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Magino Gold Project

Environment Management System

Updated Mine Material Management Plan

Technical Support Document 20-8

November 2017

PRODIGY
GOLD INCORPORATED

Updated Mined Materials Management Plan

Technical Support Document 20-8

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TECHNICAL SUPPORT DOCUMENT
MAGINO GOLD PROJECT

The Mine Material Management Plan (TSD 20-8) is an integral part of Prodigy's Environmental Management System for the Magino Gold Project.

This document has been prepared by SLR International Corp. The material and data in this report entitled Mine Material Management Technical Support Document for the Magino Gold Project, Wawa, Ontario, Canada, effective as of November 2017 were prepared, reviewed, and approved by the following people:

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CONTENTS

CONTENTS (CONTINUED)

ACRONYMS

3-D	Three-dimensional
%	Percentage
ABA	Acid-base accounting
AP	Acid-potential
ARD	Acid rock drainage
ARD/ML	Acid rock drainage/metals leaching
cm	Centimetres
GPS	Global positioning system
gm	Grams
Kt	Kilo Tonnes
LECO	Leco Corporation furnace used to determine carbon and sulpher in rock
MEND	Mine Environment Neutral Drainage
MERC	Mushkegowuk Environmental Research Centre
m	Metre(s)
ml	Millilitre
MFN	Michipicoten First Nation
MPA	Maximum potential acidity
Mt	Million tonnes
MRMF	Mine Rock Management Facility
NAG	Non-potentially acid generating
NNP	Net neutralization potential
NP/MPA	Neutralization potential ratio
NPR	Neutralization potential ratio
OM&M	Operations, maintenance and management
PAG	Potentially acid generating
Plan	Mine Material Management Plan
Project	Magino Gold Project
PSA	Project Study Area
TMF	Tailings Management Facility (refers to approach for tailings management)
tpd	Tonne(s) per day
TSD	Technical Support Document
WQCP	Water Quality Control Pond

1. INTRODUCTION

The development of the Magino Property will require excavation, processing and stockpiling of 550 million tonnes (Mt) of ore, overburden and mine rock. Up to 150 Mt will be processed as ore and the resulting thickened tailings will be stored in the Tailings Management Facility (TMF). The remaining 400 Mt will include 377 Mt of mine rock and 23 Mt of overburden materials. The mine rock will be used to construct the TMF containment embankment and, for other construction activities. The remaining mine rock will be stored of in the Mine Rock Management Facility (MRMF). The excavated overburden will be used in construction of the TMF embankment, for other construction activities, and also be stockpiled for use as cover material during closure. The general layout of the TMF and MRF facilities is shown on Figure 1-1**.**

The geochemical characterization of the mine rock completed to date (Technical Support Document [TSD] 2, SLR, 2016a) indicates that the mine rock is predominantly non-acid generating (NAG). However, a small percentage of the rock is classified as potentially acid generating (PAG), while another small fraction has an uncertain classification.

In order to improve the economics of the Magino Gold Project (Project), it will be necessary to stockpile some of the ore during the 10 years of mining. This ore will be processed during the later years of mining and for up to two years after mining has been completed. In the event economic conditions are such that not all the ore that is mined can be economically processed, the stockpiled ore will remain in the stockpile and be closed in conjunction with closure of the MRMF.

Given the occurrence of a relatively small quantity of PAG rock at the site, it is important to develop an effective material management plan that will ensure that only NAG material is used for construction of the TMF embankment, roads and water-conveying ditches, and that the PAG materials are managed in a way that will prevent the occurrence of ARD.

A preliminary Mine Material Management Plan was issued in November 2016 (SLR, 2016b) based on the existing geochemical database and the results presented in TSD 2 – Geochemical Assessment. The preliminary Mine Material Management Plan identified that further investigation to augment the database was necessary to develop a mine material management plan that is fully and confidently protective of the environment. In particular, a supplemental investigation was developed to improve the robustness of the characterization dataset for a particular lithologic unit (Unit 6 – Intrusives) and also to characterize the geochemistry of the unconsolidated overburden that covers the site. The scope of the supplemental investigation is presented in Appendix I.

The supplemental investigation was completed during 2017, and the procedures and results are reported in Geochemical Assessment Update, TSD Supplement (SLR, 2017). The supplemental data were then used to prepare this Updated Mine Material Management Plan.

1.1 SCOPE

This plan focuses on management of mine rock, ore, and overburden. Management of the tailings is discussed in the Conceptual Design of the TMF (TSD 6; SLR, 2016c).

For each of these main material categories this Mine Material Management Plan (MMMP) describes the following:

- Objectives;
- Mine rock characterization;
- Management approach;
- Key design and operational features;
- Monitoring and reporting; and
- Expected outcomes.

