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ML/ARD Management Plan

Atlantic Gold

Touquoy Mine
ML/ARD Management Plan

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1. Introduction

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1. Introduction

1.1 Project Background

The Touquoy Gold Mine (Touquoy), owned by Atlantic Mining NS Corporation (AMNS) a wholly owned subsidiary of St. Barbara Limited, is located in the Moose River Gold Mines District, around 100 km northeast of Halifax, Nova Scotia. Touquoy is an open pit mine that began commercial gold production in March 2018. Based on a cut-off grade of 0.5 g/t Au, the total measured and indicated mineral resource estimate is 11.26 Mt at a grade of 1.23 g/t Au containing 445,100 troy oz. of gold (Atlantic Gold, 2019).

Geologically, the Touquoy deposit falls into the Meguma Terrane which hosts various gold deposits in southern and central Nova Scotia. The main geological units at the site are argillite and greywacke; however, these units are interbedded and intermediate classifications are included in between these two endmembers. Lithological codes for main units encountered on site include ***AR*** (argillite with <5% greywacke), ***AG*** (argillite with 5-49% greywacke), ***GA*** (greywacke with 20-50% argillite), and ***GW*** (greywacke with <20% argillite). Rock with a higher proportion of argillite beds generally have a higher risk of ARD due to the higher overall sulphide content and lower neutralization potential (Golder, 2007). The majority of the ore is within the argillite unit.

The Industrial Approval (IA) # 2012-084244-06 for the Touquoy Mine was most recently amended in April 2020 (NSE, 2020) and outlines requirements regarding management and monitoring of metal leaching and acid rock drainage (ML/ARD) in mine rock and tailings handled and processed during mining and milling operations. Mine rock is herein defined as ore and waste material that is produced by blasting. While ore is either directly processed or temporarily stockpiled for later processing, waste material may be permanently stored in a Waste Rock Storage Area (WRSA) or is used as construction material for site infrastructure such as the Tailings Management Facility (TMF) dam. Table 1-1 provides an overview of the potential mine rock storage and construction facilities along with the estimated total quantities of waste material.

Tailings are the fine-grained waste product of the ore extraction process and, at Touquoy, are discharged in slurry form into a dammed TMF. The bulk of the tailings mass within the TMF is saturated and covered by a tailings pond, although tailings beaches develop along the peripheral upgradient portions of the TMF. The well-mixed nature of the tailings material along with the saturated storage conditions need to be considered when assessing the ARD potential within the TMF. A site layout map is provided in Figure 1-1.

Table 1-1:
Estimated Total Quantities of Waste Material

Location	Material	Estimated Final Quantity (m^3)
Waste Rock Storage Area	Waste Rock	10,805,700[a, b]
Tailings Management Facility Dam Construction Material	Waste Rock	1,182,410[c]
Tailings Management Facility	Tailings	7,758,200[d]

Notes: [a]Includes the pit expansion; [b]Atlantic (pers, comm.), 2020; [c]Stantec (pers. comm.), 2020a; [d]Stantec, 2020b

1.2 Scope and Purpose

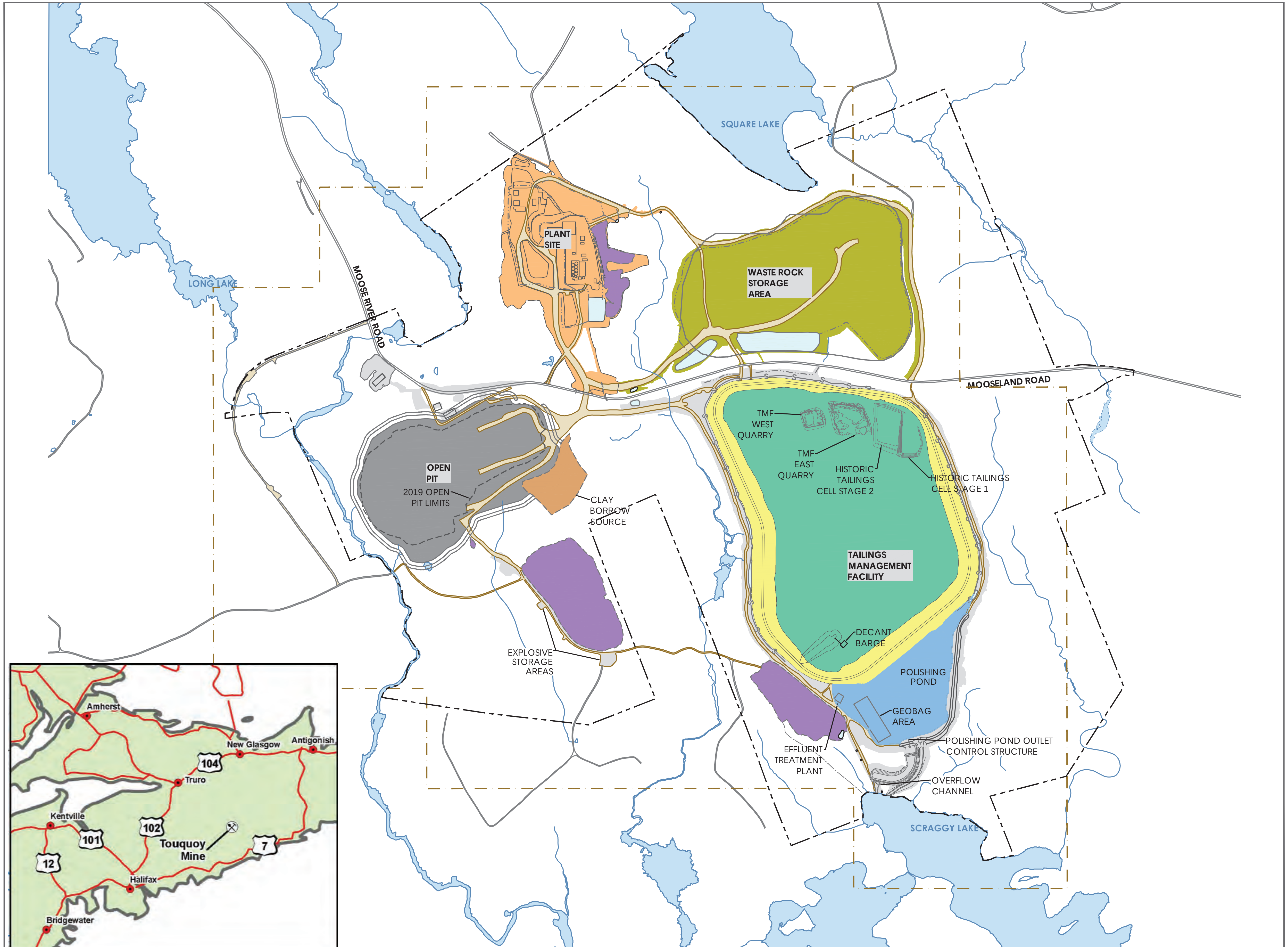
The purpose of the Plan is to formalize the ML/ARD monitoring procedures in place at the mine as well as to provide guidance to AMNS with respect to best practice ML/ARD mitigation strategies that may be considered at the mine should the results from the monitoring program indicate mitigation is necessary. The ML/ARD Management Plan will serve as a geochemical reference guide for the various different activities at the mine that have a direct or indirect impact on ML/ARD-related processes. Ultimately, the Plan will allow for proactive material handling and contaminant source control to minimize mining effects on water quality and protect the downstream aquatic environment. Specific components to be discussed in this Plan include:

- ML/ARD monitoring and analysis required as per the IA;
- Additional, non-mandatory ML/ARD monitoring and analysis that will provide an improved understanding of the site's waste rock and ore classifications;
- Definition of materials suitable for construction of site infrastructure;
- Potentially Acid Generating (PAG) material handling strategies; and

Verification sampling and monitoring of mine rock and associated seepage to test the effectiveness of the implemented mitigation measures.

1.3 Report Structure

Following the introduction and background provided in this chapter, Chapter 2 provides an overview of the classification of ML/ARD potential at Touquoy. Chapter 3 covers the obligations under the IA and the specific roles of those involved in ML/ARD management. Chapter 4 summarizes the monitoring and management requirements for waste rock and tailings and Chapter 5 outlines the reporting requirements.



LEGEND

- Existing Road
- Historic Road/Path
- Watercourse
- Waterbody
- Clay Borrow Source
- Plant Site
- Open Pit
- Waste Rock Storage Area
- Disturbed Areas
- Overburden Stockpile
- Tailings Pond
- Tailings Dam
- Polishing Pond
- Haul/Access Road
- Collector/Settling Pond
- Perimeter/Site Ditch
- Seepage Ditch
- Mineral Lease Boundary
- Site Property Boundary

Original Figure: 1A Amendment. Drawing 1. Drawn by Stantec March 18, 2020

Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

DATE SAVED:	Apr 20, 2020
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CLIENT:

Atlantic Gold

LORAX ENVIRONMENTAL

PROJECT:

Touquoy Mine ML/ARD Management Plan

TITLE:

Touquoy Mine Site Layout

PROJECT #: A457-6	*FIGURE:* 1-1

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2. Classification of Metal Leaching & Acid Rock Drainage Potential

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2. Classification of Metal Leaching & Acid Rock Drainage Potential

The ML/ARD potential of the various geologic materials at Touquoy has been previously assessed through geochemical testing completed prior to mine operation (Golder, 2007). Both static and kinetic tests were conducted on the Touquoy mine rock and tailings. The results indicate that, although the sulphide contents at Touquoy are low, there is some potential for ML/ARD and continued operational in-pit and confirmatory sampling is warranted.

The ML/ARD potential for the operational monitoring samples are classified using acid-base accounting (ABA) results. These analyses are completed externally at an accredited laboratory.

2.1 Neutralization Potential (NP) Determination

The geochemical characterization program included both bulk neutralization potential (bulk NP) and carbonate neutralization potential (CaNP) (Golder, 2007). The CaNP is calculated from the total inorganic carbon (TIC) content as it is assumed that the inorganic C is present as carbonate minerals. The carbonate minerals present in the selected samples include calcite (3.2 to 5.3%, median: 3.4%), dolomite (none detected to 1.5%, median: 0.66%), ankerite (none detected to 1.7%, median: 0.06%), and siderite (none detected to 0.02%, median: 0.01%) (Golder, 2007). Ankerite and siderite do not have the same neutralization capacity as calcite, as oxidation and hydrolysis of these Fe- and Mn-bearing carbonate minerals produces acidity. In the initial geochemical assessment, the CaNP was used to characterize the material. However, for the purpose of this Plan it is recommended that the modified Sobek NP is used for classification of the samples. The modified NP is determined through a titration-based method conducted at room temperature that is not mineral-specific. Therefore, this method inherently accounts for the buffering capacity from non-carbonate minerals as well as the reduced neutralization potential of Fe- and Mn-bearing carbonates (*e.g.*, ankerite). Silicate minerals that may act as neutralizing agents once carbonates phases are depleted include biotite, chlorite, and certain clay minerals.

2.2 Acid Potential (AP) Determination

The acid generating potential of a rock sample is estimated based on its sulphur 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 sulphide mineralogy identified at Touquoy included pyrite/marcasite, pyrrhotite, and arsenopyrite (Golder, 2007), all of which generate acidity in response to oxidative weathering. Due to the lack of acidic sulphate salts in the Touquoy mine materials, acid potential (AP) is calculated on the basis of the sulphide sulphur content in a given sample. Sulphide sulphur is calculated by subtracting the total sulphate by carbonate leach from the total sulphur.

