	139	1,073	705	25,699
Y8	26,778	5,754	1,900	1,309	4,092	1,549	41,382
Y9	29,589	10,301	3,586	1,967	3,227	291	48,961
Y10	36,737	9,197	3,074	1,470	2,664	22	53,164
Y11	31,261	5,211	870	1,637	8,732	536	48,247
Y12	18,798	5,364	3,013	1,824	20,099	130	49,228
Y13	18,196	14,836	2,741	4,052	20,012	686	60,523
Y14	26,917	17,998	2,127	2,920	10,417	3	60,382
Y15	32,385	6,071	902	786	1,202	0	41,346
Y16	27,494	791	103	31	60	0	28,479
Y17	13,260	240	4	7	37	0	13,548
Y18	381	0	0	0	0	0	381

Source: MMTS (2020)
Notes:
All units in kilotonnes.
Sub-tonnages may not add up to total tonnages due to rounding.

Waste rock will be stored in multiple locations across the mine site. These include site infrastructure such as the TSF, TSF embankments as well as the Lower and Upper Waste stockpiles, which contain <2% and approximately 70% waste rock, respectively (Table 5-3). An inventory of waste rock age placed in stockpiles will be maintained as part of the site records.

Table 5-3: Waste Rock Placement by Mine Facility

Mine Facility	PAG1	PAG2	NAG3	NAG4	NAG5	Total
TSF C impoundment	48,816	16,646	5,515	-	-	70,976
TSF D impoundment	299,808	78,266	18,785	-	-	396,860
Main Dam C – downstream embankment	-	-	2,600	8,924	14,863	26,387
Main Dam D – downstream embankment	-	-	-	11,176	55,837	67,013
Lower waste stockpile	-	-	-	400	57	457
Upper waste stockpile	-	-	-	1,440	19,475	20,916

Notes:
All units in kilotonnes.
Sub-tonnages may not add up to total tonnages due to rounding.

5.2 Ore

5.2.1 Acid Rock Drainage Potential

Ore samples were found to have elevated sulphur contents compared with waste rock, exhibiting a median total S value of 1.3% (AMEC 2014). Most of the sulphur was found to reside in sulphide minerals, with pyrite, sphalerite and pyrrhotite identified by X-Ray Diffraction. Chalcopyrite and arsenopyrite were additionally identified during petrographic analysis.

With relatively low Modified NP values (median = 4.0 kg $CaCO_3$/t), which are in agreement with sparse carbonate contents, the majority (92%) of ore samples tested returned PAG character based on an NPR threshold of 2. This finding was confirmed by the supplementary Net Acid Generation testing.

Humidity cell testing conducted on two low-grade ore samples (PAG) demonstrated little to no lag time to ARD onset (AMEC 2014). No high-grade ore samples underwent kinetic testing in the geochemical assessment program; however, it can be assumed that high-grade ore would also be PAG with little to no lag time to ARD onset and potentially even higher metal loading rates. In conclusion, all ore material should be treated as PAG and acidic drainage should be expected from low- and high-grade temporary stockpiles during operations shortly after deposition.

5.2.2 Metal Leaching Potential

More than 50% of the ore samples had elevated concentrations of Ag, As, Bi. Cd, Pb, P, Sb, or Zn. Selenium, which was found to be elevated in 36% of the samples, has a systematically higher content in samples with Zn concentrations >1,000 ppm.

The onset to acidification in the two low-grade ore humidity cells was accompanied by high metal loads for Zn, Cd, Fe, and As. Raising the pH via lime addition was found to be an effective method to attenuate Cd and Zn concentrations in mixed waste rock and low-grade ore humidity cell leachates (AMEC 2014). Specifically, an increase in pH from 4.0 to around 8.0 resulted in the reduction of Cd and Zn concentrations by approximately two orders of magnitude (attenuation rate of ~99%). Trace metal attenuation is attributed to the co-precipitation of these species with or adsorption to Fe-hydroxides.

5.2.3 Material Schedule

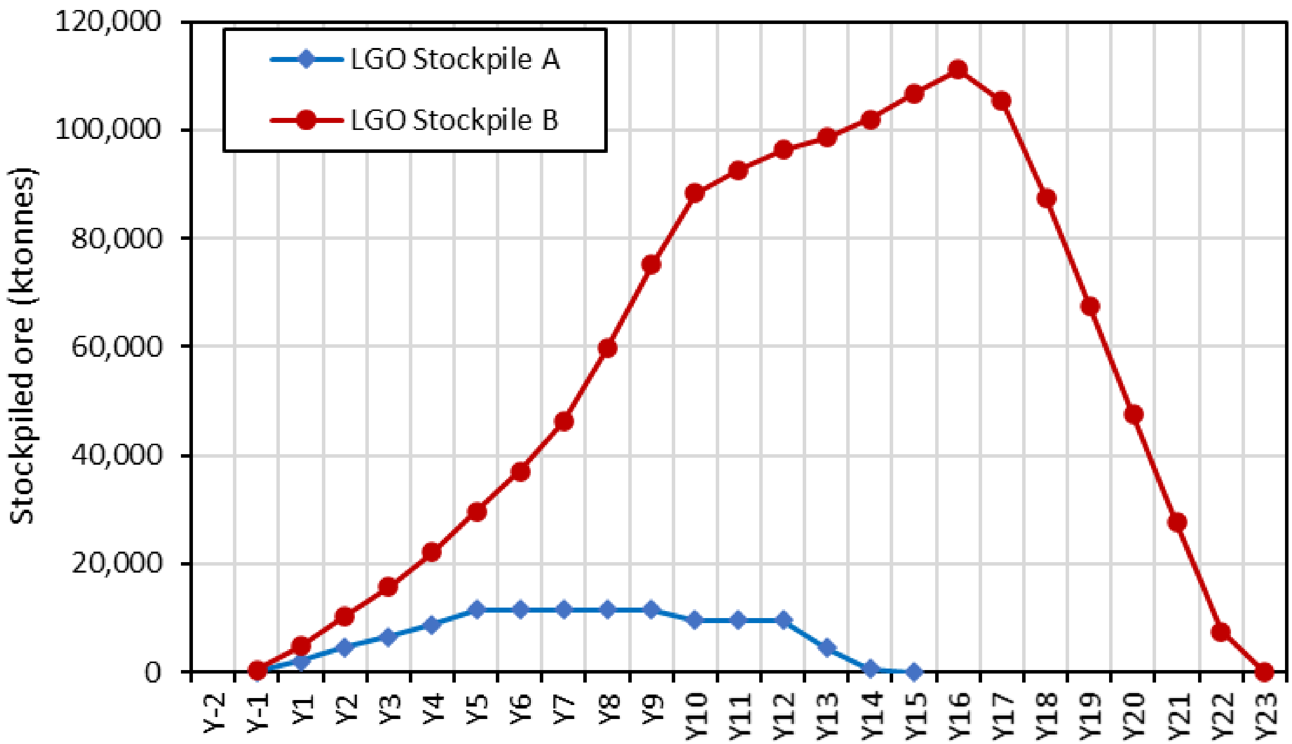
Ore excavated from the mine pit will either be fed directly to the mill via the run-of-mine (ROM) pad, or temporarily stockpiled in the low grade ore stockpiles (Table 5-4 and Figure 5-1). In total, approximately 125.5 Mt of low-grade ore will be stockpiled over the life of mine with the maximum material stored at any one time approximately being 111 Mt. It is expected that both stockpiles will be entirely consumed by the end of mining.