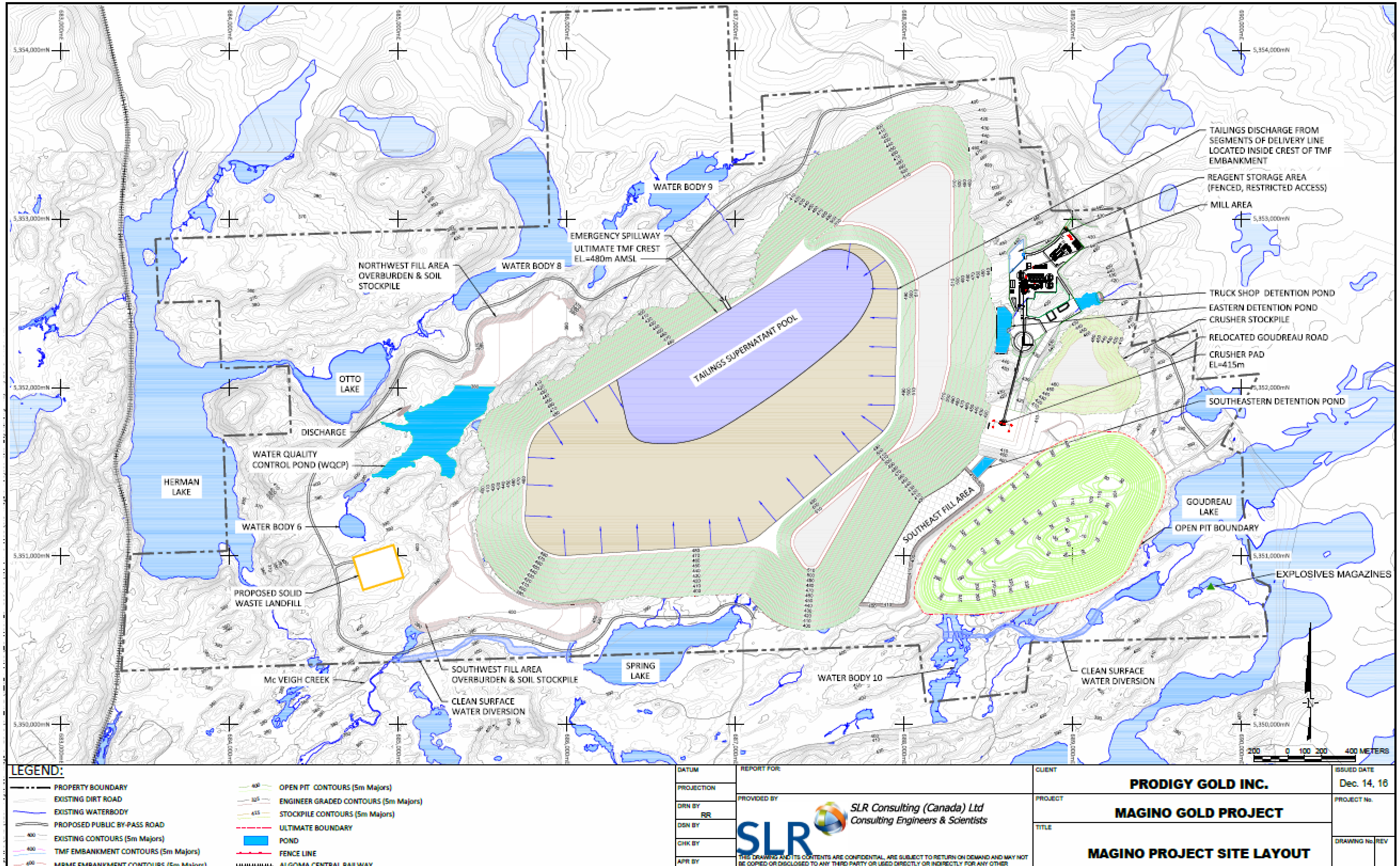
1.2 GUIDANCE DOCUMENTS

The following guidance documents have been used in establishing this MMMP:

- Global Acid Rock Drainage Guide, http://www.gardguide.com/index.php?title=Main_Page;
- Mine Environmental Neutral Drainage (MEND, 2009) Guidance Documents, http://mend-nedem.org/guidance-documents/; and
- Environment Canada's *Environmental Code for Metal Mines* (EC, 2015) (https://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=CBE3CD59-1&offset=2&toc=show).

The MEND guidelines are the basis for classification of acid-generation potential of the various mine material generated by the Magino Project. Material with a neutralization potential ratio (NPR) of less than one is classified as PAG. Material with a NPR between 1 and 2 is classified as uncertain. Material with an NPR greater than 2 is classified as NAG.

Figure 1-1: Magino Site Layout



2. MINE ROCK MANAGEMENT

2.1 OBJECTIVES FOR MINE ROCK MANAGEMENT

The objectives of mine rock management are to:

- Provide for sufficient NAG material to construct the TMF embankment; and
- Reduce potential for acid rock drainage and metals leaching (ARD/ML) from the MRMF;
- Control runoff and seepage from the MRMF.

2.2 MINE ROCK CHARACTERIZATION

2.2.1 MINE ROCK CHARACTERIZATION COMPLETED TO-DATE

The mine rock will be drilled and blasted in the pit, then excavated by shovel and hauled out of the pit in mine trucks. It will consist of rock particle sizes ranging from boulders approximately 1.0 m across to sand-sized material.

The data presented in this report is based on prior studies initiated in 2012 and completed to date (2017) by EBA (EBA, 2013) and SLR (SLR, 2016a; SLR, 2017).

The mine rock is subdivided into 11 lithological or rock type units, denoted by Units 1 through 11. Some of these units are further subdivided based on compositional and textural variations. The lithologic units, along with the most abundant rock type observed in drill core, are summarized in Table 2-1.

Unit 6 is the mineralized Webb Lake stock, which represents the major component of the ore. All other units are essentially mine rock units with no economic value with the exceptions of small fractions of sub-units of 1, 5 and 7, which are ore.

Table 2-1: Description of Lithological Units

LITHOLOGY TYPE	LITHOLOGY UNIT	DOMINANT ROCK TYPES
Mafic Metavolcanics	Unit 1	Mafic
Intermediate Metavolcanics	Unit 2	Lapilli –Tuff and Crystal Tuff
Felsic Metavolcanics	Unit 3	Crystal Tuff
Clastic Metasediments	Unit 4	Volcaniclastic – Epiclastic
Chemical Metasediments	Unit 5	Banded Sulphides (Unit 5E) and Banded Carbonates (Unit 5C)
Synvolcanic Felsic to Intermediate Intrusives	Unit 6	Granodiorite-Monzodiorite and Quartz Feldspar Porphyry
Mafic Intrusives	Unit 7	Gabbro
Ultramafic Intrusives	Unit 8	Amphibolite
Felsic to Intermediate Intrusives	Unit 9	Felsite – Aplite dykes/sills
Lamprophyre	Unit 10	Porphyritic Lamprophyre
Diabase	Unit 11	Diabase dykes

Table 2-2 below presents the results of the acid/base accounting analyses carried out to date which have included results from 578 ABA static tests. Eighty two percent of the samples tested are contained within the current pit shell, and the ARD results can be considered representative of the pit rock as a whole.

Table 2-2 indicates three rock classifications based on the ABA testing done, the relative quantities of each Unit that falls into each classification, as well as the relative quantities of mine rock and ore. The classifications include NAG, uncertain, and PAG rock based on the criteria discussed in Section 1.2 above. The simplifying assumption that has been made is that the relative percentage of these three classifications in the rock is the same as the relative number of samples representing each of the classes. This has shown to be a reasonable assumption in other projects for a robust and representative sampling program. Nonetheless, the block model for the ore body will continue to be updated with the results from the ARD classifications to refine the estimates for each of the categories and to inform mine rock management during operations.

Table 2-2 indicates that 395 Mt of the mine rock and overburden is NAG, 4 Mt of the mine rock falls in the uncertain category, and 5 Mt is considered PAG material.

The overall acid-base mass balance of the mine rock is predominantly alkaline in nature with an overall NP/MPA ratio of 9.3 as shown on Table 2-3, with the Unit 5E PAG material included. The rock has a total mass of neutralization capacity of 34,887 Kilo Tonnes (Kt) with an acid generating potential of 3,745 Kt, all in calcium carbonate ($CaCO_3$) equivalents. Including or excluding Unit 5E (the lithologic unit that is classified as PAG) in this category does not alter the acid-base balance much since the tonnage of this material only amounts to 0.2% of the total. As further shown in the table, the individual rock units have average NP/MPA ratios ranging from 3.9 to 16.9, with the exception of Unit 5E which has a ratio of 0.4.