The AP for the Touquoy mine rock is calculated as:

$$AP\ (kg\ CaCO_3/tonne) = 31.25 \times sulphide\text{-}S\ (wt.\ \%)$$

This conversion stoichiometrically accounts for the amount of acidity released per 1% of pyrite contained in the rock material and assumes that all sulphide is available for oxidation. The AP is given in units of kg $CaCO_3$/tonne to allow the direct comparison with NP.

2.3 PAG Definition

The likelihood for a sample to generate acidity can be quantified by the comparison of NP and AP. The net potential ratio (NPR = NP/AP) represents a measure that is commonly used to identify whether a sample is PAG or Not Potentially Acid Generating (NPAG). 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 $\geq$ 2 can be considered NPAG. In other words, according to this classification the NP has to be at least twice as high as the AP in order to render a sample NPAG. This approach is conservative and accounts for the potential partial liberation of carbonate (and other acid-buffering) minerals.

In the initial geochemical characterization (Golder, 2007), <10% of the samples collected were classified as PAG. Most of these samples originated from the argillite unit. Operational ML/ARD monitoring has shown an increasing trend in the PAG proportion over time reaching up to 20% in blasted rock from the Touquoy pit (Lorax 2019, 2020).

3. Planning

3. Planning

3.1 Compliance Obligations

The IA requires that waste rock from the open pit, rock from the Tailings Management Facility (TMF) quarry, and tailings are tested for ML/ARD potential. The requirement in the IA states that "*The Approval Holder shall collect and analyze samples of fresh waste rock from the open pit mine and tailings for at least every 100,000 tonnes of ore mined. Samples from the TMF quarry shall be collected and analyzed for at least every 20,000 tonnes of rock quarried*." In addition, "*Any rock used for construction which lies outside the TMF drainage catchment shall be tested for acid rock drainage and metal leaching potential. Records of such testing shall be held for inspection by the Department for the life of the project*."

The IA further stipulates that "*The B.C. Confirmation Test or alternate acceptable acid rock drainage kinetic testing shall be conducted on all samples which have an acid consuming to acid generating ratio of 3:1 or less*." The B.C. Confirmation test method is not routinely used in the industry and was, upon review of the method, considered outdated for its intended purpose. It is therefore recommended that the net acid generation (NAG) test (Smart *et al*., 2002) be conducted on this subset of samples instead. This test quantifies the relative amounts of acid producing and neutralizing phases in a sample upon oxidation of all sulphide minerals via hydrogen peroxide.

An additional requirement in the IA is that "*Drainage water pumped from the open pit (surface) mine and draining from the waste rock stockpiles shall be monitored weekly for pH. Records of this monitoring shall be maintained on the Site for inspection by the Department*." Weekly pH measurements are collected from the open pit dewatering line or sump and from the waste rock storage facility collection ponds. This is undertaken as part of the site surface water monitoring program. Field conductivity, total dissolved solids (TDS), and temperature are also collected at the same time as the weekly pH measurements in order to provide a further indication of changes in water quality.

The ML/ARD sampling and sample preparation methods should follow the requirements of the Standard Operating Procedures (SOPs) including:

- Blast Material Sampling and Handling (AMNS, 2019a);
- Tailings Solids Sampling (AMNS, 2020);
- Surface Water Sampling (AMNS, 2019b); and
- Eltra CS800 Sulphur Analyzer Operation (AMNS, 2017).

Any changes or updates to the sampling or analytical procedures shall be reflected in the corresponding SOP.

3.2 Roles and Responsibilities

A summary of the roles and responsibilities for the ML/ARD management sampling programs are provided in Table 3-1. Blast hole sampling and material management is undertaken by the Mine Geologist and Mine Operations. Tailings sampling is conducted by the metallurgists at site. The pH monitoring is conducted by environmental field technicians as part of a large water quality monitoring program at site. Ultimately, the Environmental Superintendent will review the ML/ARD results from the sampling programs and report to NSE, if required.

Table 3-1:
Summary of Roles and Responsibilities

Department/Title	Roles and Responsibilities
Blast Hole Sampling	
Mine Geologist	• Classify the blast material and determine the variability in geology in the blast area • Determine if the sampling density is suitable to characterize the blast • Communicate with Mine Operations & Engineering • Oversee the ML/ARD sampling program • Review and update blast materials sampling procedure in SOP • Notify Environment, Mine Operations and Engineering departments if PAG identified based on on-site sulphur testing.
Mine Operations & Engineering	• Plan blasting • Appropriate material handling for PAG and NPAG material
On-site Lab Facilities	• Analyze waste rock samples for total sulphur • Notify geology of samples with total sulphur values of >0.4%.
Health & Safety	• Review and audit Blast Hole Sampling procedure outlined in the SOP
Environment	• Review blast materials sampling procedure in SOP • Ship samples to external lab for appropriate testing • Review ML/ARD sampling results and communicate with Geology and Mine Operations and Engineering • Report results to NSE
Tailings Sampling	
Chief Metallurgist	• Review and update tailings sampling procedure in SOP
Metallurgist	• Review and update tailings sampling procedure • Assist Metallurgical Technician in the undertaking of the sampling procedure in the SOP
Metallurgical Technician	• Perform tailings solid sampling following the procedure outlined in the SOP
Health & Safety	• Review and audit Tailings Solids Sampling procedure, as outlined in the SOP
Environment	• Review tailings sampling procedure in SOP • Review ML/ARD sampling results • Report results to NSE
pH Monitoring	
Environmental Field Technician	• Collect weekly pH measurements of drainage water pumped from the open pit (surface) mine and draining from the waste rock stockpiles • Collection of weekly field conductivity, TDS, and temperature measurements • Enter field results into the database
Health & Safety	• Review and audit Surface Water Sampling procedure
Environmental Superintendent	• Provide field technicians with necessary tools required to complete the work safely • Maintain database for inspection by NSE, if required

3.3 Quality Assurance/Quality Control (QA/QC)

QA/QC measures will be implemented during both the sampling and the geochemical analysis of the blast hole and tailings materials. The sampling QA/QC protocol will include the collection of a replicate sample for every 10^{th} blast hole monitoring sample and for every 10^{th} tailings sample. The sample collection procedure for the replicate sample should be identical to that for the original sample. Laboratory QA/QC measures will include the implementation of analytical duplicates and the use of certified reference materials.