Table 5-4: Ore Production and Processing Schedule over the Life of Mine

Mine Year	Resource Mined Directly to Mill	Ore Mined to LGO Stockpile A	LGO Stockpile A to Mill	Cumulative LGO Stockpile A Balance	Ore Mined to LGO Stockpile B	LGO Stockpile B to Mill	Cumulative LGO Stockpile B Balance	Cumulative LGO Stockpile Balance
LOM	208,706	11,499	11,499	-	113,842	113,842	-	-
Y-2	-	-	-	-	-	-	-	-
Y-1	-	101	-	101	380	-	380	481
Y1	4,500	1,954	-	2,055	4,353	-	4,733	6,788
Y2	5,500	2,494	-	4,549	5,722	-	10,455	15,004
Y3	5,500	1,895	-	6,444	5,170	-	15,625	22,069
Y4	5,500	2,348	-	8,792	6,534	-	22,159	30,951
Y5	5,500	2,708	-	11,499	7,416	-	29,575	41,074
Y6	12,000	-	-	11,499	7,492	-	37,067	48,566
Y7	12,000	-	-	11,499	9,072	-	46,139	57,638
Y8	12,000	-	-	11,499	13,504	-	59,643	71,142
Y9	12,000	-	-	11,499	15,450	-	75,093	86,592
Y10	10,000	-	2,000	9,499	13,155	-	88,248	97,747
Y11	20,000	-	-	9,499	4,419	-	92,667	102,166
Y12	20,000	-	-	9,499	3,659	-	96,326	105,825
Y13	15,000	-	5,000	4,499	2,194	-	98,520	103,019
Y14	16,000	-	4,000	499	3,382	-	101,902	102,401
Y15	19,000	-	499	-	5,314	500	106,716	106,716
Y16	20,000	-	-	-	4,381	-	111,097	111,097
Y17	12,000	-	-	-	2,246	8,000	105,343	105,343
Y18	2,204	-	-	-	-	17,796	87,547	87,547
Y19	-	-	-	-	-	20,000	67,547	67,547

Mine Year	Resource Mined Directly to Mill	Ore Mined to LGO Stockpile A	LGO Stockpile A to Mill	Cumulative LGO Stockpile A Balance	Ore Mined to LGO Stockpile B	LGO Stockpile B to Mill	Cumulative LGO Stockpile B Balance	Cumulative LGO Stockpile Balance
Y20	-	-	-	-	-	20,000	47,547	47,547
Y21	-	-	-	-	-	20,000	27,547	27,547
Y22	-	-	-	-	-	20,000	7,547	7,547
Y23	-	-	-	-	-	7,546	-	-

Notes:
All units in kilotonnes.
Sub-tonnages may not add up to total tonnages due to rounding.
LGO = Low Grade Ore



Note: LGO = Low-Grade Ore

Figure 5-1: Ore Stockpile Material Balance – LGO Stockpiles

5.3 Pit Wall Rock

5.3.1 Acid Rock Drainage Potential

Pit wall exposures will be comprised of waste rock, ore, and overburden. Pit wall exposures as a function of elevation are presented in Table 5-5. The block model was used to estimate the relative proportions of PAG1, PAG2, NAG3, NAG4, and NAG5 in the pit walls. The proportion of PAG wall rock that is acid generating is determined as a function of lithology and exposure times, as described in Section 4.1.3.

Table 5-5: Percentage of Pit Wall above Bench Elevation – Operations

Bench	PAG1	PAG2	NAG3	NAG4	NAG5	OVB
1146	41%	16%	5%	4%	22%	12%
1158	40%	16%	5%	4%	22%	12%
1170	40%	16%	5%	4%	22%	12%
1182	40%	17%	5%	4%	22%	12%
1194	39%	17%	5%	4%	22%	13%
1206	39%	17%	5%	4%	23%	13%
1218	37%	17%	5%	4%	23%	13%
1230	36%	17%	5%	4%	24%	13%
1242	33%	18%	5%	5%	25%	14%
1254	32%	18%	5%	5%	26%	14%
1266	30%	18%	5%	5%	26%	15%
1278	30%	19%	5%	5%	26%	15%
1290	29%	19%	5%	5%	27%	15%
1302	27%	19%	6%	5%	27%	16%
1314	25%	19%	6%	5%	28%	17%
1326	25%	19%	6%	5%	28%	17%
1338	23%	19%	6%	5%	29%	17%
1350	22%	19%	6%	5%	29%	18%
1362	20%	20%	6%	5%	30%	19%
1374	18%	19%	6%	5%	32%	20%
1386	16%	19%	6%	5%	32%	20%
1398	15%	19%	6%	5%	33%	21%
1410	14%	19%	6%	5%	34%	22%
1422	14%	17%	6%	4%	35%	24%
1434	13%	13%	5%	4%	38%	26%
1446	13%	12%	4%	4%	39%	27%
1458	12%	11%	4%	3%	40%	30%
1470	12%	11%	4%	3%	40%	31%
1482	10%	10%	2%	3%	41%	34%
1494	8%	10%	2%	4%	43%	34%
1506	8%	8%	2%	4%	44%	34%
1518	5%	7%	2%	4%	48%	34%
1530	4%	6%	1%	4%	50%	34%
1542	4%	5%	1%	3%	54%	33%
1554	1%	3%	1%	2%	57%	34%
1566	1%	3%	0%	2%	59%	35%
1578	0%	3%	0%	0%	60%	36%
1590	0%	3%	0%	0%	59%	37%
1602	0%	4%	0%	0%	55%	41%
1614	0%	5%	0%	0%	52%	43%
1626	0%	5%	0%	0%	49%	45%
1638	0%	4%	0%	0%	36%	59%
1650	0%	3%	0%	0%	32%	65%
1662	0%	0%	0%	0%	28%	72%

5.3.2 Metal Leaching Potential

Pit wall exposures will be made up of materials representative of waste rock, ore, and overburden. Since the ML potential of these materials was already described previously and is further described below (Section 5.5: Overburden), it is not discussed further in this section.