As discussed further in the Geochemical Assessment Update, TSD Supplement (SLR, 2017), the above evaluation of the mine rock is based on the Sobek method of analyzing for the neutralizing capacity of the rock material as it is considered more representative for rock that is predominantly basic in nature. The Sobek method is one of the methods provided for in the MEND Guidelines. When carbonate content of the rock is used to estimate the NP, as Carb-NP, the amount of rock classified as PAG and uncertain (8 and 10 million tons, respectively) are approximately double that classified with the Sobek NP.

Table 2-2: Summary of Rock Sample Classification and Comparison to Expected Inventories

ABA Samples		ARD Classification						Total Mined Rock		Ore			Mine Rock		
		PAG		Uncertain		NAG		Ore	Waste	PAG	Uncertain	NAG	PAG	Uncertain	NAG
Unit	Number of Samples	#	%	#	%	#	%	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt
OB	15	0	0%	0	0%	15	100%	0	31.0	0.0	0.0	0.0	0.0	0.0	31.0
MV (1,2&3)	287	7	2.4%	5	1.7%	275	96%	11	171	0.3	0.2	10.1	4.2	3.0	164
U5; non-5e	21	2	9.5%	3	14.3%	16	76%	0.15	4.72	0.0	0.0	0.1	0.4	0.7	3.6
5e	20	16	80%	2	10%	2	10%	0.00	0.8	0.0	0.0	0.0	0.6	0.1	0.1
6	41	0	0.0%	0	0.0%	41	100%	130	184	0.0	0.0	130	0	0	184
7	156	2	1.3%	0	0.0%	154	99%	3.9	4.9	0.1	0.0	3.9	0.1	0.0	4.8
9	10	0	0.0%	0	0.0%	10	100%	0.5	0.5	0.0	0.0	0.5	0.0	0.0	0.5
11	28	0	0.0%	0	0.0%	28	100%	0.0	7.1	0.0	0.0	0.0	0.0	0.0	7.1
Totals	578	27	4.7%	10	1.7%	541	94%	145	404	0	0	144	5	4	395

Table 2-3: Overall Acid/Base Mass Balance for Waste Mine Rock

Unit	Abundance	Average for Unit (tCaCO3/kt rock)		Totals (t CaCO3 equiv.)			Unit NPR
	Percent	MPA	NP	MPA	NP	NNP	
MV (1,2,& 3)	42.4%	12	122	2,058	20,918	18,861	10.2
Other Unit 5	1.2%	74	323	349	1,524	1,175	4.4
5E	0.2%	360	150	272	113	-159	0.4
6	45.4%	5.2	58.9	956	10,813	9,856	11.3
7	1.2%	10	131	49	639	591	13.1
9	<0.1%	7	27	3	11	8	3.9
11	1.7%	5	68	35	480	445	13.6
OB	7.7%	0.74	12.5	23	388	365	16.9
Totals	100% 404	**Mt**		**3,745**	**34,887**	**31,142**	**9.3**

2.3 MINE ROCK MANAGEMENT

The mine rock will be handled and stockpiled based on its ARD classification and according to whether it is classified as NAG, uncertain, or PAG in accordance with the criteria described in Section 1.2. Based on the mine production schedule for ore and mine rock, mining of PAG rock will occur over the entire period of mining. Therefore, there is a need to provide for ongoing classification of the rock that is mined so that appropriate placement can occur without the risk of causing ARD runoff or seepage that could enter receiving waters both during operation and after closure.

The following section describes how the classification will be accomplished during mining. It should also be noted that the management and classification procedures described here are subject to confirmation and refinement as necessary.

Each class of mine rock will be managed differently. The classes include:

- NAG Mine Rock;
- Unit 5 Mine Rock;
- Other PAG Mine Rock; and
- Mine Rock with an Uncertain Classification.

2.3.1 NAG ROCK

NAG mine rock represents approximately 94% (Table 2-2) of the mine rock mass mined and amounts to 395 Mt based on current estimates. This NAG rock will be trucked either to the TMF to be used as embankment fill, to other sites where it is needed for construction, or to the MRMF for ultimate storage.

It is estimated that the TMF embankment will require approximately 133 Mt of NAG material. This means that the remaining 262 Mt will be placed in the MRMF. It is estimated that up to 1 Mt of this NAG material will be used other construction needs.

2.3.2 MINE ROCK UNIT 5

While lithologic Unit 5E (a massive sulphide) is the only subunit of Unit 5 (metasediments) that was classified above as PAG, there is an elevated frequency of individual samples of non-5E Unit 5 subunits with PAG or uncertain classification. Because the total amount of this material is relatively small and as a conservative measure to ensure environmental protection, all the Unit 5 material will be managed the same.

The total amount of this material is expected to be relatively small (5.7 Mt) and the quantity that is classified as PAG is estimated to be about 1 Mt. This material will be placed in the TMF for co-disposal with the tailings. It will be hauled in from the east side of the TMF and placed by end dumping as close to the edge of the water pond or tailings as possible. This PAG rock will eventually be covered by tailings which will be saturated with water and isolated from oxygen in the long term, thus eliminating the risk of acid generation.

2.3.3 OTHER PAG MINE ROCK

This category is expected to represent a small percentage of the mine rock, about 4.3 Mt (Table 2-2). It is likely that this material can be co-disposed with the NAG material in the event that further geochemical and mine rock scheduling evaluations demonstrate that this small amount of rock can be spread throughout the NAG rock and that, if some acid is generated, it will be neutralized by the presence of the NAG material. This material represents less than 2% of the 262 Mt of NAG material that will be placed in the MRMF.

The PAG rock, other than Unit 5 material, will be strategically placed in the MRMF to avoid any potential for localized ARD seeps to develop, and to maximize the natural neutralization capacity of the surrounding NAG rock. Placement criteria for this PAG material are as follows:

- The PAG material no closer than 10 m to 15 m from the edge of the final MRMF or 5 m from the bottom of the MRMF;
- The PAG material will be spread in lifts not exceeding 1 m in thickness; and
- NAG cover will be placed over the PAG.

2.3.4 MINE ROCK WITH AN UNCERTAIN CLASSIFICATION

This category also represents a small percentage of the mine rock with about 3 Mt, with the current estimates, which is approximately 1.1% of the 262 Mt of NAG rock to be placed in the MRMF. Subject to the results of further studies, it is expected that this material can be placed in a similar manner to the “Other PAG” materials discussed in Section 2.3.3 above.

