TREASURY METALS

INCORPORATED

# Goliath Gold Project at Dryden, Ontario Environmental Impact Statement

**Treasury Metals Incorporated**
130 King Street West, Suite 3680
Toronto, Ontario  M5X 1B1
T: (416) 214-4654
F: (416) 599-4959

April 2015

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# GOLIATH ENVIRONMENTAL IMPACT STUDY SUMMARY

## 1.0 INTRODUCTION AND ENVIRONMENTAL ASSESSMENT CONTEXT

Treasury Metals Incorporated is a TSX-listed (TML) leading gold exploration and development company, headquartered in Toronto, Ontario. Treasury Metals (Treasury) is currently focused on northwestern Ontario mineral properties and is proposing to develop the Goliath Gold Project (the Project) and associated infrastructure near Dryden, Ontario (Table ES.1.1). Treasury has been exploring the Project site since 2008 and has completed more than 370 diamond drill holes totalling approximately 119,000 m. Beginning in 2008; Treasury commenced extensive environmental, geotechnical, metallurgical, engineering, socio-economic, and logistical studies in order to advance the Project towards commissioning and operation.

**Table ES.1.1 Project Details**

| | |
|---|---|
| Project Name: | Goliath Gold Project |
| Proponent: | Treasury Metals Incorporated |
| Primary Contact: | **Treasury Metals Incorporated:** |
| | Norm Bush |
| | Vice President, Goliath Gold Project |
| | P.O. Box 783 |
| | Dryden, Ontario, P8N 2Y4 |
| | T: 807-938-6961 |
| | F: 807-938-6499 |

Treasury submitted a project description to the Canadian Environmental Assessment Agency (the Agency) on November 26, 2012 and on January 18, 2013 received draft guidelines for the preparation of an environmental impact statement (EIS) for an environmental assessment conducted pursuant to the *Canadian Environmental Assessment Act, 2012*. The EIS guidelines were issued as final on February 21, 2013. The following document was prepared in accordance with the EIS guidelines. Treasury used the EIS guidelines as reference in adopting a precautionary approach to planning and designing the Project. At each stage of planning and development, alternatives were assessed and where possible mitigation of potential effects was incorporated into the Project design. This EIS report is intended to fulfill the requirements as set within the EIS guidelines issued by the Agency.

# 2.0 PARTICIPANTS IN ENVIRONMENTAL ASSESSMENT

Treasury has been an active member of the local community since its inception in 2008. Treasury holds Project offices in Wabigoon, Ontario within the former Ontario Ministry of Natural Resources and Forestry (OMNRF) tree nursery facility (Figure ES.2.1) and on September 15, 2014 opened a satellite office in Dryden, Ontario to provide an easily accessible location to enhance public awareness of the Project, and provide the community an opportunity to learn about the Project. Treasury continues to engage and consult with the local communities, including First Nations and Metis community members. Through public meetings, open houses, site tours, and regular communications, Treasury has worked to ensure engagement of all members of the local communities.

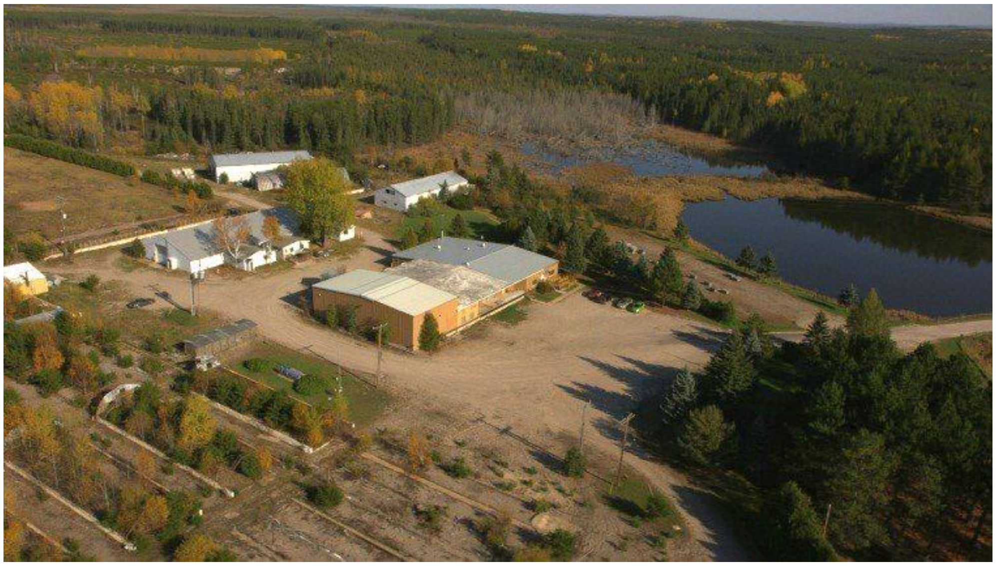


**Figure ES. 2.1 Treasury Metals Project Office**

The Project has involved a range of stakeholders associated with the Project. This range of stakeholders has included those that hold direct interest in the development of the Project, Federal and Provincial government agencies, community and municipal organizations, First Nation representatives, and other similar groups. The range of stakeholders is expected to grow with the development of the Project and with the reintroduction of the Project's development within the local community representing the varying levels of interest and opportunities presented by the Project.

Stakeholders engaged by Treasury to date include:

## 2.1.1 Business, Community Groups and Environmental Organizations

- Merkel's Camp;
- Davis' Bonny Bay Camp;
- Huber's Lone Pine Lodge;
- Polar Star Lodge;
- Pine Sunset Lodge;
- Indian Point Camp;
- Keeewatin-Patrica District School Board;
- Northwest Catholic District School Board;
- Conseil scolaire de district catholique des Aurores boreales;
- Confederation College;

- Lakehead University;
- Northwest Employment Works;
- Dryden Trapping Council;
- Kenora District Services Board;
- Dryden Regional Health Center;
- Dryden Naturalists;
- Goliath Mine Stakeholders;
- Dryden Chamber of Commerce;
- Dryden Rotary Club;
- Dryden Economic Development Corporation;
- Wabigoon Local Services Board;
- Domtar Incorporated;
- Known local mineral rights holders; and
- Other small business owners.