5.3.3 Material Schedule

The open pit will be developed to a maximum planar area of ~227 ha. This corresponds to a total surface area of ~315 ha at the end of mining.

5.4 Tailings

A range of tailings materials, representing rougher, cleaner, and whole ore leach (WOL) tailings, were analyzed and discussed in AMEC (2014). A combined gravity and whole ore leach circuit was selected for processing ore (MMTS 2020). Crushed ore will be sent to the mill for grinding, followed by gravity concentration, pre-oxidation, cyanide leaching, carbon-in-pulp adsorption, desorption, and refining. Cyanide destruction using SO_2/air will be conducted on the tailings slurry before discharge into the TSF. In order to minimize SO_4 accumulation in the process water and tailings ponds, liquid SO_2 will be used rather than sodium metabisulfite ($Na_2S_2O_5$) as a SO_2 source, thereby minimizing the Na loadings to the system which will promote gypsum formation.

5.4.1 Acid Rock Drainage Potential

The ARD potential of tailings is similar to or lower compared to ore. The AP of the material will remain unchanged through processing; however, some NP will be introduced in the form of lime during the milling process. Tailings samples analyzed for the project (n = 14 samples) were generally found to be PAG with NPRs falling below 1.0 with the exception of one rougher tailings sample (NPR = 1.2). This includes the high-grade ore (HGO) tailings and low-grade ore (LGO) tailings generated during 2019 metallurgical testing. These tailings samples were found to have similar AP and NPR below 1. Consistent with ore and waste rock, sulphur is most commonly associated with sulphide minerals which were identified as pyrite, arsenopyrite, sphalerite, pyrrhotite, galena and chalcopyrite.

Neutralization potential for tailings is generally low, with Modified NP values most commonly falling below 10 kg $CaCO_3$/t. Lag times to depletion of these low levels of NP and the resulting onset to acidic conditions in humidity cells were slightly longer than those observed for waste rock. The lag time to onset of ARD in the whole ore leach tailings was estimated to be on the order of one year. In general, sulphide and transition ore tailings were determined to constitute a higher ARD risk than tailings produced from oxide zone ore.

5.4.2 Metal Leaching Potential

A range of elements were found to be enriched in the solid phase in the majority of the tailings samples, with Ag, As, Cd, P, Pb, Sb, and Zn exceeding ten times the average crustal abundance. This is consistent with findings from ore analyses (see Section 3.2.2).

As for ore and waste rock, increased metal leaching rates of various metals were observed under conditions of low-pH drainage. Cadmium and Zn were also found to be released at elevated concentrations even under neutral pH conditions. Two samples that turned acidic during the humidity cell test program additionally released elevated concentrations of Co, Mn, Pb, and Fe.

Saturated tailings column experiments were conducted in 2013 and 2020 to assess tailings behaviour under saturated conditions. Overall, absolute concentrations of most trace elements in column effluents were low, and illustrate a low risk associated with the potential for metal remobilization from saturated tailings over the range of redox conditions likely to be encountered at site (mildly suboxic to strongly reducing). The 2013 columns showed some indication of enhanced mobility for Fe, Mn, and Zn under mildly suboxic redox potentials. However, the recent columns showed lower metal concentrations and lower potential for sulphate release and metal leaching in comparison to the 2013 saturated column tests. In particular, Zn concentrations remained low in the 2020 columns and do not show evidence of Zn release correlated with Mn-oxide dissolution. Cobalt concentrations remained relatively high in the column effluents for both 2013 and 2020 columns, presumably in response to the presence of strong cobalt-CN complexes.

5.4.3 Material Schedule

The TSF was designed to a maximum capacity of 462 Mm^3 of tailings that will be pumped into two cells that are contained by three tailings dams. The TSF C cell will be developed first and will receive tailings over 21 years of operation amounting to a total of approximately 300 Mt (Table 5-6). Tailings discharge will be switched to TSF D in year 21 where the remaining ~33 Mt of tailings will be deposited until end of mining.

Table 5-6: Annual Tailings Production

Year	Annual Tailings (tonnes)		Year	Annual Tailings (tonnes)	
	TSF C	TSF D		TSF C	TSF D
-2	0	0	12	20,000,000	0
-1	0	0	13	20,000,000	0
1	4,500,000	0	14	20,000,000	0
2	5,500,000	0	15	20,000,000	0
3	5,500,000	0	16	20,000,000	0
4	5,500,000	0	17	20,000,000	0
5	5,500,000	0	18	20,000,000	0
6	12,000,000	0	19	20,000,000	0
7	12,000,000	0	20	20,000,000	0
8	12,000,000	0	21	14,700,000	5,300,000
9	12,000,000	0	22	0	20,000,000
10	12,000,000	0	23	0	7,546,000
11	20,000,000	0			

Source: KP (2021a)

5.5 Overburden

Overburden material was assessed as part of the pre-mine geochemical characterization work conducted by AMEC (2014). The dataset (n = 95 samples) included samples from the open pit footprint, proposed tailings storage facility (TSF) site, as well as the access road alignment. Of these, 19 samples from the open pit footprint were recovered from near the overburden-bedrock interface to assess geochemical properties of the overburden/bedrock transition zone.

5.5.1 Acid Rock Drainage Potential

Total sulphur concentrations in overburden samples were very low, ranging from 0.01% to 0.66% (95^{th} percentile of 0.04%). The sample with the highest total S content was sourced from the overburden -bedrock transition and may have included bedrock intersects. Median contents of total S, sulphate S, and sulphide S were calculated to be 0.01%, which represent the analytical detection limit. No discrete sulphide minerals were identified through mineralogical testing.