The field pH probe should be properly maintained and calibrated regularly. Field QA/QC for pH monitoring should include collecting duplicate readings at one in every ten sites. In addition, the field measurements should be compared to laboratory values when water quality samples are collected at these monitoring stations.

4. Monitoring and Management

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4. Monitoring and Management

4.1 Mine Rock Sampling

4.1.1 In-Pit and TMF Quarry Monitoring

Waste rock is currently monitored by collecting blast hole material from within the open pit. To allow for flexibility with respect to material classification and handling, the collection and analysis of ML/ARD monitoring samples should be conducted as early as possible. In order to provide additional time between sampling and material movement, AMNS intends to integrate the ML/ARD monitoring program with the grade control sampling program. Characterizing the material well before it is being moved will allow for PAG and NPAG mine rock to be placed according to the material management strategy. Further, the development of a geo-environmental model capable of predicting PAG and NPAG tonnages to be mined will facilitate pro-active mitigative planning.

ML/ARD potential at the Touquoy mine is determined via acid-base accounting (ABA) comprising the analysis of paste pH, total sulphur, sulphate sulphur, sulphide sulphur (by calculation), modified NP, and NAG testing (where necessary). Although not specifically mandated, occasional analysis for aqua-regia digestible metals is recommended in order to develop a database relating the solid-phase composition of different material types.

The NPR (NP/AP) is calculated using the modified NP and AP based on sulphide S content. As per the specific wording in the IA, an NPR < 3 will trigger further confirmatory analysis via NAG testing (Figure 4-1). However, for the purpose of this ML/ARD Management Plan, a sample is considered PAG if it shows an NPR < 2 in accordance with recommendations made in Price (2009). Confirmatory NAG testing on materials with NPR < 3 results will be used to increase the confidence in the environmental designation and support operational waste management decisions.

The sampling frequency required by the IA for in-pit waste rock, TMF quarry rock and construction fill include:

- One sample for every 100,000 tonnes of ore mined in-pit;
- One composite sample for SFE testing per 100,000 tonnes of construction fill material. It should be noted that since the IA does not state a specific sample frequency, one sample per 100,000 tonnes of construction rock was proposed in AMNS (2019a); and
- One rock sample for every 20,000 tonnes of rock generated from the TMF quarry.

Currently, blast hole cuttings are submitted for ML/ARD testing. Total S is determined at the on-site laboratory following the Sulphur Analyzer SOP (AMNS, 2017) and the remaining geochemical testwork is carried out at the external laboratory. A data acquisition procedure through the collection of grade control samples is currently being initiated and will allow for the generation of a predictive PAG rock model. This, in turn, will allow for a more proactive material handling approach. The analysis of total sulphur using a LECO furnace is a relatively rapid analytical technique. It was found that a sulphur content of 0.4% is a reliable and conservative proxy with respect to the geochemical class where samples exceeding this sulphur value have a very high probability of being PAG (Figure 4-1). This relationship can be used for rapid pre-screening of blast rock to allow for preliminary storage planning.

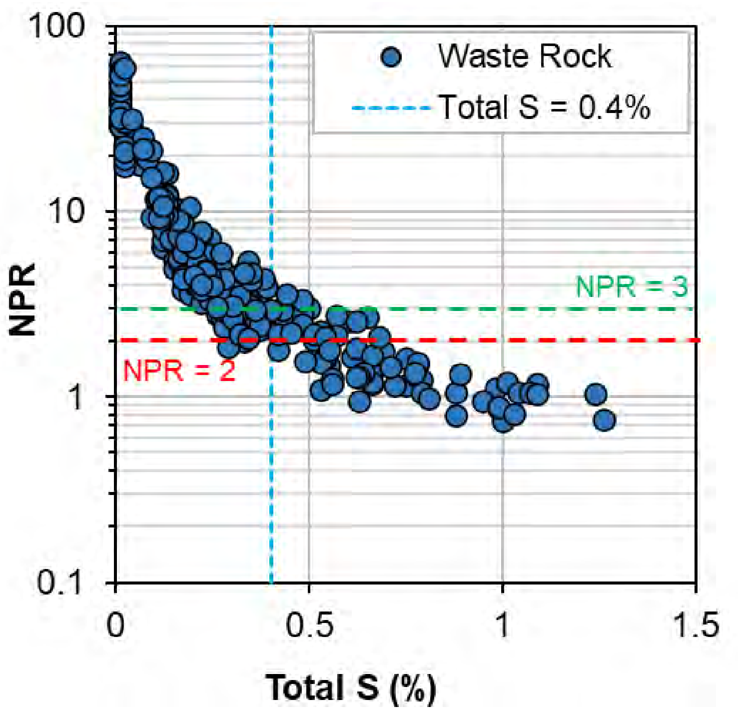

Figure 4-1: NPR versus Total S in Touquoy blast hole monitoring samples

4.1.2 Material Handling and Management

From an environmental standpoint, three general types of material are expected to be produced during mining, namely NPAG waste rock, PAG waste rock, and ore. While ore will either be processed directly or temporarily stockpiled for later processing (if low-grade), waste material will be hauled to the WRSA for permanent storage or used for the construction of mine infrastructure. The IA does not prescribe specific management actions to be followed should PAG material be encountered nor does it establish ML criteria for potential construction material. Material handling recommendations made in this document are based on industry practice standards.