### 2.1.2 Municipal Government

- City of Dryden;
- Town of Ignace;
- Municipality of Sioux Lookout;
- Municipality of Machin; and
- Village of Wabigoon

### 2.1.3 Provincial Government

- Ministry of Aboriginal Affairs;
- Ministry of Agriculture, Food, and Rural Affairs;
- Ministry of Economic Development and Trade;
- Ministry of Health and Long-Term Care;
- Ministry of Energy;
- Ministry of Infrastructure;
- Ministry of Labor;
- Ministry of Municipal Affairs and Housing;
- Ministry of Natural Resources;
- Ministry of Northern Development and Mines;
- Ministry of the Environment and Climate Change;
- Ministry of Tourism Culture and Sport;
- Ministry of Transportation;
- Hydro One Networks Inc.;
- Ontario Provincial Police; and
- Provincial Parliament representatives.

### 2.1.4 Federal Government

- Aboriginal Affairs and Northern Development Canada;
- Canadian Environmental Assessment Agency (the CEA Agency);
- Environment Canada;
- Fisheries and Ocean Canada;
- Health Canada;
- Major Projects Management Office;
- Natural Resources Canada;
- Transport Canada; and
- Federal Parliament representative.

### 2.1.5 Aboriginal Groups

The Aboriginal groups engaged in discussions with Treasury regarding the Project were identified using the following criteria:

- Proactive engagement by Treasury;
- Proximity to the Project;
- Direction from the Provincial Crown (Ministry of Northern Development and Mines); and
- Direction for the Federal Crown (the CEA Agency).

Aboriginal Groups identified to be consulted with respect to the Project are:

- Wabigoon Lake Ojibway Nation;
- Eagle Lake First Nation;
- Lac Seul First Nation;
- Wabauskang First Nation;
- Naotkamegwanning (Whitefish Bay) First Nation;
- Grassy Narrows First Nation;
- The Métis Nation of Ontario; and
- The Aboriginal People of Wabigoon.

Treasury will continue to consult and engage with the First Nation communities that have been identified as part of the on-going development of the Project.

## 3.0 REGULATORY FRAMEWORK

The Project is subject to the Regulations Designating Physical Activities under the Canadian Environmental Assessment Act 2012 (CEAA 2012). Specifically, Section 16(c) of the regulations which lists “the construction, operation, decommissioning and abandonment of a new rare earth element mine or gold mine, other than a placer mine, with an ore production capacity of 600 tons/day or more” is subject to an environmental assessment (EA) under CEAA 2012.

Treasury submitted a Project Description to the CEA Agency on November 27, 2012 which was accepted. Based on the Project Description submitted by Treasury, the CEA Agency confirmed that a Federal EA is required. The EIS guidelines, which identify the scope of the EA required for the Project, were subsequently issued on February 21, 2013.

This EIS report is intended to meet the Federal EIS guidelines and serve as the base for discussions moving forward with the Provincial regulatory needs. After the EA process is completed, environmental approvals from both the Federal and Provincial government agencies will be required to construct, operate and decommission the Project. The Province provides a number of these approvals and the full list of such permitting activities will be prepared though consultation with regulatory bodies upon EIS acceptance. There are also a number of regulatory tools that apply to the Project which require compliance, but do not involve the issuing of such approvals or licenses, such as the Metal Mining Effluent Regulations (MMER).

# 4.0 PROJECT OVERVIEW

The Project is located within with the Kenora Mining Division in northwestern Ontario. The Project site is approximately 4 km northwest of the village of Wabigoon, 20 km east of Dryden and 2 km north of the TransCanada Highway 17 and within the Hartman and Zealand townships (Figure ES.4.1).

Treasury proposes to construct, operate, and eventually decommission a new gold mine and is currently conducting engineering studies to confirm and determine the technical and economic aspects of the Project.

The mine layout places most required mine related facilities in close proximity to the proposed open pit, and to the extent possible, on private lands owned by Treasury (Figure ES.4.2). The Project footprint will cover approximately 188 hectares (ha) during the maximum of extent of operations with 133 ha or 71% of the footprint on Treasury private lands. This site plan shows the preferred alternatives for Project components as described in Section 2 of the EIS.

The Project is designed to:

- Use well known, conventional and environmentally sound mining techniques and technologies used commonly in northern environments;
- Minimize overall footprint;
- Minimize associated potential effects;
- Manage water effectively and efficiently;
- Mitigate or compensate for effects on biological habitat; and
- Accommodate effective planning for final closure and site abandonment, rendering the site suitable for other compatible land uses and functions.

## 4.1 EXISTING INFRASTRUCTURE AND FACILITIES

The area surrounding the Project is a mixture of abandoned homesteads, small hobby farms and residential dwellings. Most of the properties associated with the Project have been privately owned since around 1900 and have been acquired by Treasury by means of private purchase agreements. Mineral exploration of the Project site has been carried out since 1990 by various companies and is ongoing. The OMNRF established a tree nursery facility, located north of the mineral deposit which was sold to Treasury in 2011 which houses the Project office (Figure ES.4.3).


| | | |
|---|---|---|
| GOLIATH GOLD PROJECT<br>DRYDEN, ONTARIO, CANADA | SCALE: 10 000 000 | **LEGEND** |
| | *TREASURY METALS INC.* | |
| **LOCATION OF GOLIATH GOLD PROJECT (PROVINCIAL SCALE)** | *DESIGN: AT 06 FEB. 2014*<br>*GIS: AT 20 FEB. 2014*<br>*CHECK: MP 12 SEP. 2014* | |
| FIGURE: ES.4.1 REV.01 | | |