Modified NP covered a relatively wide range from 0 to 127 kg $CaCO_3$/t. The analysis deemed 94% of all tested overburden materials as NAG. Six samples classified as PAG were all derived from the overburden-bedrock interface within the open pit footprint. With the exception of the one sample that may have been contaminated by bedrock, all other PAG overburden samples showed low total S values and were classified as PAG due to their low NP. Net acid generation testing conducted on a subset of 29 samples confirmed the NAG character of these materials.

5.5.2 Metal Leaching Potential

Elevated Cd concentrations were reported in 35% of all tested overburden samples and 19 samples (20%) had elevated zinc concentrations. Antimony, lead, selenium, and bismuth were also found to be enriched in some samples. In general, metal concentrations were greater in samples near the overburden/bedrock interface (AMEC 2014).

Shake flask extraction data identified metal leaching potential (e.g., Cd, Fe, Pb, Zn) in some overburden samples. However, these results are viewed as inconclusive owing to the high Al and Fe concentrations. These parameters (Al and Fe) are insoluble in neutral-pH and aerobic conditions and their presence in SFE leachate (median: Al = 17.5 mg/L; Fe = 10.3 mg/L) shows that suspended solids are likely bypassing the filter during leachate collection. This is commonly observed in SFE tests conducted with silt-clay bearing material. Furthermore, elevated ML potential of overburden at this site is not supported by baseline water quality, which generally shows low metal concentrations in site surface and groundwater. Sorption studies using weathered bedrock, basal till and sand and gravel units under the proposed Blackwater TSF found that this material effectively attenuated >90% of Cd and Zn concentrations produced from waste rock humidity cell tests. Sorption was not, however, incorporated into the site water balance/water quality model. Humidity cell tests completed on Mine waste rock show that ML potential is related to metal content. A similar relationship can be expected in overburden, with metal leaching risks likely limited to samples with elevated trace metal concentrations (e.g., Zn > 1,000 ppm).

5.5.3 Material Schedule

Over the life of mine, an estimated ~120 Mt of overburden will be stripped from the open pit footprint as well as construction sites such as mine access roads plant site, and the TSF embankments. Overburden will be used for construction purposes across the mine site as needed and the majority of the overburden inventory will be utilized in the construction of TSF Embankments (Table 5-7). Excess material will be stored in the Lower (early life of mine) and Upper (later mine phases) Waste stockpiles. During mine closure, overburden will also be used for reclamation purposes (e.g., stockpile covers).

Table 5-7: Annual Overburden Production Schedule

Year	Construction Sites (tonnes)	TSF Embankments (tonnes)	Lower Waste Stockpile (tonnes)	Upper Waste Stockpile (tonnes)	Total Excavated (tonnes)
-2	250,000	590,909	25,969	-	866,878
-1	250,000	3,131,818	295,502	-	3,677,320
1	-	2,300,000	4,035,378	-	6,335,378
2	-	2,481,818	439,877	-	2,921,695
3	-	609,091	6,469,371	-	7,078,462
4	2,800,000	940,909	13,982,062	-	17,722,971
5	-	2,159,091	2,626,461	-	4,785,552
6	-	3,354,545	106,140	-	3,460,685
7	-	8,918,182	365,803	-	9,283,984
8	-	15,859,091	243,672	-	16,102,763
9	-	7,090,909	54,813	-	7,145,722
10	-	2,504,545	46,896	-	2,551,441
11	-	5,472,727	-	3,834,594	9,307,322
12	-	2,422,727	-	4,478,813	6,901,540
13	-	8,776,000	-	1,442,459	10,218,459
14	-	5,545,455	-	29,372	5,574,827
15	-	4,580,364	-	-	4,580,364
Total	**3,300,000**	**76,738,182**	**28,691,942**	**9,785,239**	**118,515,362**

5.6 Water Treatment Plant Sludge

Sludge products will be generated from two of the proposed active water treatment systems, including the Lime Neutralization System and Metals WTP.

5.6.1 Geochemical Characteristics

No in-depth geochemical testwork has been conducted on WTP by-products to date. Sludge produced from the Metals WTP bench scale studies was analyzed using the synthetic precipitation leaching procedure (SPLP; McCue 2021). The results showed some potential for the leaching of Fe, Mn, and Zn when exposed to synthetic rainwater. While these results are illustrative of sludge behaviour under mildly acidic conditions, the results have limited application to behaviour within the TSF since pH-neutral conditions are expected to be maintained.

No characterization of sludge produced from bench scale testing of the Lime Neutralization System process is available. The geochemical composition of sludge produced from analogous operational lime neutralization systems is discussed in Lorax (2021). Overall, based on observations from a number of relevant site analogues and given the relative tonnages of the sludge to be produced, no significant impacts on TSF pond chemistry and seepage are expected. Verification of these assumptions will occur via operational monitoring.

WTP sludge will be classified as PAG if the NPR is less than 2. Prior to further geochemical characterization, AP will be calculated from total S and NP will be determined by the modified Sobek method. Sludge will be considered acid generating if the paste pH is less than 6.5 or the rinse pH is less than 5.0.

5.6.2 Material Schedule

Over the life of the Mine, the Metals WTP is estimated to generate approximately 54,000 tonnes of sludge, while the Lime Treatment System is estimated to generate approximately 340,000 tonnes of sludge (Table 5-8). The sludge will be stored in TSF C and TSF D and represents a minor proportion of material stored in these facilities (<0.1%).

Table 5-8: Annual Sludge Production Schedule

Year	Metals WTP Sludge (tonnes)	Lime Neutralization System Sludge (tonnes)	Total Sludge (tonnes)
-2	0	1,657	1,657
-1	1,162	4,593	5,755
1	1,162	6,695	7,857
2	1,781	8,676	10,458
3	1,781	10,656	12,438
4	1,781	12,734	14,515
5	2,401	15,015	17,416
6	2,401	17,294	19,694
7	2,401	19,572	21,973
8	2,401	21,833	24,234
9	3,020	22,965	25,986
10	3,020	22,204	25,225
11	3,457	21,335	24,792
12	3,457	20,449	23,906
13	3,457	19,595	23,053
14	3,457	18,746	22,203
15	3,457	18,160	21,618
16	3,457	18,003	21,461
17	3,457	16,857	20,315
18	1,056	14,053	15,109
19	1,056	11,153	12,210
20	1,056	8,247	9,303
21	1,056	5,353	6,410
22	1,056	2,531	3,588
23	1,056	0	1,056
Total	**53,853**	**338,376**	**392,229**

6.0 ML/ARD Management

The following section is intended to provide practical guidance with respect to ML/ARD management practices. Facilities that will be built with mine materials and are considered part of this ML/ARD Management Plan include:

Tailings Storage Facility and embankments;

Upper and Lower Waste stockpiles;

High- and low-grade ore stockpiles;

Open Pit; and

Other infrastructure (e.g., road alignments, construction pads, laydown areas).