4.1.2.1 Waste Rock

Waste rock is tracked within the WRSA in case it is determined that management is required. Currently site operations are working towards the recommended material handling strategy included in Figure 4-2 (see Section 5.1). In this approach, material is pre-screened prior to preliminary placement in the WRSA. Material with total S > 0.4% will be stored in a separate stockpile prior to obtaining the results from the full ABA and metals analysis. Material with NPR < 3 will be submitted for NAG testing. If NAG testing confirms the overall PAG character of the blast (NAG pH < 4.5), this material cannot be used for site infrastructure construction purposes and will have to be managed within the WRSA.

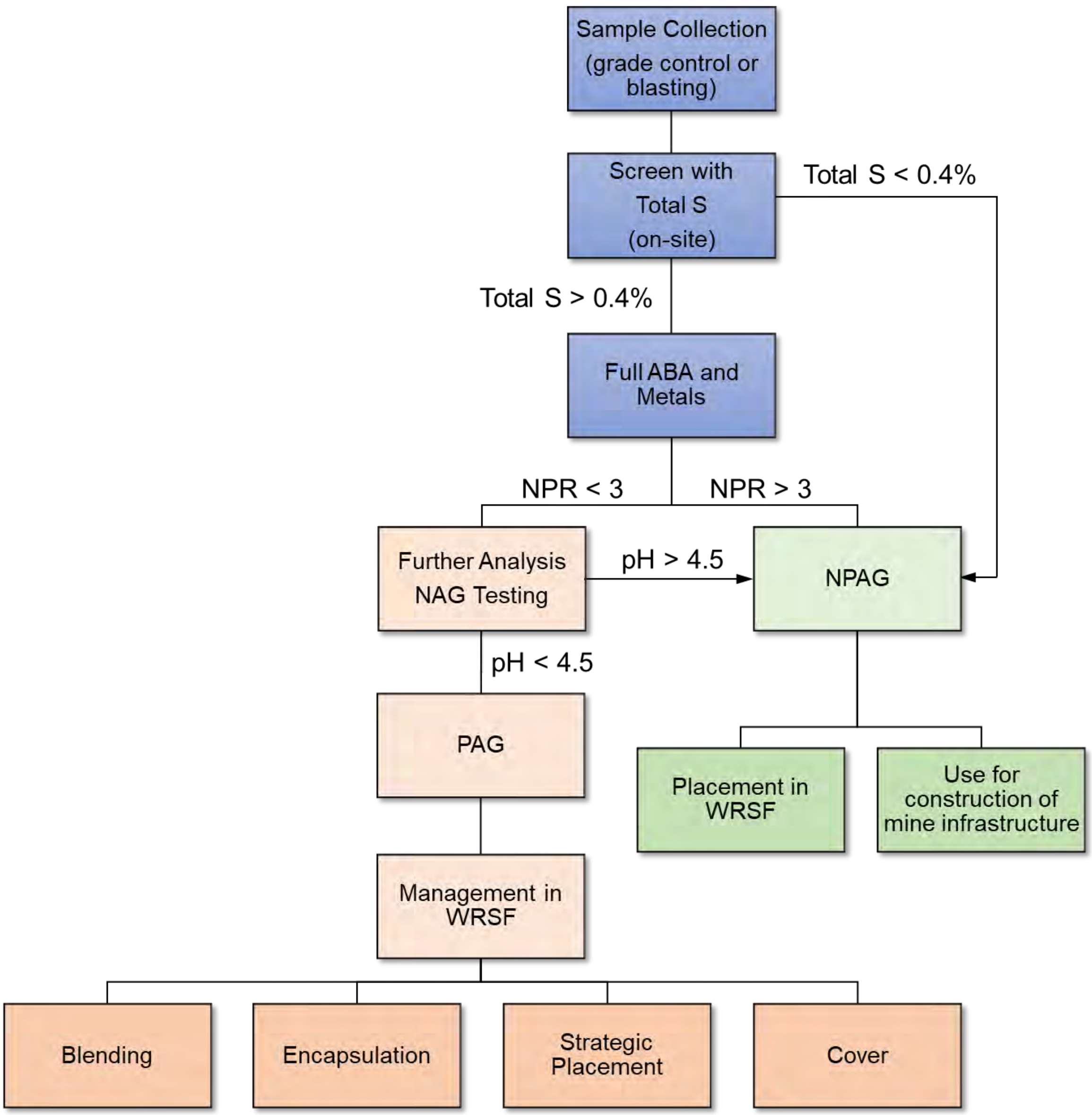

Figure 4-2: In-Pit Material Handling Decision Tree

One or more of the following material handling strategies may be implemented in order to mitigate the risk for acidic drainage from the Touquoy WRSA:

- Strategic placement of PAG material (*i.e*., away from watercourses);
- Blending of PAG and NPAG materials;
- Encapsulation of PAG within NPAG material; and/or
- Placement of synthetic or natural cover systems.

Strategic placement of PAG material

If the total volumes of PAG rock are relatively low, the simplest mitigation strategy would be to strategically place the material in an area within the WRSA or other approved storage area. Segregation of PAG from NPAG material during operations will minimize the volume of material requiring management. At closure, the PAG material could be covered in-place or re-handled and deposited in the pit. The prediction of PAG zones and volumes within the undeveloped portions of the pit is important for this mitigation strategy to accommodate for early planning, segregation and design considerations.