2.3.5 ADAPTIVE MANAGEMENT PLANS

In the unlikely event further studies indicate that co-disposal of all or some of the Other PAG and/or uncertain rock is not advisable, there are mitigation measures that can be considered.

Options include placement of some of the PAG in the TMF or placement of the PAG in a separate lined cell.

2.4 MINE ROCK MANAGEMENT APPROACH

2.4.1 OVERALL APPROACH

Effective PAG rock management will require;

(1) Careful planning and scheduling of the different classifications of mine rock that will be mined over time;
(2) Reliable field methods of identifying various rock types and ARD categories; and
(3) A reliable dispatching system to ensure the different mine rock categories are hauled and placed in the appropriate locations mentioned in Section 2.3 above.

The proposed approaches to achieving these requirements are discussed below.

2.4.2 PLANNING AND SCHEDULING

The basic planning tool will be the mine block model that is used to conduct mine planning and scheduling. The ARD material classifications will be incorporated into this block model. The rock in each mine block will be identified as either PAG, uncertain or NAG. Other geochemical characteristics such as sulphide content, mineral type, and potentially other parameters will also be included in the block model. The model will be continually updated and the rock material scheduling will be routinely updated. This will ensure there is sufficient time for the mine operators to plan for, and prepare, suitable mine rock placement areas within the MRMF footprint and for the rock fill dam construction.

Sources of information for the updates, in addition to those the mine operators will be using for ore control, include:

- Any ABA testing done on samples collected from exploration, geotechnical or dewatering well drilling that is conducted within the future pit shell;
- Chip sampling and logging from blast hole cuttings sampling and any ABA testing of chip samples;
- Potentially pit face sampling including mapping, visual inspections, and sampling; and
- Refinement of any ABA test data contained in the block model based on actual experience gained during mining.

2.4.3 FIELD METHODS

Site-specific criteria will be developed to allow identification of PAG mine rock. These criteria will rely on:

- Visual mapping by the mining geologist,
- The analysis of sulphur and carbon contents of mine rock,
- Potentially some field chemical tests, and
- Estimates of the mass/volume of a unit chemically characterized as PAG

It has been shown that the total carbon to total sulphur ratio (C/S) is an excellent surrogate for the carbonate neutralization potential ratio (Carb-NPR). The C/S values of 0.375 and 0.75

correspond to Carb-NPR values of 1 and 2, respectively, representing the upper cutoff for PAG and lower cutoff for NAG rock. The carbon and sulphur will be measured on the blast hole cuttings during the mining operation in a similar manner that will be done for grade control. Provision will be made to provide an onsite laboratory equipped with, amongst other items, a LECO carbon-sulphur analyzer.

Blast hole cuttings will be collected as necessary during blasting operations for analysis at the onsite laboratory. The number of blast hole samples collected will depend on the type of rock being mined at the time, geologic conditions within the blast area, and the blast hole pattern.

The above observations and test results will be used to classify the rock as PAG, uncertain or NAG and the mass/volume will be estimated. If the contiguous mass/volume of an identified block of PAG or uncertain material is sufficient to warrant segregation and special management, it will be managed as such using the dispatching system described below.

The sampling and testing will be completed on the same schedule as the ore testing in order to be effectively included in the short-term mine planning process. These short-term projections will, therefore also include schedules and tonnages for the three different rock categories and of any Unit 5 material that is mined.

2.4.4 MINE ROCK DISPATCHING SYSTEM

The resulting information will be used to assign material types to the active placement areas within the MRMF and the TMF embankment area. A comprehensive mine rock tracking system will be established to identify the three categories of rock to be excavated after blasting and assigning haul trucks to load specified materials and to haul these to designated locations. The type of system and its level of sophistication will depend on further analyses of the mine rock schedules and is discussed in Appendix I. Typical systems that will be considered, include topographic surveying and field marking of different mine rock categories, supervision of the loading and hauling process by a qualified geologist, tracking the loads of the different rock categories using GPS, and using electronic maps and GPS tracking of excavation and haulage.

A quality control and quality assurance (QA/QC) program will also be implemented to verify that the designated materials were delivered to the appropriate locations. Periodic sampling of rock in the NAG pile and at the TMF embankment will be performed, and results compared to the original material classifications. Non-conforming materials will be removed and placed in the appropriate areas.

2.5 RUNOFF AND INFILTRATION CONTROLS

Runoff from the MRMF and TMF embankment will be collected in a series of ditches constructed along the outer toes of the placed material and conveyed to the Water Quality Control Pond (WQCP) for management (TSD 6, SLR, 2016c). Infiltration into the placed material will be collected on the bedrock underlying the placed material where it flows to a seepage collection system of ditches and sumps, and then is conveyed by gravity flow and pumps to the WQCP.

Water that collects in the WQCP will be discharged as required to Otto Lake. Refer to Prodigy's *Water Management Plan* for the Magino site for details.

2.6 KEY DESIGN FEATURES

The overall design concepts for the MRMF are presented in TSD 6 (SLR, 2016c). The TMF embankment will be constructed in stages using NAG rock. The rock will be end-dumped, spread and compacted using construction equipment. The remaining mine rock will be placed around the edges of the TMF embankment and in a larger dedicated mine rock placement area to the north-east of the TMF.

2.7 MONITORING AND REPORTING

The mine rock removed from the pit will be closely tracked and monitored during operations. Environmental monitoring will be conducted both during operations and after closure to confirm that no unacceptable impacts to water quality are occurring.

The environmental monitoring is described in the site-wide *Environment Monitoring Plan* and the pertinent elements of that plan are summarized here.

2.7.1 MONITORING AND REPORTING DURING OPERATIONS

2.7.1.1 Operational Monitoring and Reporting

The classes and final locations of mine rock and ore will be recorded during operations, and these data will be tabulated monthly by geochemical classification. The results of any laboratory analyses will be maintained on-site. This geochemical data will be processed monthly to calculate the average NPR's of the placed mine rock.

In order to verify mine rock is managed as proposed, routine surveys of the advancing MRMF lifts will be conducted to make sure the minimum set-back for the PAG material is maintained. In addition, the final placed rock slopes will be inspected for evidence of ARD and to determine if PAG material was placed on the final MRMF surfaces. A sampling program will also be developed for QA/QC purposes to verify that the designated classes of rock were placed in the appropriate areas.

Visual inspections of the MRMF and associated water management structures will be conducted to evaluate the performance and the condition of the facility. The toes of the MRMF will be checked for seepage, and if seepage is observed, the specific location and flow rate will be recorded, and, as necessary, a sample will be collected for water quality analysis. These inspections will be conducted monthly and as soon as practicable after significant precipitation events.