The capacity, construction period, and timeline for reclamation for the facilities used to store geologic materials are summarized in Table 6-1. The full extent of the mine site layout as it is designed for the later mine phases is illustrated in Figure 6-1.

Table 6-1: Capacity, Construction Period, and Reclamation Timeline for Mine Facilities

Facility	Capacity (Mt)	Construction Period	Reclamation Start
TSF (waste rock/overburden)	600	Year -2 to 18	Year 24
TSF (tailings solids)	334	Year 1 to 23	Year 24
Lower Waste Stockpile	29	Year -1 to 10	Year 11
Upper Waste Stockpile	31	Year 11 to 17	Year 19
LGO Stockpile	111	Year -1 to 23	Year 23
Other Infrastructure	7.8	Year -2 to 15	Variable

Most mine waste generated by mining activity will be stored in the TSF. The TSF was designed to contain all tailings and potentially acid generating (PAG) waste rock generated from the pit (MMTS 2020).
An inventory of material placed within the TSF, including waste rock, tailings, and WTP sludge, will be maintained by site staff. The inventory will include geochemical characteristics, quantities, storage locations, and exposure times of materials placed within the TSF.

The TSF will be bounded by a series of embankments, namely the Main Dam D, the Main Dam C, and the West Dam. An environmental control dam (ECD) and interception trenches serve to capture seepage downstream of the facility.

6.1 Tailings Storage Facility

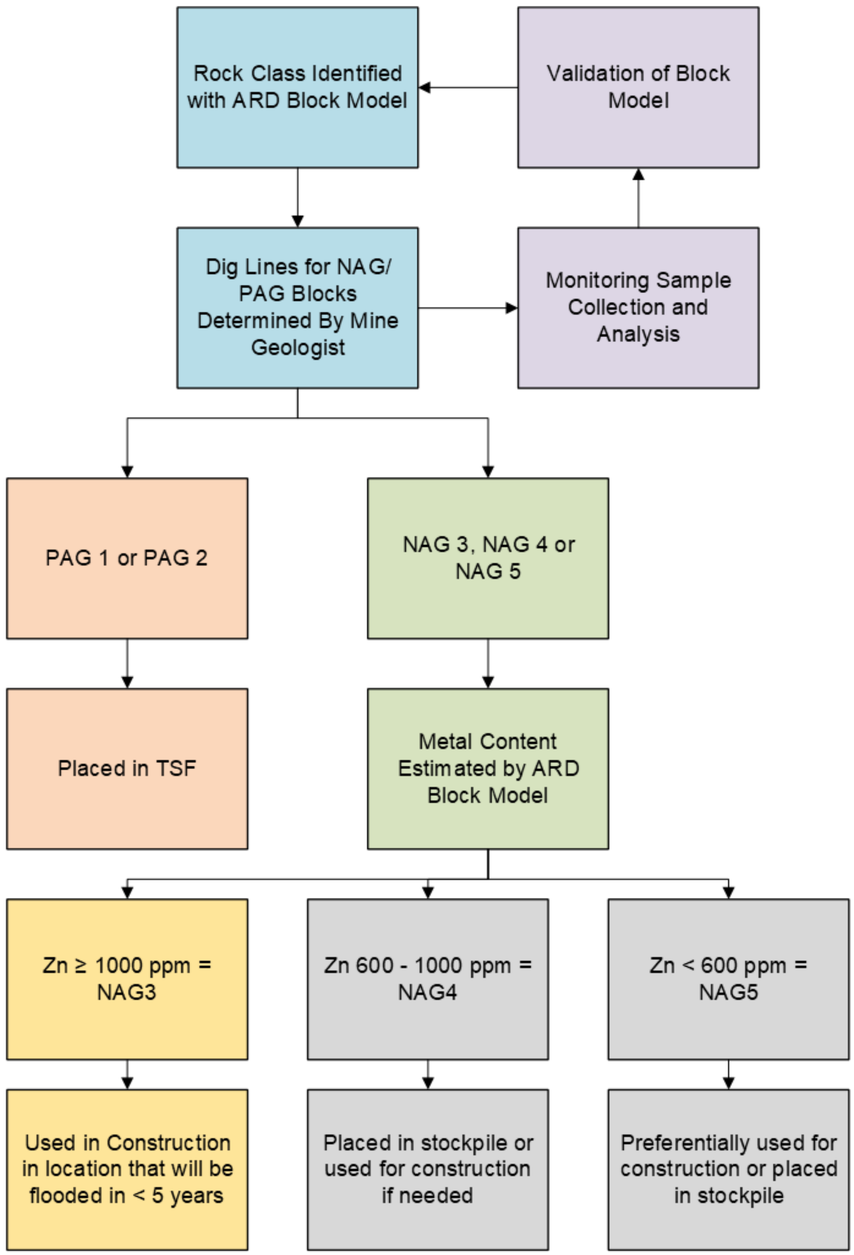
6.1.1 Tailings

Whole ore leach tailings are expected to be PAG with relatively short lag times of up to one year to ARD. Therefore, the operational tailings management plan is to cover any unsaturated tailings beaches with fresh tailings within one year of tailings deposition. This will likely require relatively frequent adjustment of tailings lines and spigots.

At closure, a tailings pond will remain in place and maintain saturation of a large portion of the tailings. A relatively small tailings beach will remain unsaturated at closure. Any permanently exposed tailings beaches will be covered with a till/overburden layer to shed meteoric water and limit oxygen ingress into the uppermost tailings layer.

6.1.2 Waste Rock and Overburden

Waste rock management will occur based on environmental class (i.e., PAG1, PAG2, NAG3, NAG4, NAG5) of a mining block defined through pre-mine characterization and validated through operational monitoring. A flow chart showing the decision-making sequence with respect to waste rock is given in Figure 6-1.



Note: PAG = Potentially Acid Generating; NAG = Non-Acid Generating.