**LEGEND**

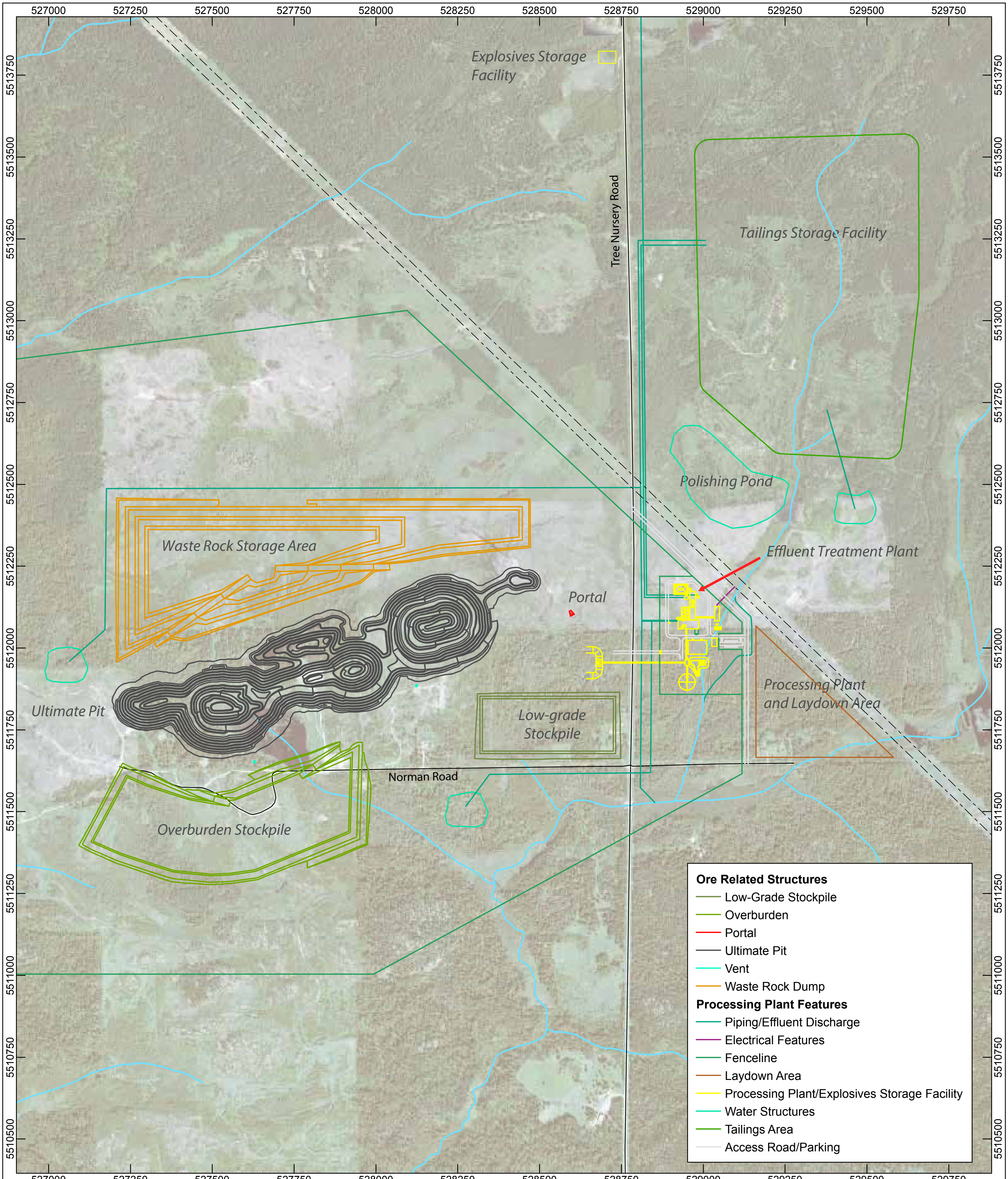
- Populated Area
- Goliath Gold Project Indicator
- Highway/Major Roadway
- Major Waterbody
- Canada
- United States

N

0 100 200 300
Kilometers

***REFERENCE***

*Data by Treasury Metals Inc.*
*Projection: NAD83 UTM Zone 15N*




GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

GENERAL ARRANGEMENT OF PROJECT SITE DURING OPERATIONS PHASE

FIGURE ES.4.2 REV.00

SCALE: 15 000

TREASURY METALS INC.

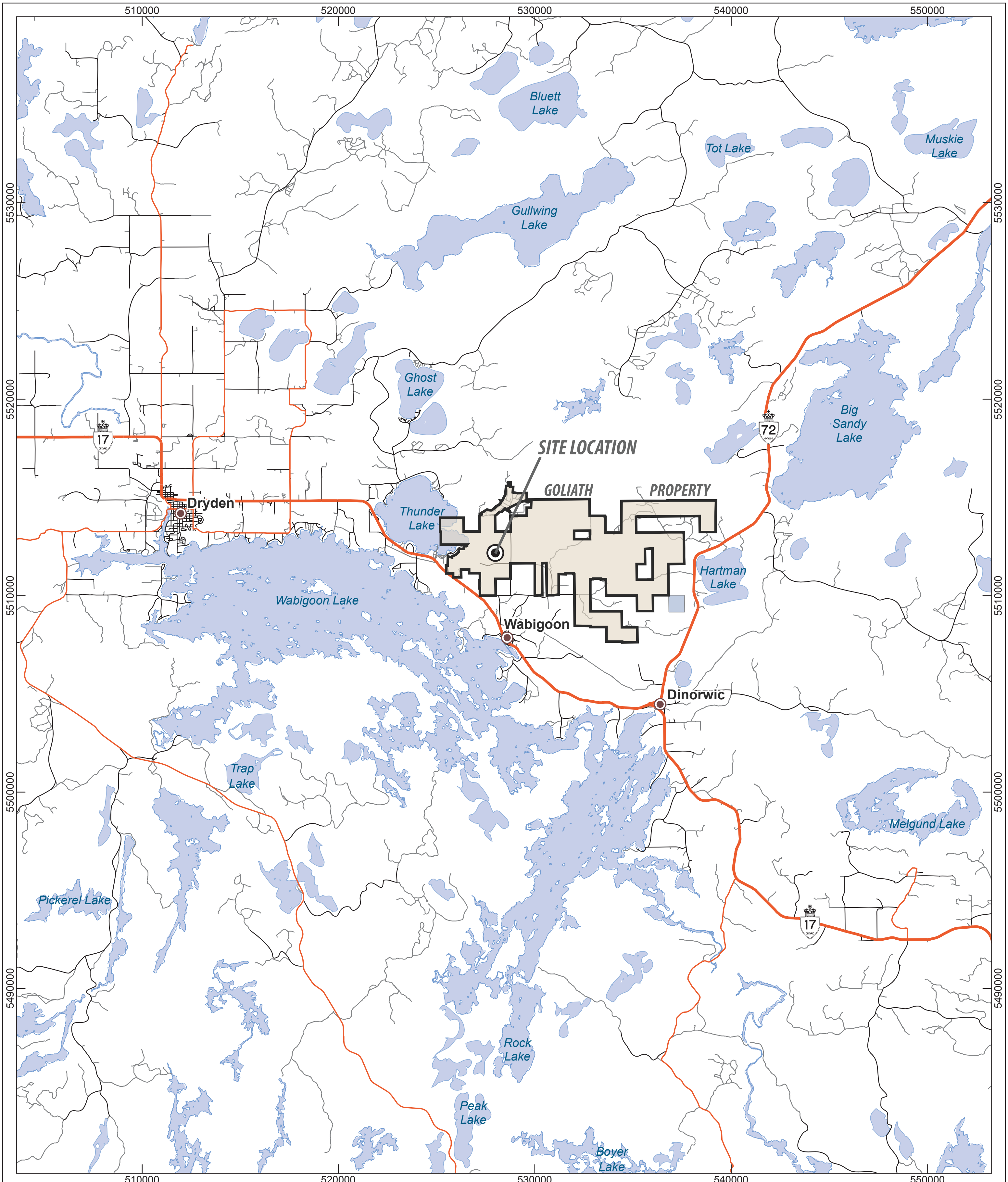
DESIGN: MP 20 FEB. 2015
GIS: AT 20 FEB. 2015
CHECK: XX ADD DATE
REVIEW: XX ADD DATE