Blending of PAG and NPAG materials

The objective of blending PAG and NPAG materials is to obtain a NPAG composite. The principle of the method is based on the principle that excess NP in the NPAG material will neutralize the acid produced by the PAG material. A good understanding of the variability in NP and AP for both PAG and NPAG material is required in order to determine the proportions of PAG and NPAG material that will consistently produce a NPAG composite. Generally, since complete mixing of PAG and NPAG rock may not be easily achievable in coarse waste rock materials and zones with higher PAG material concentrations can be expected, the blended layers pile should have a target bulk NPR of ≥ 3. In order to prevent the development of ARD, either the dissolved pore water alkalinity must be sufficient to buffer the generated acidity or the NPAG zones must neutralize any acidic seepage generated by the PAG zones.

Blending has better success where the PAG material has low sulphide S and slow reaction rates. Possible mixing strategies (Figure 4-3) include:

1) Alternate end dumping of NPAG and PAG rock,
2) Alternate lifts of NPAG and PAG rock,
3) Alternate tips of NPAG and PAG rock in multiple lifts, and
4) Encapsulation of PAG within NPAG rock.

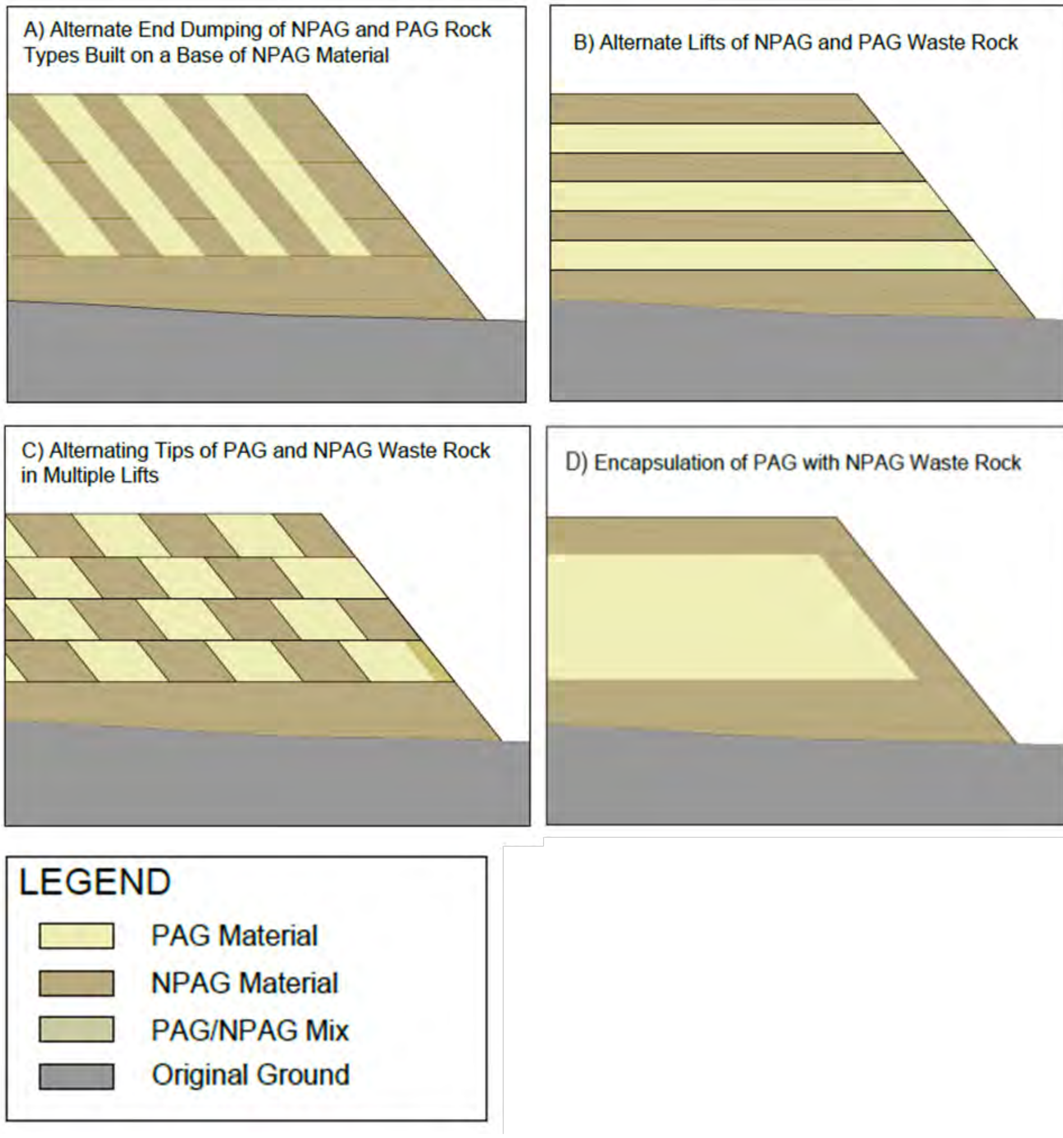

Figure 4-3: Schematic cross sections of different approaches to blending NPAG and PAG material.

With each of the options, suitable thicknesses of the NPAG and PAG layers must be determined. In general, the layered waste rock in each of these methods is placed over a thicker NPAG base layer. A PAG layer thickness of 1 m or less should be targeted to prevent the development of hotspots within the dump.