Figure 6-1: Flow Chart Illustrating the Decision Sequence and ML/ARD Management Strategies that Will Be Employed for Waste Rock and Overburden

During active mining the ARD classification of mine rock from the open pit will be defined by the ARD Block Model. The ARD Block Model was developed by GeoSim Services Inc. for the Feasibility Study and was originally described in AMEC (2014). The block model was updated in 2016 to include an empirical equation (Eqn. 4.2) to define neutralization potential (NP) (New Gold, 2016). The model is populated with over 280,000 ICP results from exploration drill core supplemented by 890 acid base accounting (ABA) samples. Each 10 m x 10 m x 10 m block the model contains the following properties:

- Lithology;
- Oxidation;
- Ore/Waste;
- Elemental concentration of S, Ca, Fe, As, Cd, Cu, Pb, and Zn;
- Acid Potential (AP) and NP;
- Rock Class (PAG1, PAG2, NAG3, NAG4, and NAG5).

The ARD Block Model allows for ARD and ML potential to be estimated for each block within the mine pit as it is excavated. Mine waste monitoring samples will also be collected, as defined in Section 7.0, to validate the environmental classification and potentially update ARD Block Model, as defined in Section 8.0.

All PAG1, PAG2, and NAG3 waste rock will be stored under saturated conditions in the TSF in the long-term. Specifically, PAG1 and PAG2 waste rock will be stored in the TSF which will ultimately be submerged by tailings slurry. AG and PAG waste rock will be submerged within one year with either tailings slurry or water. ML waste rock and overburden must be submerged within five years with either tailings slurry or water The current water balance assumptions indicate that more rapid submergence may be possible and estimated exposure periods are shown in Table 6-1. Based on the results from the kinetic test program (AMEC 2014), it is expected that ARD may develop locally in PAG domains within the TSF basin before flooding is achieved. This scenario is accounted for in the source term and water quality model.

Table 6-1: Months of Exposure Prior to Submergence of PAG Rock Stored in TSF C and TSF D as Defined in the Life of Mine Water Balance Model

Year	Estimated Months of Exposure	
	TSF C	TSF D
-2	<1	-
-1	<1	-
1	1	-
2	3	-
3	6	-
4	12	-
5	12	-
6	12	<1
7	-	3
8	-	3
9	-	3
10	-	3
11	-	3
12	-	3
13	-	3
14	-	3
15	-	3
16	-	3
17	-	3
18	-	-

Source: KP (2021b)

NAG3 waste rock will be used in construction of the TSF dams or otherwise stored in the TSF and submerged within five years of mining to reduce metal leaching. NAG4 and NAG5 material will be used in the construction of unsaturated and downstream portions of the TSF embankments.

The vast majority of overburden across the project site is expected to be NAG with low ML potential. Overburden will be required for the construction of TSF embankments. Management of overburden material that is either PAG and/or has a solid-phase Zn content >1,000 ppm will mirror that of waste rock as illustrated in Figure 6.1-1. The volume of overburden requiring active management is expected to be minor and limited to zones near the bedrock contact.

6.2 Upper and Lower Waste Stockpiles

Excess NAG overburden as well as NAG4 and NAG5 waste rock that is not being used for construction purposes will be deposited in surface (i.e., unsaturated) stockpiles located north (Lower Waste stockpile) and west (Upper Waste stockpile) of the open pit.

As an additional layer of conservatism, NAG5 material should be prioritized in the construction of infrastructure where possible, in particular near water courses. At closure, all permanent stockpiles will be covered with a minimum of 30 cm of overburden and revegetated for reclamation purposes to reduce water ingress into these facilities.

6.3 Ore Stockpiles

Ore will be managed as PAG material. The ore stockpile (i.e., lower- and higher-grade ore) will be built over a compacted, low-permeability foundation intended to limit seepage. as defined in the Low-Grade Ore Stockpile Inteim (End of Year 3) Design Report (Knight Piésold, 2024b). Geotextile material will be wrapped around the collection drains. Drainage from these stockpiles is expected to be acidic and contain elevated concentrations of sulphate and metals shortly after exposure. A contingency water management plan has been developed describing monitoring and groundwater interception strategies should contact water bypass the LGO stockpile water management system (Knight Piésold, 2024a). When acidification of drainage is observed, water will be neutralized before being discharged into the TSF.

Ore material that is classified as direct mill feed will be stored on a ROM ore pad temporarily to reduce the risk of acid generation from this pad and minimize geochemical loads reporting to the water management system.

6.4 Open Pit

At the end of mining operations, surplus TSF water will be pumped to the open pit to accelerate pit filling. This has the effect of flooding exposed PAG rock more rapidly and thereby inhibiting further sulphide oxidation occurring within the pit walls.

6.5 Other Infrastructure

Infrastructure such as road alignments, construction pads, and laydown areas are part of the operational mine site layout and will be constructed with excess waste rock and/or overburden borrow source material. To prevent ML/ARD release from construction sites that contain waste rock fill, only NAG4 and NAG5 material will be used for unsaturated construction locations across the mine site.

6.6 Water Treatment Plant Sludge

Any WTP sludge produced during Operations will be transported to and stored subaqueously within the TSF. During Operations, sludge will compose 0.1% to 0.01% of the mass deposited into TSF C and TSF D, respectively. These proportions are estimated to be slightly higher during Construction (1.4% to 0.5%) owing to the lack of tailings deposition and the conservative assumptions regarding ore stockpile water quality.

7.0 Mine Waste Monitoring

The overarching objective of the ML/ARD monitoring program is to generate a high density of representative waste rock, ore, overburden, tailings, and WTP sludge samples to enhance the current (pre-mining) geochemical databases and confirm environmentally relevant material classes and tonnages. Data generated during this program will guide ML/ARD management strategies that are communicated directly to mine operations. The monitoring program described herein will be conducted using an independently operated laboratory. QA/QC measures will be implemented on a subset of samples using an independent check laboratory.

7.1 Solid Phase Monitoring

In this section, sample collection methods and sampling frequency of geologic materials are described. SOP describing in detail the various tasks and responsibilities of the monitoring program can be requested from the site Geology Manager and/or site Environmental Manager or their designates and will be provided upon request. An overview of the required sample frequency for the different material types is given in Table 7-1.

Table 7-1: Sampling Frequency for the Different Material Types during Operational Monitoring

Sample Type	Sampling Frequency
Waste rock/ore	1 sample per 50,000 t
Pit wall rock	1 sample per 1 ha for final pit wall
Tailings/Supernatant	5 grab samples per quarter (tailings and supernatant) + 1 composite tailings solids sample per month
Overburden and construction materials	1 sample per 25,000 m^3
WTP Sludge	Quarterly
Verification (Waste Stockpiles and Tailings Beach)	Waste stockpiles: 1 sample per 200,000 t Tailings: Opportunistically when access allows
QA/QC	1 duplicate per 20 samples (Waste rock/ore/pit wall rock/overburden) 1 duplicate per quarter (Tailings)

For each sample, the location and significant features will be recorded. The information recorded will vary by sample type but may include lithology, oxidation, carbonate and sulphide mineralogy and abundance, alteration, significant structural features, and texture.