Site personnel will carry out monthly visual inspections on each area of the MRMF that is undergoing active rock placement or concurrent reclamation. The general condition of the MRMF will be recorded. Items to be observed will consist of physical stability, presence or absence of erosion, confirmation that lifts and slopes are within design limits, and the status of any reclamation. Inspection of non-active areas of the facilities will be carried out quarterly.

Upon completion of reclamation of a portion of the facility, inspections will be carried out annually until closure.

The results of the inspections will be incorporated into the on-site document control system.

2.7.1.2 Environmental Monitoring

This monitoring will include water quality sampling of monitoring wells located in the TMF/MRMF area. Surface water monitoring will include flow measurements in the runoff and seepage collection system and the WQCP, as well as the natural streams and lakes surrounding the TMF/MRMF.

2.7.2 CLOSURE AND POST-CLOSURE MONITORING AND REPORTING

Closure and post-closure environmental monitoring will be conducted in accordance with the *Closure and Post-closure Monitoring Plan* for the site as a whole. This plan will include visual inspections of the TMF/MRMF, including the covered areas, areas of potential runoff, where seepage will have the highest potential to occur, and storm water control facilities. Inspections will be carried out for a defined period of time and at frequencies described in the above-referenced monitoring plan.

The purpose of the inspections will be to observe and document the following:

- The physical integrity of the soil cover including areas of erosion;
- Evidence of any staining, discoloration, streaking or moisture conditions indicating significant geochemical reactivity of disposal facility surfaces;
- The condition of water management control structures; and
- The location and extent of any ponded storm water.

Conditions observed that require repair, maintenance, or further evaluation will be documented and scheduled for requisite action as soon as possible. Inspections, repairs, and evaluations will be documented and submitted to the regulatory agency as required by the authorization/permits.

2.8 EXPECTED OUTCOME

The rock management procedures are expected to prevent the occurrence of ARD.

3. ORE AND TAILINGS

3.1 INTRODUCTION

Of the up to 150 Mt of ore to be mined, approximately 25 Mt will be stockpiled in the "crusher stockpile" shown on Figure 1-1. This stockpile will be processed at the end of mining, i.e. from years 11 onward. In addition, during mining, some ore will be stored at the south-east corner of the MRMF on the Southeast Fill Area. Storage of up to 10 Mt will occur and will be used as needed to even out the delivery of ore to the process plant. This stockpile will be created during the first four years of mining when more ore is mined than can be processed. This ore stockpile will be depleted by the end of the fifth year of operations.

The ore that is processed will produce up to 150 Mt (dry weight) of thickened tailings that will be stored of in the TMF. The design of the TMF, and the method of placement, is discussed in more detail in the TMF/MRMF Conceptual Design Report TSD (TSD 6; SLR, 2016c).

The following sections provide a summary of the geochemical characteristics of the ore and tailings, and describe how these materials will be managed.

3.2 ORE STOCKPILES

The ore is contained mostly within lithologic Unit 6 with a smaller portion within Unit 1. Very small amounts of the ore are from Units 5 and 7 (Tables 2-2 and 3-1). The overall average NPR for the ore is 15.3. This ranges from 4.4 to 21.0 with the exception of the small amount (0.10%) of Unit 5E which has an NPR of 0.5. The ore is not expected to be acid generating and can be treated as a NAG material.

Table 3-1: Overall Acid/Base Mass Balance for Ore

Unit	Abundance of Ore	Average $CaCO_3$ per 1,000 t of rock		Totals Kt of $CaCO_3$ equivalents			Unit NPR
	Percent	MPA	NP	MPA	NP	NNP	
MV(1 & 2)	7%	12	122	127	1,291	1,164	10.2
Other Unit 5	0.10%	74	323	11	47	36	4.4
5E	0.00%	360	150	2	1	-1	0.4
6C	90%	5.2	58.9	677	7,649	6,972	11.3
7	2.7%	10	131	39	511	472	13.1
Totals	**100%** **145**	**Mt**		**855**	**9,498**	**8,643**	**11.1**

(a) Crusher Stockpile

The ore will be stockpiled by end dumping from mine trucks. Surface drainage and infiltration water will be collected in perimeter drainage ditches, temporarily stored and pumped to the

MRMF's water collection system, to flow into the WQCP, and/or be pumped to the TMF for storage.

(b) Ore Stockpile in MRMF

This ore will be stockpiled within the MRMF footprint in an area separate from the mine rock. Once this ore stockpile is removed, mine rock will then be placed in the area so the ultimate profile of the MRMF conforms to that shown Figure 1-1.

Surface water and infiltration control for this ore stockpile will be as described for the MRMF in Section 2.5.

3.3 TAILINGS

The tailings will be pumped to the TMF for storage. The TMF will be operated in accordance with the *Operations, Maintenance and Management Plan* (OM&M Plan) for this facility and as described in the Design TSD 6 (SLR, 2016c).

The tailings will be comprised of NAG material (TSD 6, SLR, 2016a) that is similar to the ore. The material consists of finely ground, approximately silt-size particles mixed with water to form a thickened slurry. The gold is extracted by cyanide leaching, after which the tailings are treated by using a cyanide destruct plant to remove most of the cyanide.

Tailings are expected to be relatively homogeneous because of the need to maintain relatively constant grades in the feed to the mill. Therefore, the NP and the AP are also expected to be well mixed and all NP will be available for neutralization in the fine grained tailings.

4. TOP SOIL AND OVERBURDEN

4.1 INTRODUCTION

The layer of overburden is variable across the site, ranging between 1 to 6 m in depth at the MRMF/TMF footprint and in places exceeding 12 m in the pit area. Typically, this overburden includes thin layers of surficial woody material (forest litter) and topsoil which are underlain by glacial deposits of mixed silts, sands and gravels. All three of these types of materials are valuable resources and will be excavated from the Project infrastructure and mine pit areas, and managed in accordance with their ultimate proposed uses.

It is estimated that approximately 23 Mt of total overburden will be excavated. This includes 20 Mt of glacial material, 1 Mt of forest litter and 2 Mt of topsoil.

4.2 OBJECTIVES FOR OVERBURDEN MANAGMENT

The objectives for overburden management are to:

- Excavate and remove overburden in the areas where this is necessary to achieve access to the areas to be mined and secure foundation conditions under the TMF embankment and other mine infrastructure;
- Separate the three basic types of overburden (forest litter, topsoil and glacial materials);
- Maximize use of overburden materials during the construction and operational phases of the mine for construction purposes;
- Stockpile the overburden materials not used for construction purposes in a manner that protects the environment; and
- Use stockpiled overburden materials for site closure construction.