The maximum allowable fraction of PAG rock that would result in a bulk blended NPR of ≥ 3 can be calculated per the following relationship:

$$\frac{[(1-f)\ NP_{NPAG} + f\ NP_{PAG}]}{[(1-f)\ AP_{NPAG} + f\ AP_{PAG}]} = 3$$

where NP_{NPAG} is the NP content of the NPAG sample population; NP_{PAG} is the NP content of the PAG sample population; AP_{NPAG} is the AP content of the NPAG sample population; AP_{PAG} is the NP content of the NPAG sample population; and f is the maximum allowable PAG fraction. Solving for f, this equation can be re-arranged as follows:

$$f = \frac{[NP_{NPAG} - 3\ AP_{NPAG}]}{[3\ AP_{PAG} - 3\ AP_{NPAG} -\ NP_{PAG} + NP_{NPAG}]}$$

Using median AP (PAG: 23 kg $CaCO_3$/t; NPAG: 6.9 kg $CaCO_3$/t) and NP (PAG: 27 kg $CaCO_3$/t; NPAG: 32 kg $CaCO_3$/t) results for the PAG and NPAG populations from the Touquoy waste rock static test database, the maximum allowable PAG proportion in the blended waste rock facility would be 22% or 78% NPAG. Assuming a 0.5 m thick PAG layer, this translates into a required NPAG layer thickness of >1.8 m.

<u>Encapsulation of PAG within NPAG material</u>

Encapsulation is a specific type of blending option that requires PAG material to be entirely enclosed by NPAG material. This decreases the exposure of the PAG material to both water and oxygen and provides alkalinity before and after water comes in contact with the PAG zone. In order to be effective, any acidic seepage generated by the PAG material must be neutralized by the encapsulating NPAG material. In this regard, similar considerations to blending PAG and NPAG material are required, including the placement of a layer of NPAG material that provides sufficient alkalinity to neutralize any acidity produced by the PAG rock. Since the WRSA is already being constructed, encapsulation of PAG rock may need to occur in specific sections of the WRSA, should this strategy be an option. When choosing such WRSA areas, strategic placement of the PAG core as far as possible away from the receiver should be considered.

<u>Synthetic or Natural Covers</u>

Covers will only be considered if the other management options are not suitable for the material excavated at site (*i.e.*, if the acid generating potential of the material is higher than expected) and operational monitoring suggests that long-term ARD may become a risk at the Touquoy WRSA. Covers over PAG material limit ML/ARD by reducing the exposure of the PAG material to water and oxygen. These can include geosynthetic covers or geomembranes as well as natural covers made of low hydraulic conductivity material such as till or clay or store and release covers. The covers must be carefully constructed in order to meet the design objectives and may require regular inspection for potential damage.

The benefits of cover placement are twofold. First, the cover will shed precipitation and thereby reduce the infiltration rate and net percolation within the WRSA. The resulting lower seepage rates will result in a reduction of the overall geochemical load being released from the WRSA which facilitates water management or treatment, if necessary. Second, both synthetic and natural covers may be designed to act as an oxygen barrier that slows the diffusion of oxygen into the waste pile. Once pore water oxygen is depleted by sulphide oxidation, the slow replenishment of oxygen through the cover will result in a lower proportion of the WRSA being exposed to oxygen. As such, the risk for ARD developing in the pile is reduced.

Although not specifically designed for ML/ARD management, the current Reclamation Plan (Stantec, 2019) specifies that the WRSA will be covered by a vegetated cover. The composition and thickness of this cover will be determined as part of ongoing reclamation work. The vegetated cover may provide some benefit from an ML/ARD perspective if the cover has sufficient water storage capacity to allow vegetation to remove water via evapotranspiration that would decrease the ingress of water into the waste rock, thereby reducing the geochemical loadings released from the WRSA.

4.1.2.2 Ore

Material classified as ore will either be processed directly or transported to the low-grade ore stockpile for temporary storage. In consideration of the current geochemical knowledge of Touquoy ore, these materials contain sufficient NP to buffer acidity in PAG rock at circum-neutral pH levels for the duration of storage until re-handling and processing is initiated prior to closure. Therefore, no special handling considerations are currently required. Should continued operational monitoring indicate contiguous areas of low-NP PAG material, a geochemical investigation into the lag time to onset of ARD and potential mitigation measures will be triggered. In addition, if unforeseen circumstances render the low-grade ore stockpile uneconomic effectively making it a permanent waste rock facility, then ARD mitigation measures will be re-evaluated.

4.1.3 Verification Monitoring

Confirmatory sampling of placed waste rock should be conducted in the WRSA and in areas where waste rock is used for construction (*e.g.*, the TMF embankment). This sampling will ensure that proper material handling protocols have been implemented and that placement of PAG material has been properly managed. A sampling frequency of one sample per every 400,000 tonnes of material placed is recommended. These samples should be submitted for ABA and aqua-regia digestible metals.

In addition to waste rock sampling, regular surface water monitoring of the waste rock collection ponds as well as opportunistic sampling of surface seeps are recommended as part of the verification monitoring for the site. Currently, monthly samples are collected from the West and East Waste Rock Collection Ponds. Any ML/ARD influence on the pond water quality would be indicated by a decrease in pH and/or an increase in metal concentrations. Such water monitoring will allow for the early detection of waste rock zones that have turned acidic and trigger adaptive management.

4.2 Tailings

4.2.1 Monitoring

The monitoring frequency for tailings samples is one sample for every 100,000 tonnes of ore processed. Tailings slurry is collected from the tailings screen at the mill. The slurry is then filtered, and the tailings solids are submitted to the lab for analysis. The IA requires that samples are analyzed for ABA. As outlined for the waste rock, occasional analysis for aqua-regia digestible metals is recommended although not specifically mandated in the IA. The requirement for additional confirmatory analysis via NAG testing for samples with NPR < 3 that is required for waste rock also applies to tailings samples. Although samples will not be classified as PAG unless the NPR is below 2, NAG testing will increase the confidence in the sample classification.