7.1.1 Waste Rock and Ore

Waste rock and ore will be monitored by collecting either blast hole or grade control drill cuttings from within the mine pit with subsequent analysis at the independently operated laboratory. Grade control sampling is preferable since geochemical data would be produced well before material movement allowing for more flexibility with respect to integration into the geological block model and mine planning. However, it is understood that grade control sampling will on occasion not adequately cover waste rock blocks and therefore, blast hole sampling will need to be employed as needed. The overall sampling frequency will be a minimum of one (1) sample per 50,000 tonnes of material blasted. This frequency shall be achieved via the combined blast hole and grade control sampling monitoring programs.

Geochemical data obtained from grade control monitoring will be validated with the ARD Block Model together with other assay data. The Mine Geologist will use geostatistical models to predict metal distribution and determine appropriate dig lines for NAG / PAG blocks at the same time as doing grade outlines for the production crew. Outlines will be uploaded to a high precision GPS unit on the excavator and/or clearly marked with wooden stakes on the ground or a similar means of demarcation. After blasting, material will be tracked with tracking sheets or electronic material tracking software recording both origin and destination of material. Analytical results will be recorded within a database such that the sample can be correlated with the geologic model for the Mine.

Boundaries of environmental waste rock classes predicted by the block model will be considered during blast/sampling design to be avoided during a given blast where possible.

7.1.2 Pit Wall Rock

During active mining, pit wall rock exposures will be constantly changing. Samples from active pit wall faces will be collected from drill cuttings as part of the regular waste rock and ore monitoring program (Section 7.1.1). Information obtained from this sampling, including geological and geochemical data, will be incorporated into the block model. Once operations expose the final (permanent) pit walls, geological mapping of the final pit wall will be completed and a sampling program will be conducted to characterize the geochemical composition of these exposures in support of long-term water quality modelling. At this point, it is proposed that one (1) sample per 1 ha of surface area be collected from the pit exposures where safe access permits. At an estimated final pit wall exposure area of 315 ha, this will produce approximately 315 wall rock monitoring samples. If safe access to the open pit at the end of mining is not feasible, pit wall ML/ARD characteristics to rely on predictive modelling based on the operational ML/ARD monitoring database.

7.1.3 Tailings

The tailings slurry will be sampled at a frequency of five (5) samples per quarter. The slurry will be filtered and the tailings solids will be submitted for analysis at the independently operated laboratory. Supernatant (process water) associated with the tailings slurry should undergo water analysis at the same frequency. The parameter list for supernatant samples is consistent with the standard parameters required as part of the Mine Water and Discharge Management and Monitoring Plan (Application Section 9.6). Given the mine life of 23 years over which tailings production will occur, this sample frequency will result in approximately 460 tailings solid and supernatant samples collected in total.
In addition to the above samples, a monthly composite sample will be collected for comparison with the grab samples. The proposed frequency is a 1-week composite sample made up of 7x daily samples once per month. The composite sample will only include the tailings solids.

7.1.4 Overburden

Inorganic overburden will be monitored by collecting composite samples from test pits, active excavation or drill holes areas as it is being excavated. One (1) composite overburden sample is to be collected for every 25,000 m^3 of material disturbed and analyzed at the independently operated laboratory. A minimum of two well-spaced samples collected from each distinct Mine component (e.g., plant site) where excavation of overburden amounts to <50,000 m^3. Borrow material for construction will be characterized at the same frequency as overburden.

Overburden is highly heterogeneous, and baseline sampling shows that the material has minimal NP and AP owing to its highly weathered nature. If a single sample from a borrow site is classified as ML, PAG or AG, then a second confirmatory round of sampling will be required. The confirmatory sampling will consist of samples collected from the immediate vicinity (within 10m) of the initial sample that was classified as ML, PAG or AG.

7.1.5 Water Treatment Plant Sludge

In order to confirm assumptions concerning sludge composition and potential impacts on TSF water quality a detailed monitoring program will occur in the first two years of WTP operations. This testing will occur at an external laboratory. The results will be used to confirm assumptions regarding sludge reactivity and composition and revise water quality predictions and associated mitigations if required. Following the first two years of monitoring, the ML/ARD potential of the sludges will be assessed in the same manner as for other solid-phase monitoring samples. The ML/ARD Management Plan will be updated accordingly, should the current assumptions around sludge chemistry prove inaccurate.

7.1.6 Verification Monitoring

A verification monitoring program will be initiated for selected mine components to confirm NAG identification and segregation practices as well as to validate assumptions made in support of geochemical source term development. This supplementary monitoring program will apply to:

1. Waste rock deposited in the Upper and Lower Waste Stockpiles; and
2. Tailings exposed under unsaturated conditions on TSF beaches for ≥ 1 year.

The waste rock verification monitoring program will be implemented at a sampling frequency of one (1) sample per 200,000 t of waste rock stored in either of the two waste facilities. The samples will be collected *in situ* or drilled samples from the Upper and Lower Waste Stockpiles.

Verification monitoring of the TSF beaches will be carried out opportunistically when safe access to beached tailings allows. If safe access is not possible, safety concerns at the time of a planned sampling event will be documented.

7.1.7 QA/QC Sampling

In order to maintain quality assurance and quality control (QA/QC) of monitoring data, duplicate samples will be collected and submitted to an independent laboratory. One (1) QA/QC sample will be taken for every 20 samples. With the exception of WTP sludges and tailings samples, QA/QC sampling will be conducted across all material types and the sample collection procedure of all duplicates should be identical to that of the primary samples. A WTP sludge duplicate sample should be collected once per calendar year. Duplicate samples are not required for mineralogy QAQC. Internal procedures of the independent laboratory will be relied upon for QAQC of mineralogy results.

7.1.8 Analytical Techniques

A variety of static testwork will be conducted as part of the ML/ARD monitoring program at an independently operated laboratory facility. A basic suite of geochemical parameters comprising ICP ML/ARD proxies will be prioritized as part of the routine monitoring program. In accordance with the assessment conducted by AMEC (2014), proxy analyses required for the reliable determination of the different environmental material classes (e.g., PAG1, NAG4, etc.) are as follows:

Aqua regia digestible elemental scan.