Utility Line
Roadway
Waterbody
Watercourse

N

0 125 250 500 Meters

REFERENCE
Data by Treasury Metals Inc.
Projection: NAD83 UTM Zone 15N




| | | | |
|---|---|---|---|
| GOLIATH GOLD PROJECT<br>DRYDEN, ONTARIO, CANADA | SCALE: 250 000<br>*TREASURY METALS INC.* | | |
| **LOCATION OF GOLIATH GOLD PROJECT (LOCAL SCALE)** | *DESIGN: AT 06 FEB. 2014*<br>*GIS: AT 20 FEB. 2014*<br>*CHECK: AT 12 SEP. 2014* | | |
| FIGURE: ES.4.3 | REV.00 | | |

**LEGEND**

- Populated Area
- Goliath Gold Project
- Waterbody
- Project Site
- Arterial Road
- Highway
- Local Road
- Recreational Road

N

0 2,000 4,000 6,000
Meters

**REFERENCE**
*Data by Treasury Metals Inc.*
*Projection: NAD83 UTM Zone 15N*

### 4.1.1 Roads

The Project site is accessed from Highway 17 via Anderson Road and Tree Nursery Road. Highway 17 is part of the TransCanada Highway network and is operated by the Ministry of Transportation (MTO). Anderson Road and Tree Nursery Road are unpaved and maintained by the municipality. The intersection of Anderson Road and Highway 17 is an unsignalized 'T' intersection with stop sign control on Anderson Road. There are no signalized entrances located on Highway 17 in the area of the Project (Keewatin-Aksi, 2014). In addition to the municipal roads, there are a number of unpaved roads and trails associated with the former tree nursery that are in use by Treasury for access to drill targets and environmental sampling locations.

### 4.1.2 Power

The existing power infrastructure includes the 115 kV and 230 Hydro One M2D line that cuts diagonally across the Project property. Current electrical power is supplied by a separate and smaller power line that runs parallel to the Tree Nursery Road. Treasury has been informed by Hydro One that this has no capacity and electrical power is better supplied by the aforementioned M2D line.

### 4.1.3 Natural Gas

There is a main Trans-Canada natural gas (NG) pipeline that runs adjacent to and north of Highway 17. This pipeline provides natural gas for the Dryden area. Union Gas is the sole distributor of natural gas in the Dryden area. The main Trans-Canada line does not provide gas directly to the Project site, or local home owners in the immediate vicinity.

### 4.1.4 Railway

The Canadian Pacific Railway main line runs south of the Project, along the north shore of Wabigoon Lake. There are no plans to establish a spur, siding, or load-out facility to service the project. Established load-out facilities in Dryden will be used for material arriving by rail.

### 4.1.5 Warehousing and Office Facilities

The former OMNRF tree nursery facility is owned by Treasury and operates as the Project office and as a warehousing facility.

### 4.1.6 Dams and Impoundments

The unnamed tributaries passing through the former tree nursery were historically impounded by OMNRF to provide water for the tree nursery. The structures and impoundments remain in place and functional.

## 4.2 OPEN PIT MINE

### 4.2.1 Overburden Stripping

Prior to the start of open pit mine production the area must be prepared by stripping overburden and establishing a water management system including diversion channels, ditches, and flood protection. This will minimize inflows to the open pit area and therefore mine water production. The overburden thickness varies across the site with generally shallow thickness (0 m to 2 m) in the eastern area of the pit and deepening (approximately 15 m) towards the western most pit with an average thickness of 10 m to 15 m. The stripped overburden material will be stockpiled south of the pit for use in site reclamation activities. Stripping will be completed using conventional technologies of bulldozers, excavators, and haul trucks. An aerial view of the proposed open pit area can be seen in Figure ES.4.4.