4.2.2 Material Handling and Management

The tailings slurry is deposited in the TMF. A water cover is maintained over the majority of the tailings pond, while some tailings are exposed to atmospheric conditions along the upgradient periphery of the TMF in the form of a tailings beach. At closure, the TMF will be dewatered and covered by a dry cover consisting of overburden and topsoil (Stantec, 2019).

Of the 54 operational monitoring tailings samples submitted for geochemical testing in 2018 and 2019, 21 were classified as PAG (NPR < 2) and 23 had NPR values between 2 and 3 (Lorax 2019, 2020). As opposed to blast rock, the acid-producing and -consuming phases in the tailings slurry are relatively well mixed which generally bears a lower risk of localized ARD generation. Nevertheless, should operational monitoring unexpectedly show an increase in PAG tailings being deposited in the TMF, similar mitigation strategies to those included for waste rock can be considered and include:

- Covering of PAG with NPAG tailings in the long-term; and
- Synthetic or natural cover that limits the ingress of water and oxygen into the TMF.

In addition, potential mitigation options specific to tailings that can be considered, if required, are:

- Increased addition of lime;

- Tailings desulphurization; and
- Subaqueous storage, if feasible.

Increased Addition of Lime

Increasing the amount of lime added to the tailings will increase the neutralization potential of the tailings stream. The volume of lime added must be sufficient to neutralize the acid generating potential of the tailings to increase the NPR > 2.

Tailings Desulphurization

This method involves implementing a sulphide flotation circuit in the processing plant in order to concentrate the sulphide minerals into a low-volume stream that can be more effectively managed. The tailings desulphurization option is most effective for the high-sulphur tailings.

Subaqueous Storage

Storage of PAG material under water cover reduces sulphide mineral oxidation by decreasing the availability of dissolved oxygen; however, there may be impacts to water quality through pH and/or redox-dependent processes. In order to maintain a continual water cover over the PAG material, consideration must be given to the design of the storage facility's water balance and long-term geotechnical stability.

4.2.3 Verification Monitoring

Opportunistically, when safe access allows, tailings solids from the exposed beaches should be collected and submitted for ABA. Sampling from different distances downgradient across the beach is required as there may be particle size segregation along the tailings beach, with coarser grained tailings particles settling out from the tailings slurry more rapidly. The effect of particle size on the ABA characteristics needs to be confirmed.

Water quality monitoring of non IA-required tailings pond stations should be continued. Additional monitoring is recommended for surface seeps that may drain the tailings mass, where safely accessible. This will support the understanding of oxidative weathering of the Touquoy tailings materials and help estimate geochemical loads contributing to the tailings pond.

5. Implementation and Reporting

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5. Implementation and Reporting

5.1 Recommendations

The following updates to the current ML/ARD monitoring plan are recommended:

- Use of grade control samples to classify PAG and NPAG mining blocks.
- Incorporation of ARD results into the block model to allow for the quantification of PAG material tonnages and mitigative planning prior to blasting.
- Development of a verification monitoring procedure.
- Review of WRSA and TMF cover characteristics following the 2020 update to the Reclamation Plan, in order to further evaluate the impact of this cover on ML/ARD.
- Consider the feasibility of depositing NPAG tailings as the final layer on the TMF, prior to placement of the dry cover.

5.2 Record Keeping and Tracking

The Environmental Superintendent or designate is responsible for the implementation of the ML/ARD Management Plan with support from Mine Engineering, Geology, and Mill Metallurgy. The laboratory chain of custody (COC) and raw data files from the laboratory should be kept on file. Field notes and external laboratory test results should be compiled into an electronic database. The Environmental Superintendent or designate will be responsible for the maintenance of the original records and database. Records of ML/ARD assessment testwork and weekly pH measurements for drainage water quality must be available on site for inspection by NSE.

Tracking of lithologies (argillite- versus greywacke-dominated) for the individual blasts is recommended where possible due to the known different geochemical behaviour of the two rock type end-members. A record of the volume, material type, and material placement should be maintained by Mine Operations & Engineering and updated on a regular basis. A copy of the record should be provided to Atlantic Gold's environmental department on a monthly basis. Investigation and corrective action will be undertaken if monitoring data indicates that actual geochemical characteristics are significantly different than expected based on geochemical characterization testwork conducted to date.

5.2.1 Monitoring Reporting

A summary of the ML/ARD results is required in the Annual Report under Condition 12 of the IA. An analysis of the new sampling results should be included and any notable deviations from previous years should be discussed. Condition 19 of the IA requires that the Blast Material Sampling Procedure "*be reviewed and updated annually by a Professional Geochemist and a copy provided to the Department with the Annual Report*".

5.2.2 Incident Reporting

Condition 19 of the IA states that "*Should the results of testing indicate potentially acid generating conditions the Approval Holder shall notify the Department immediately and may be required to conduct additional monitoring/testing or implement a plan to monitor and mitigate potential acid mine drainage, if so directed by Department*".

The current wording in the IA does not clearly define what would indicate "potentially acid generating conditions". It is proposed that the requirement to notify NSE be triggered by the identification of PAG material that requires further management, including the following:

- Placement of PAG material outside the TMF drainage catchment;
- If further management of PAG material in the WRSA is required (*i.e*., due to a higher PAG:NPAG ratio than defined in Section 4.1.2.1); or
- If a surface water sample has an acidic pH measurement.

Each of these would require additional monitoring and/or mitigation.

6. Closure

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6. Closure

This report was prepared by Lorax Environmental Services Ltd. for the exclusive use of Atlantic Mining NS. This initial plan has been developed to outline ML/ARD monitoring measures and management options that can be considered for the Touquoy Mine. Please contact the undersigned should you have any questions or comments or require additional information in support of this work.

Sincerely,
Lorax Environmental Services Ltd.

Prepared by:

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