4.3 OVERBURDEN CHARACTERIZATION

4.3.1 TOP SOIL AND FOREST LITTER

The range of thickness for top soil and forest litter is 10 to 20 cm and 2 to 5 cm respectively. The topsoil is not acid generating and currently supports a good vegetative cover.

Organic deposits are typically found in small low-lying areas close to standing bodies of water. A thin veneer of organic material covers most of the site. However, in some areas organic deposits are as thick as 1.5 to 2 m. As encountered, the organic deposits commonly form planar units and are poorly drained. These organic materials will be included with the forest litter.

4.3.2 GLACIAL DEPOSITS

The glacial deposits, which include some fluvial deposits as well, consist of gravel, cobbles, and boulders, of varying proportions, in a sand matrix. These sediments may contain up to 80% clasts; however, the average is 50% clasts with the rest of the deposit consisting of sand. Gravelly units are generally matrix-supported, with a matrix of fine- to very-fine sand. Occasionally the matrix includes medium to very coarse sand and/or silt. At several locations, the uppermost layer of the deposit (up to 1 m thick) is composed of pure fine or very fine sand. The fine-grained layer is commonly underlain by sandy, pebble-cobble-boulder gravel.

Static ABA testing of overburden was performed as part of the supplemental investigation described in Appendix I. The results of the overburden characterization are presented in the Geochemical Assessment Update, TSD Supplement (SLR, 2017) and are summarized in Tables 2-2 and 2-3. The overburden is NAG.

4.4 OVERBURDEN MANAGEMENT APPROACH

The three types of overburden material will be separately excavated, managed and stored in two dedicated overburden stockpile areas located to the west of the TMF as shown on Figure 1-1. These areas are referred to as the Northwest and Southwest Area Fills and Overburden and Soil Stockpile Areas.

The major use of the glacial deposits will be in construction of the TMF embankment. This material may be processed to gravel and sand for the filter and backing to the geomembrane liner to be placed on the upstream face of their embankment. It may also be part of the embankment fill. The amount required is estimated at 4.8 Mt. Approximately 1.2 Mt will be required during the pre-production (year -1) and in years 2, 5 and 8 of operations, as the TMF embankment is raised. Waste (very fine silt and organic material) from the processing will be placed in the MRMF or one of the above referenced overburden stockpiles.

4.5 RUNOFF CONTROLS

The materials placed in the stockpiles will be compacted with equipment and at slopes that will prevent significant erosion during storm events. The glacial material and topsoil stockpiles will be revegetated to further reduce erosion.

Runoff controls in the two stockpile areas will include perimeter berms and drainage ditches to prevent any runoff from leaving the area. The drainage ditches will also be used to convey the runoff to sediment detention ponds. This pond will allow for settling of suspended solids, and the clarified water will be discharged into the WQCP. Further discussion is provided in the TMF/MRMF Design Report (TSD 6, SLR, 2016c).

4.6 KEY DESIGN FEATURES

Key design features include the above referenced diversion ditches and the sedimentation ponds. These will be sized to handle a specified period storm and to provide for at least 24-hours of detention in the pond. The ditches will be rip-rapped where necessary to prevent excessive erosion. The sediment detention ponds will be fitted with stand-pipe type outlets that provide for storage of water before it flows out through the top of the standpipe, and which will also allow sediments to accumulate at the bottom of the ponds. The ponds will be maintained and cleaned out as necessary. Any sediment removed from the ponds will be placed on the topsoil stockpiles.

4.7 MONITORING AND REPORT

Monitoring and reporting will include the following:

- Volumes of the three types of materials placed in the stockpiles areas;
- Routine inspections of the stockpile areas and the ponds check on any erosion damage, with associated repairs as necessary; and
- Routine observation of sediment accumulation in the ponds, and removal as necessary.

4.8 EXPECTED OUTCOME

The management of the overburden material is expected to provide:

- A stockpile of overburden that can readily be accessed and used for maintenance of road and site surface areas throughout the life of the Project;
- Managed stockpiles that avoid erosion and excessive runoff of sediment in Water Quality Control Pond; and
- Sufficient top soil and forest litter to meet reclamation needs.

5. REFERENCES

MEND, 2009. – *Prediction Manual for Drainage Chemistry* from Sulphidic Geologic Materials, MEND Report 1.20.1. Prepared by Price, W.A.

EBA, 2013. – *Preliminary Geochemical Characterization of Mine Waste Rock at the Magino Property, Ontario*, prepared by EBA a Tetra Tech Company, February.

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TSD 2 - SLR, 2016a. *Magino Gold Project: Geochemical Assessment Technical Support Document*, prepared by SLR Consulting (Canada) Ltd., December.

TSD 1 - SLR, 2016b. *Magino Gold Project: Geotechnical and Geohydrologic Investigation Summary Technical Support Document*, prepared by SLR Consulting (Canada) Ltd., November.

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APPENDIX

APPENDIX I: CONFIRMATION TESTING AND ANALYSIS PLAN

1. INTRODUCTION

The preliminary geochemical characterization for the Magino Mine was performed by EBA, A Tetra Tech Company (EBA) during 2012 and 2013 (EBA, 2013). EBA followed the procedures presented in the MEND (2009) guidelines, and performed static acid-base accounting (ABA) testing and laboratory evaluations. Based on this characterization of the mined materials, SLR International (SLR) performed supplemental testing to further characterize certain rock types. This supplemental testing consisted of kinetic testing using laboratory humidity cells as well as field cells. The rock types tested included the lithologies that either represented the greatest potential for acid rock drainage (ARD) or metals leaching (ML), or the materials which represented the greatest masses of mine rock and ore. The geochemical testing results are provided in the Geochemical Assessment TSD (TSD 6; SLR 2016).

The results of the EBA and SLR testing indicate that there is only one rock type, a metasedimentary unit (Unit 5E), that has the potential for consistent ARD formation throughout the rock mass. Unit 5E is massive sulphide and a component of Unit 5. This unit represents approximately 0.4 % of the total mined rock (Sections 2.0 and 3.0 of the main report). The results also indicate that there are small but not insignificant percentages of Units 1 (3.0%), 2 (1.7%), 5C (20%) and 7 (1.3%) that can be classified as potentially acid generating (PAG) or are in the uncertain category according to the MEND criteria[1]. The Unit 5C's influence is not large since it only amounts to approximately 1.0 % of the total mass mined.