**Figure ES. 4.4 Aerial View of Proposed Open Pit Area**

### 4.2.2 Surface and Mine Water Management

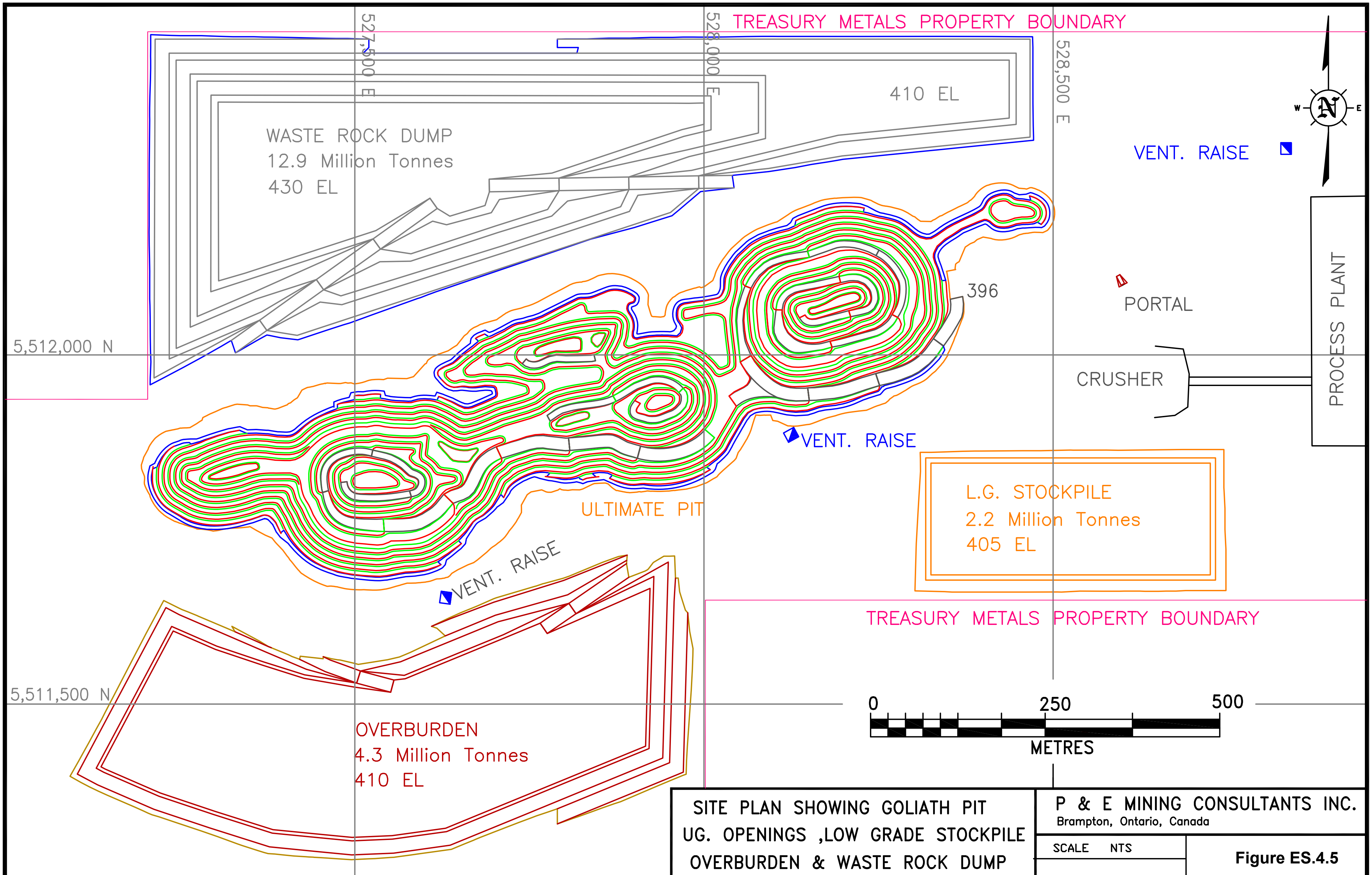
The topography of the Project site is generally flat which allows the mine water management to consist mainly of surface water runoff redirection or collection. There are no permanent ponds or lakes that require dewatering. Prior to overburden removal, any beaver dams within the Project footprint will be removed and the impoundments will be allowed to draw down.

Surface water runoff will be prevented from entering the open pit by means of a small berm or ditch. This water will be collected and will then form part the recycled water used for processing in the plant facility. Further information on mine water management is described in Section 3.8 of the EIS.

### 4.2.3 Open Pit Design

The open pit, as currently designed, is scheduled to last for approximately 5 years at moving an average ore production rate of 2,700 tonnes per day (tpd) to the mill. The maximum extent of the pit will be 1,500 m by 500 m with a total area of 31.8 ha. The pit will be comprised of three separate pit bottoms that will be mined in sequence, from west to east, which will allow for backfilling of mined out pits with waste rock. The deepest pit bottom is designed to be a maximum of 180 m deep. The open pit mine will produce approximately 25 million tonnes of waste rock with 13 million tonnes stored adjacent to the pit and the remainder backfilled into the mined-out pits (Figures ES.4.5 and ES.4.6).

Conventional drill and blast mining techniques will be used to develop the open pit. Benches will be mined in a sequential manner using drilled blast holes filled with either emulsion or ammonium nitrate/fuel oil (ANFO) depending on the rock characteristics. An in-pit sump will be used to collect mine water resulting from groundwater inflows and surface runoff. Perimeter wells or drainage holes in the pit walls may be installed to aid in the mine water management as mining progresses.