Using aqua regia digestible S (proxy for AP), Ca (proxy for NP), and Zn (metal leaching criteria), the environmental designation can be derived in the same manner as was done for the block model development. Aqua regia digestible elemental analysis with ICP-finish will be conducted at an independently operated laboratory.

Since the above parameters are merely ABA surrogates to quantify NP and AP for the calculation of NPR, samples will also be submitted for additional geochemical analyses. Initially, all samples will be submitted to the laboratory for the full analytical suite comprising:

Paste pH;

Total S;

Sulphate S by HCl digestion;

Total Inorganic Carbon;

Modified NP;

Net Acid Generation Test;

Aqua regia digestible elemental scan; and

X-ray Diffraction (XRD).

Once it can be demonstrated that the laboratory has been shown to produce accurate results for the proxy analyses, the possibility of reducing the frequency of samples submitted for the full analytical suite can be investigated, such that only the QA/QC samples described in Section 7.1.6 will undergo the more comprehensive analytical suite. All samples will continue to be submitted for aqua regia digestible metals scan at the independently operated laboratory. Laboratory QA/QC procedures (e.g., analysis of standard reference materials and internal duplicates) will apply to ensure analytical precision and replicability.

The detailed WTP sludge monitoring program which will occur in the first two years of WTP operations will include the following testwork on quarterly samples:

Paste pH;

Total S;

Sulphate S by HCl digestion;

Total Inorganic Carbon;

Modified NP;

Net Acid Generation Test;

Aqua regia digestible elemental scan;

Particle size distribution;

Sequential extractions using Tessier technique or similar;

High resolution microscopy; and

Kinetic testwork (saturated columns).

Following the first two years of monitoring, the WTP sludge samples will be submitted for the same suite of analyses as other solid-phase monitoring samples.

7.2 Contingency Measures

Several contingency measures were established to manage and mitigate potential ML/ARD risk associated with the Mine's geological materials. These are summarized in Table 7-2.

Table 7-2: Overview of Potential ML/ARD Contingency Measures

Condition	Contingency Measure
Higher than expected PAG or NAG3 proportion	Adjustment of assay proxies
	Redefinition of ARD Block Model using ML/ARD monitoring results
	A contingency storage allowance is incorporated into the TSF design, which allows for storage of additional PAG material if needed; this will be updated as construction progresses
	Revisit source term assumptions and water quality models
Misplaced PAG or NAG3 material	Delineation of misplaced PAG zones
	Rehandling of PAG and NAG3 material as necessary
	Quantify effect on source term and water quality models
	Adjust water management and/or treatment capacities
Failure to submerge PAG or NAG3 rock within prescribed time frame in TSF	Increase water quality monitoring frequency at location of interest to assess pH stability
	Optimize tailings spigot placement to ensure unsaturated beaches are not exposed >1 year
	Adjust water management/sourcing to accelerate flooding of PAG and NAG3 materials
	Add lime to tailings ponds or tailings discharge line to stabilize decreasing pH as necessary

Adaptive management and trigger response measures related to geochemical results in contact water, such as higher than predicted metal concentrations or development of acidic pH conditions in the TSF or other site water management ponds, are further addressed in the Mine Water and Discharge Management and Monitoring Plan (Application Section 9.6). Water management and monitoring components described in that plan are intended to form the foundation of a detailed Trigger Response Plan that will be developed prior to initial discharge from the Freshwater Reservoir.

8.0 Implementation and Reporting

8.1 Communication and Operational Protocols

The Mining Manager is responsible for the implementation of the ML/ARD Monitoring program. The Mining Manager or designate is responsible for coordinating sampling and will arrange for sampling support by qualified Technicians. SOPs for each part of the ML/ARD Monitoring program will be provided upon request.

8.2 Record Keeping and Tracking

Field results will be recorded when taken, and onsite and external lab test results will be transferred electronically into a database. The Environmental Superintendent and the Geology Superintendent or designate will be responsible to ensure the maintenance of the original records and databases for there assigned sections. Parameters of concern will also be tracked graphically and reviewed periodically to identify trends.

An inventory of material placed within the TSF, including waste rock, tailings, and WTP sludge, will be maintained by site staff. The inventory will include geochemical characteristics, quantities, storage locations, and exposure times of materials placed within the TSF. Investigations and corrective action will be undertaken if monitoring data indicate that observed geochemical characteristics are significantly different than expected based on geochemical characterization test work conducted to date.

The monitoring results will be tracked against predictions of the ARD Block Model as they become available. The correlations used to define AP and NP within the block model, and the accuracy of the block model will be reviewed on at least an annual basis. A comparison of ARD Block Model and monitoring results will be included in the Annual Reclamation Report, along with any recommendations for revisions to the ARD Block Model to improve the accuracy of mine rock classifications.

8.3 Reporting

Results of the ML/ARD monitoring program will be reviewed and summarized in external reports as needed. At a minimum, results of the ML/ARD monitoring program will be included in the Annual Reclamation Report. Should adaptive management or trigger response be required throughout the life of mine, adaptive management strategies, rationales and associated monitoring results will be described in standalone memoranda.

After eight-teen months of commencing blasting in the Open Pit an Operational ML/ARD Characterization Report must be submitted to the Chief Permitting Officer. The report must suffice the conditions set in Mine Permit M-246 Section C.3.(e)(iv).

9.0 Plan Revision

This plan is a 'living document' and components of the plan may be reviewed and updated over the life of the Mine. BW Gold will conduct an annual (or as necessary) evaluation of the efficacy of mitigation and monitoring activities. The plan may be updated by BW Gold as needed if more suitable procedures or changes are required or as frequently as every year, or not at all, if the mitigation and monitoring measures are found to be robust.

As per Condition C.3(c)(i)(a), (b), and (c) of the M-246 *Mines Act* permit, the ML/ARD Management Plan will be reviewed, updated (as applicable), and signed-off by a Qualified Professional annually. As per Condition A.8, the updated plan will be provided to LDN, UFN, and NFNs at the same time that they are submitted to EMLI.

10.0 Qualified Professionals

Under the direction of Lorax, this management plan has been prepared and reviewed by, or under the direct supervision of, the following qualified professionals:

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Approval Signature Record

Reviewer Role	Name	Signature	Date
Manager Mining & Technical Services	Shayne Paul		2024-12-19
Project Geologist	Keith Baker		2024-12-19

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