Additional lithologic and geotechnical borings (TSD 1, SLR, 2016b) have been performed and additional rock samples were collected and characterized in order to update the geochemical data base and to perform some additional studies to inform and refine this *Mined Material Management Plan* (MMMP). Since the details of the mining plan itself are being finalized it is also appropriate to integrate the MMMP with the results of the geochemistry evaluations to allow more detailed mining schedules to be established for the different rock types. This appendix provides the work plan for the proposed additional studies that are expected to be completed prior to Project construction.

2. OBJECTIVES OF THE PROGRAM

The objectives of the program are as follows:

1) Refine the mining block model

There has been additional geologic exploration of the ore body and vicinity since the earlier EBA static testing program. The mining block model therefore requires refinement with the new data to verify the estimated locations and volumes of the various rock types.

The mine block model is also used to develop the mine life mined material schedule. This schedule will identify when the NAG and any PAG material is mined, and how its mining is

[1] Rock with a neutralization potential to acid potential (NPR) ratio of less than 1.0 is considered potentially acid generation (PAG), while rock with a NPR ratio of greater than 2.0 is considered to be non-potentially acid generating (NAG). Rock with NPR ratios in between 1 and 2 are considered to have an "uncertain" classification.

distributed over the mine life. This material schedule is important to refining the current approach to providing NAG rock for the Tailings Management Facility (TMF) embankment construction and the management of the small quantities of PAG materials.

In addition, the locations of samples for the existing database need to be reviewed relative to the mining block model to determine whether the samples that could be characterized as PAG or uncertain are grouped, dispersed, or adjacent to the metasedimentary Unit 5E (90% of which classified as PAG or uncertain).

2) Characterize mine rock Unit 6 and overburden

Rock type Unit 6 (synvolcanic felsic to intermediate intrusives) is the “Webb Lake Stock” in which the ore body occurs. The amount of this material that will be mined is 247 million tonnes (Mt) and it represents 86% of the ore and 30% of the waste mine rock. Geochemical characterization of this major amount of material is based on 21 samples that were subjected to ABA testing, 20 samples subjected to whole rock analysis, and 4 samples subjected flask extraction testing (EBA, 2013) For context, the other major rock Units 1, 2, and 3, which together represent 260 Mt of the material to be mined are characterized by 287 ABA tests, 113 whole rock analyses, and 44 shake flask extractions. A higher frequency of testing for Unit 6 is therefore justified and will be conducted.

The static testing performed by EBA did not include any characterization of the overburden at the mine. The MEND guidelines suggest geochemical characterization of all materials which will be mined, which includes the overburden. The overburden at the site is largely glacial till, likely transported from off-site areas, so it is highly unlikely that it will generate ARD or leach metals. Nevertheless, the overburden will be characterized using static ABA testing.

3) Interpret NP depletion rates

The humidity cell testing results can be used as an approximate guide to assess whether a material has the potential to generate acidic conditions in the long term, even if the static ABA testing indicates the NP/MPA ratio is greater than 2 as per the MEND guidelines for a NAG classification. To do this, the humidity cell test results for the rate at which the alkalinity and acid generating potential (AGP) are leached out of the sample are used and extrapolated out to calculate which of these two components will be depleted first by leaching. If the alkalinity is depleted before the acid, there is a potential for ARD in the future. The results of the humidity cell tests conducted by SLR (TSD 2, SLR, 2016) indicate the two tests for Unit 5E (massive sulfide), and the single test for Unit 6 (a synvolcanic felsic to intermediate intrusive), had an alkalinity depletion time that was shorter than the AGP depletion time. All the other samples tested have alkalinity depletion times that are much longer than the AGP depletion time (including the tailings sample, which is comprised mostly of Unit 6 material). Since a simple extrapolation of the depletion rates measured during a humidity cell tests on its own is insufficient[2] to make a decision on the ARD potential further analyses of these test results is warranted.

[2] The humidity cell test occurs under very aggressive leaching procedures (e.g. a one pore volume is leached per week) which are not at all representative of actual field conditions where a pore volume displacement can take place over tens or hundreds of years or more. Furthermore, the depletion rates are extrapolated for a test that lasts a year or two to over tens of hundreds of years with no assurance that the same chemical reactions and the same reaction rates that occur in the humidity cell, will continue over the much longer period of extrapolation.

4) Develop site-specific criteria for identifying PAG and uncertain material that can readily be used during the mining operation

Site-specific criteria and procedures that allow identification of PAG and NAG rock as it is mined are important to the MMMP. Criteria may be based on visual identification in the mine, location within the pit as determined from the block model and prior testing, confirmatory chemical testing of samples obtained during the drilling of the rock in the mine for blasting, potentially others, or combinations of these.

3. WORK PLAN

The Work Plan includes the following five tasks:

- Refinement of the geologic block model;
- Additional geochemical characterization of mine rock and overburden;
- Refinement of the depletion rate analyses;
- Development site-specific criteria for classifying mined materials during mining; and
- Updating the MMMP.

These tasks are discussed below and a schedule for these activities is provided in Figure I.1 and discussed in Section 4.0 below.

3.1. INCLUDE GEOCHEMISTRY PARAMETERS IN BLOCK MODEL

Prodigy geologists are currently refining the block model and once complete it will be used by mine planners to develop a mining schedule and long- and short-term mining plans. The block model is a three-dimensional depiction of the estimated locations of each rock type and the ore body. Once the three-dimensional block model is updated, SLR will work with the Prodigy geologists to incorporate the location of samples used in the geochemical characterization within the appropriate mine blocks. The geochemical samples will be identified as PAG, uncertain or NAG. Other geochemical characteristics such as sulphides (or sulphur) content, mineral type, and potentially other parameters will also be included in the block model.

The block model will then be used to determine whether all the material of concern (PAG and uncertain) is dispersed throughout the mine pit or if it is all located in specific areas of the pit, possibly adjacent to the PAG metasediments or associated with some other recognizable geologic features. The block model with then be used to generate a detailed quarterly schedule over the mine life of the mined rock types and quantities.

This information will provide the basis for refining the current Mine Rock Management Plan.

3.2. ROCK AND OVERBURDEN ANALYSES

Additional geochemical characterization will be performed on Unit 6 rock and the overburden. Up to 25 samples of Unit 6 rock will be selected from existing core and the recent geotechnical borings, and up to 15 samples of overburden will be collected from test pit samples that have previously been collected and stored at the site. If insufficient representative overburden samples exist, additional samples will be collected using a backhoe or other excavating equipment.

3.2.1. SAMPLE COLLECTION

For the Unit 6 material, sample selection will be based on a detailed review of existing core logs, the spatial distribution of drill holes, and locations of previously tested material. Lithological logs prepared by Prodigy will be reviewed by SLR and Prodigy geologists. The sample selection will focus on locations within the proposed pit shell, in areas that have not been previously characterized geochemically, and on borehole core material from recent drilling.