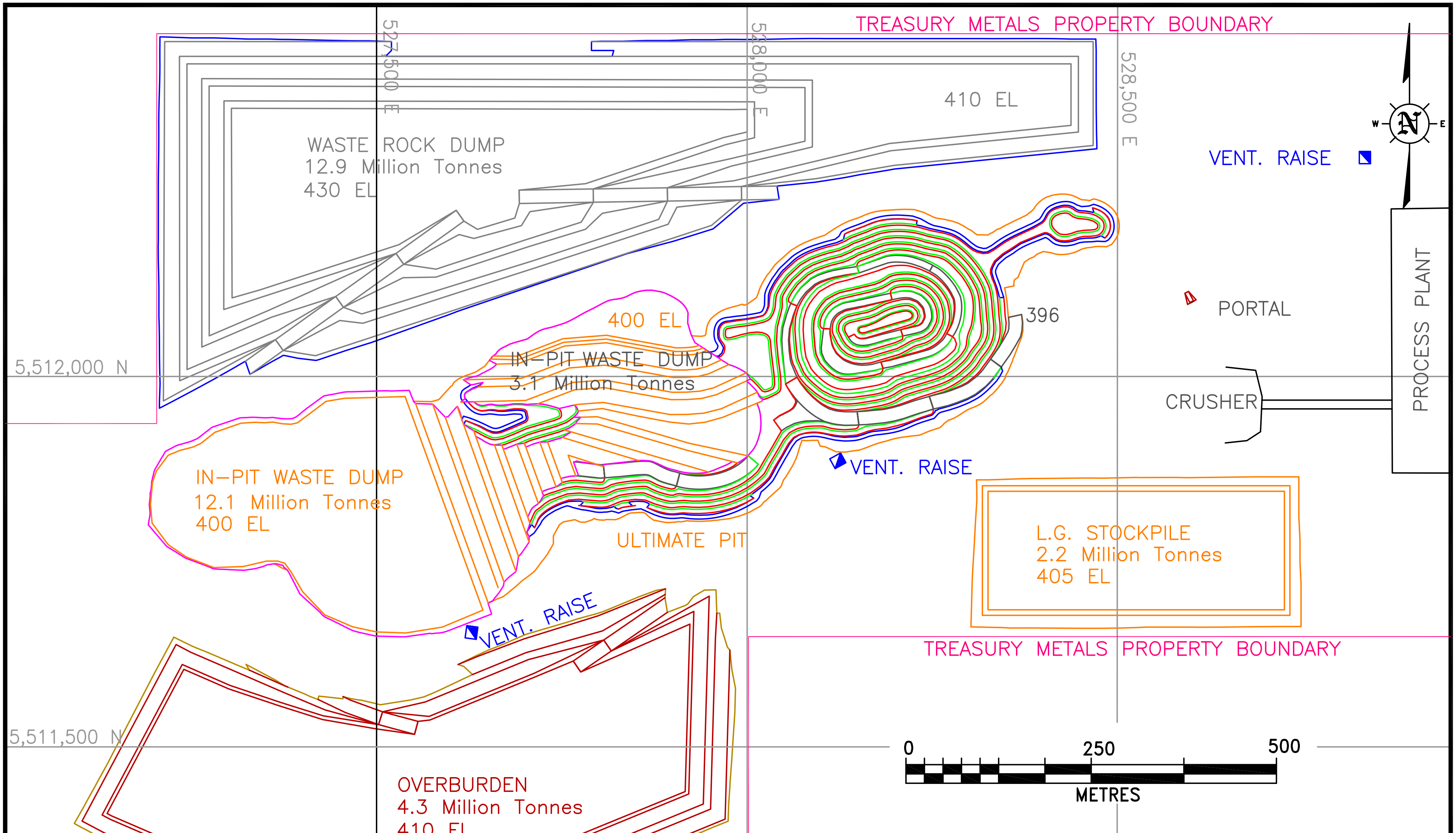



SITE PLAN SHOWING GOLIATH PIT
UG. OPENINGS ,LOW GRADE STOCKPILE
OVERBURDEN & WASTE ROCK DUMP

P & E MINING CONSULTANTS INC.
Brampton, Ontario, Canada

SCALE NTS

Figure ES.4.5




SITE PLAN SHOWING GOLIATH PIT WITH INPIT WASTE DUMP ,UG. OPENINGS ,LOW GRADE STOCKPILE OVERBURDEN & WASTE ROCK DUMP

P & E MINING CONSULTANTS INC.
Brampton, Ontario, Canada

SCALE NTS

**Figure ES.4.6**

## 4.2.4 Open Pit Mine Operations

Mining will be accomplished using conventional truck and shovel methods.

The open pit mine will operate on a 24-hour basis using either 2 x 12-hour shifts or 3 x 8-hour shifts. It is intended that the open pit mine operate on a 365 days per year basis over a life of approximately three to five years and a maximum production rate of approximately 2,700 tpd of ore. Low grade ore (~0.3 - 0.7 g/tonne) will be stockpiled between the open pit and the mill facility for processing with higher grade ore produced during the underground mining phase.

Both ore and waste rock will be mined in a similar fashion with the only significant difference being that ore will be mined using a smaller bench height to aid in dilution and recovery of the ore rock. It is anticipated that this be done at approximately 10 m and 5 m benches for waste and ore rock, respectively.

Benches will be drilled using conventional blasthole drills and blasted using conventional blasting technologies. A small fleet of 50 tonne to 70 tonne mining haul trucks will be loaded using either front end loaders or small mining excavators. The loaded material will be transported to either the waste rock storage area, low grade stockpile, or directly to the primary crusher. Ramps will be designed using widths sufficient to safely accommodate the selected haulage equipment.

Under normal operations, it would be anticipated that blasting would occur 5 times per week. Treasury will work with blasting specialists to determine a maximum charge per delay to minimize both noise and vibration. Explosives are not expected to be manufactured on site but delivered as required by a contractor. Explosives storage is further detailed in EIS Section 3.13.1.

Dust control measures will be in place for all phases of the Project as required. It is likely that this will be in the form of a water truck to keep roads damp during the summer.

Over the life of the open pit mine, a total of approximately 30.5 million tonnes of both waste and ore will be moved. It is anticipated that a significant portion of the waste rock will be used to fill the completed pit bottoms as scheduling allows. This has the benefit of both reduced operational mining costs and more importantly overall footprint reduction of the mining area.

### 4.2.4.1 Related Buildings and Infrastructure

The open pit mining operations will require an onsite maintenance facility for the mobile mining equipment such as trucks and bulldozers. This facility will be located in close proximity to the processing plant for ease of logistics and overall site footprint reduction. The facility will be an enclosed structure designed to be amendable to a pre-engineered structure. The facility will also include a centralized lube distribution system that will allow for a single storage point for grease and other necessary fluids.

## 4.3 UNDERGROUND MINE

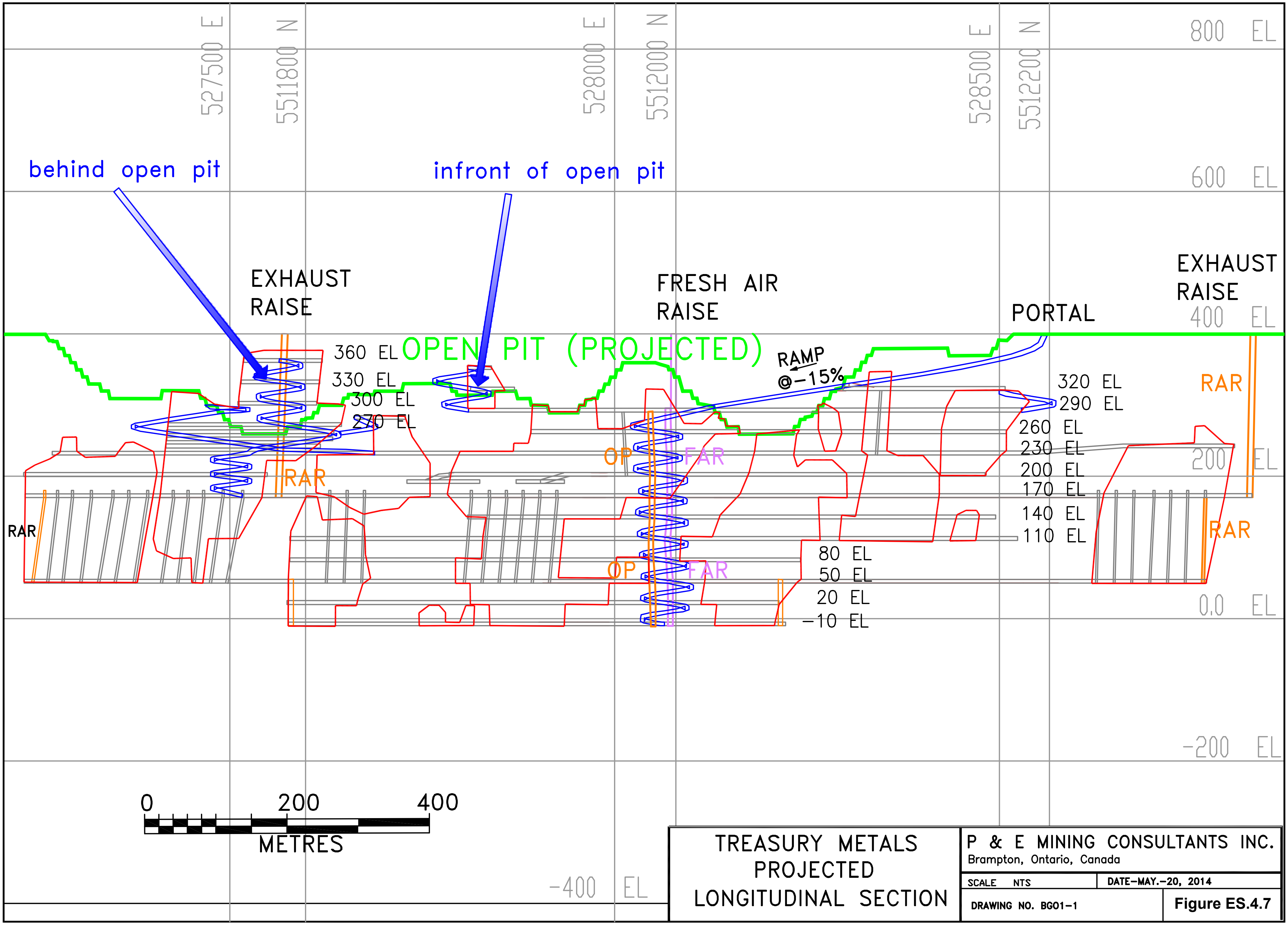
The underground mine will be used to extract ore that is either impractical or uneconomical to mine using open pit methods. The underground (UG) mine production will reach 1,800 tpd at full production. Current resource definition to allow for UG mine design has been completed to the proposed depth of 600 m (Figure ES.4.7). The ore body sits generally directly below the open pit dipping south-southeast at approximately 75 degrees from vertical. It should be noted that the resource is “open at depth”; meaning that there is a possibility that it could extend to further depths with continued underground drilling and exploration.

The UG mine will be accessed with a ramp system from surface (Figure ES.4.8). A portal will be constructed between the open pit and processing plant and advance downwards towards the ore-body. Once the open pit has been completed a secondary portal within the closed pit may be established in order to limit haul distances and costs. Level access drives will be made branching off from the main ramp at specific vertical intervals to provide level and sublevel access for production mining. It is anticipated that the development of the ramp for the initial mining levels will be completed in approximately 18 months to start after production of the open pit mine. Ramp and level access development will be ongoing through the mine life of the UG mine.

The ramp dimensions are expected to be on the order of 5 m wide by 5 m high to allow for truck traffic and supplemental ventilation requirements while the level access drives are expected to be smaller due to limited truck travel on these levels.

Ramp and level development will be primarily completed in waste rock. This is done to maximize effectiveness and recovery of the mineralized material. It is anticipated that approximately 2 million tonnes of waste rock will be generated by underground development. This rock will typically be hauled to surface due to limited availability of open space for underground storage at the time that this waste rock is generated. After haulage to surface, it is anticipated that this rock will be placed with the open pit waste material either in the waste rock storage area or within the completed open pit bottoms. There is also the possibility that this rock could be crushed and used for backfill of the completed open mining stopes. This option will depend on the sequencing of mining operations.

A combination of mining methods is proposed depending on the area of the mine and ore-body width. In general it is intended to be mined using a long-hole open stoping method with primary and secondary stopes. In this method an access tunnel is developed in both above and below the area to be mined. Holes are drilled at an angle to follow the orebody and subsequently blasted using explosives. The broken rock is then loaded with convention front end loading equipment and hauled to surface. Stopes will be backfilled using a consolidated waste rock fill with the option to begin using paste fill depending on the mine conditions. The mine plan will detail the method and ground support required to eventually mine the crown pillar from below the open pit.