The SLR and Prodigy team will develop a list of core segments to be sampled. Prodigy site geologists will prepare these samples, place them in bags and labelling them for submittal to the laboratory. Labels will be duplicate with the date, drill hole ID, sample interval, and lithology of each sample; the duplicate label will be stapled to the inside of the core box that the sample material was collected. Approximately 2 kg of material will be collected for each sample.

For the overburden, Prodigy site personnel will inventory available test pit samples that have been stored on-site. The inventory list will be used by an SLR geologist to select the samples. The focus will be on sample locations distributed throughout the area of the proposed pit, and samples located at various depths. All samples will be from material below the topsoil and any organics. If there are insufficient samples, or if sample locations are not well-distributed around the pit area, additional samples will be collected using on-site excavation equipment at locations specified by SLR. Sample material will be placed in bags or buckets, and labeled for submittal to the laboratory. Approximately 2 kg of material are needed for each sample.

3.2.2. SAMPLE PREPARATION AND ANALYSIS

The samples will be shipped under chain-of-custody protocol to a qualified lab for analysis. Samples will be prepared and tested by the laboratory in accordance with the MEND guidelines. Sample preparation involves the following steps:

- Sample is logged in the laboratory's tracking system,
- Samples are weighed, dried and finely crushed to more than 70% passing a 2 mm (Tyler 9 mesh, US Std. No. 10) screen; and
- A split of up to 250 gm is taken and pulverized to better than 85% passing a 75 micron (Tyler 200 mesh, US. Std. No. 200) screen.

3.2.3. ABA ANALYSIS

ABA analysis includes whole rock paste pH, total sulphur and sulphate sulphur (HCl and CO_2 leach) by LECO furnace, neutralization potential (NP) by standard Sobek method, and a fizz rating. Total inorganic carbon and sulphide sulphur are calculated from analytical results.

The net neutralization potential (NNP) is determined by subtracting the maximum potential acidity (MPA) from the NP. The NPR value is the ratio of neutralization potential to the maximum potential acidity or acid potential (NP/MPA). NP is a function of neutralization capacity provided by carbonate and silicate minerals in the samples. MPA is often considered to be a more conservative estimate of the acid generation potential than AP. MPA values are calculated on the basis of total sulphur (S%); AP is calculated on the basis of only the acid-generating sulphide sulphur component in the rocks. Sulphide sulphur values are calculated by subtracting the sulphate sulphur value from total sulphur. Note that in the Preliminary Geochemical Characterization by EBA (EBA 2013), the more conservative MPA was used in all calculations.

The carbonate NP (CO3-NP) is calculated based on carbon dioxide (CO_2) evolved during acidification of sample. The calculation of CO_3-NP is based on a formula provided in the MEND guidelines. The CO_3-NP represents the acid neutralization capacity if all carbonate in a sample reacted like calcite, the most common and most reactive neutralization carbonate mineral. It does not account for neutralization potential that may be provided by silicate minerals. In some instances, the Sobek-NP may overestimate available neutralization capacity, and using the CO_3-NP is considered to be more conservative. Note that the EBA analysis (EBA, 2013), the Sobek-NP was used after careful consideration of site conditions. The main report also uses the results from the Sobek testing. Comparisons of ARD classifications using the two types of test protocols have shown there is no effect on categorization of the different lithologic units.

3.2.4. WHOLE ROCK ANALYSIS

The solid phase metal content is determined through standard ICP-AES. Samples are first decomposed through standard HNO_3 – HCl (nitric acid-hydrochloric acid) aqua regia digestion.

Aliquots of all samples that are collected and prepared as described above will be analyzed by an ultra-trace level method using ICP-AES for whole rock metals content. Samples will be analyzed for the same suite of 48 elements that were analyzed as part of the whole rock analysis by EBA (EBA, 2013).

3.2.5. SHAKE FLASK EXTRACTION (SFE) ANALYSIS

SFE analysis to assess ML potential, carried out according to the method outlined in Price (1997), will be performed on aliquots of each of the samples collected and prepared as described above. The consists of mixing 250 gm of sample with 750 mL of de-ionized water followed by 24 hours of continuous agitation on an orbital shaker table to extract a liquid concentrate (leachate) solution from a crushed rock sample. After this step, the extract is allowed to settle and subsequently filtered through a 0.45 micron membrane filter and analyzed using cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7) for Hg, ICPMS/ICP-OES for metals, ion chromatography for anions, fluorescence for ammonia, and titration for alkalinity and acidity. The same suite of metals that were analyzed by EBA will be used for this supplemental testing.

3.2.6. EVALUATION OF RESULTS

The results of testing will be evaluated using a similar approach to that used by EBA in (EBA, 2013). This includes evaluating the ABA results in consideration of the criteria suggested by the MEND guidelines, comparing the SFE test results to benchmark water quality criteria, and comparing solid phase metal content to global crustal abundance to evaluate if a metal concentration in a sample is considered abnormally elevated. A value of 10 times the crustal abundance is used to identify constituents enriched in the rock which may warrant further consideration.

3.3. NP DEPLETION RATES

SLR will provide more context on the meaningfulness of the depletion analysis relative to the potential for generation of ARD. This will include calculations comparing the conditions in a humidity cell to the conditions that are expected to occur at the Magino Mine both in the MRMF and the TMF. These analyses will include long-term fate and transport analyses that consider precipitation infiltration rates and corresponding pore water volume displacements over time.

This analysis can be performed while the additional rock testing activities described above are performed.

3.4. ROCK MANAGEMENT CRITERIA

Once the above evaluations are completed, the results will be used to develop appropriate site-specific criteria for identifying materials of concern (materials classified as PAG and uncertain). The criteria may be visual by mine geology staff, such as for identification of the Unit 5E material, which is very distinctive visually, and/or by location (i.e., located in the vicinity of Unit 5E material or in an area of the pit identified using the spatial analysis and block modeling of the sample results and the block model described above). If necessary, a procedure including chemical testing either in the field on an on-site laboratory will be developed.

3.5. MINE ROCK MANAGEMENT PLAN UPDATE

The MMMP will be updated to incorporate the results of the above analyses. It will also include a detailed mine materials schedule and more details on how the PAG rock will be identified and managed at the site.

4. SCHEDULE

The proposed schedule for updating the Mine Rock Management Plan is shown in Figure I.1. It is anticipated that the Prodigy geologists will finalize the new block model by the end of January 2017. Sampling of materials for testing will be conducted during December 2016, and the associate testing will be conducted from January through February 2017. The MMMP will be updated by May 2017.

Figure I.1: Mine Rock Management Plan Schedule