TREASURY METALS
PROJECTED
LONGITUDINAL SECTION

P & E MINING CONSULTANTS INC.
Brampton, Ontario, Canada

| | |
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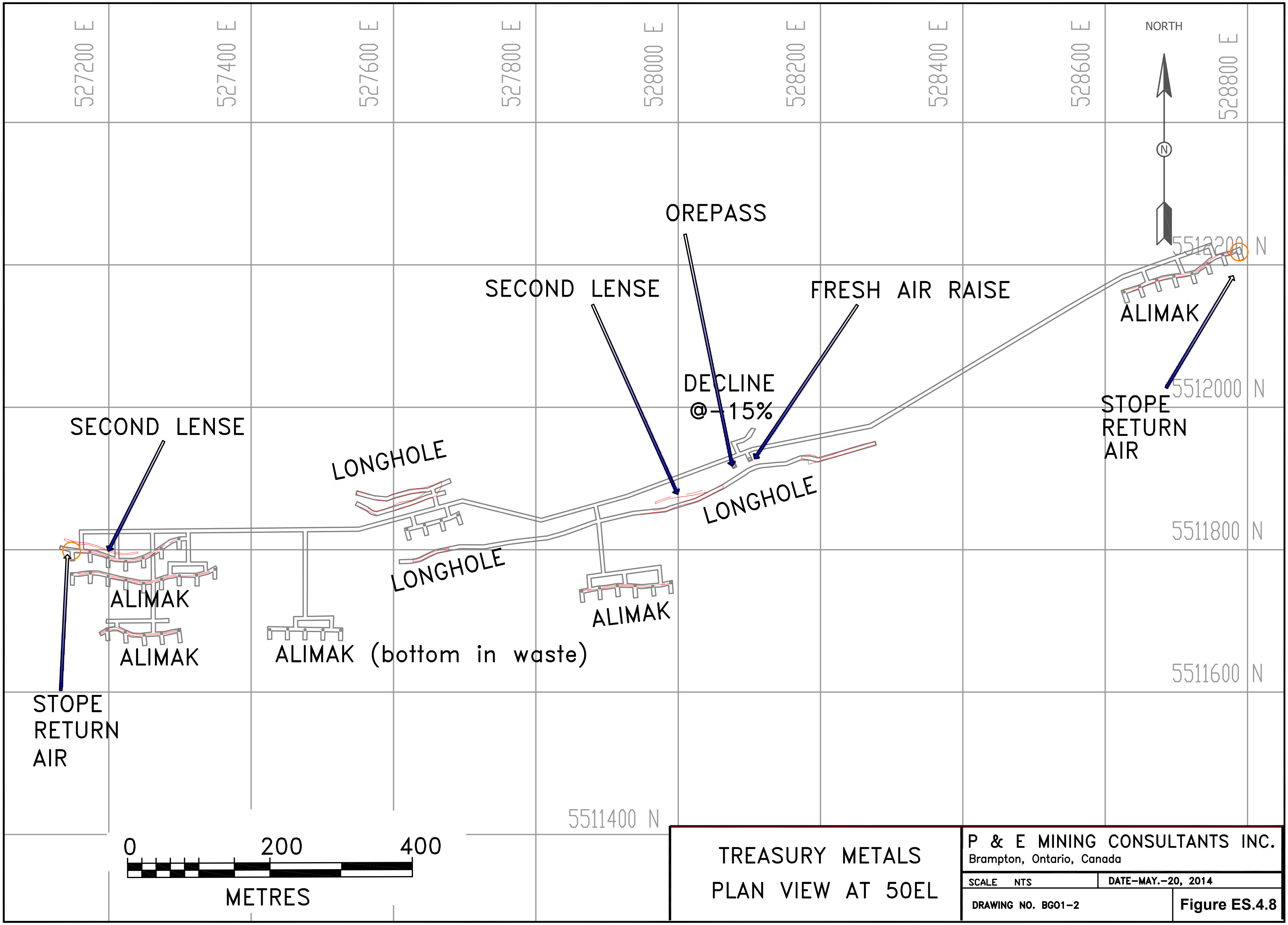
| SCALE NTS | DATE-MAY.-20, 2014 |
| DRAWING NO. BG01-1 | Figure ES.4.7 |


527200 E
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528800 E
NORTH
N
5512200 N
5512000 N
5511800 N
5511600 N
5511400 N
OREPASS
SECOND LENSE
FRESH AIR RAISE
ALIMAK
DECLINE
@-15%
STOPE
RETURN
AIR
SECOND LENSE
LONGHOLE
LONGHOLE
LONGHOLE
ALIMAK
ALIMAK
ALIMAK (bottom in waste)
ALIMAK
STOPE
RETURN
AIR
0
200
400
METRES
TREASURY METALS
PLAN VIEW AT 50EL
P & E MINING CONSULTANTS INC.
Brampton, Ontario, Canada
SCALE NTS
DATE-MAY.-20, 2014
DRAWING NO. BG01-2
Figure ES.4.8

## 4.4 STOCKPILES

Mining operations are expected to generate 25 million tonnes of waste rock and 4 million to 6 million tonnes of overburden. The principle considerations for stockpile location selection were:

- Reasonable proximity to mine operations;
- Minimized final height of stockpile to reduce visual impact;
- Minimized impact on potential fish and fish habitat;
- Maximize footprint residing on privately owned land;
- Facilitate water run-off control;
- Minimize potential adverse effect on terrestrial habitat; and
- Minimize reclamation efforts in the case of potential acid rock drainage (ARD).

### 4.4.1 Mine Rock Stockpile

Approximately 23 million tonnes of waste rock will be produced during the open pit mine life with an additional 2 million tonnes being generated and stored on surface from underground mining. The area surrounding the open pit has relatively little in the way of topographical relief which facilitates the placement of this rock directly to the north of the proposed open pit (Figure ES.4.5). The pits will be developed and mined in series from west to east. As a result, approximately 40% (or 12 million tonnes) of the total open pit waste rock can be used to backfill the pits and minimize the volume and footprint of the waste rock stockpile north of the pit (Figure ES.4.5). The waste rock stockpile will have a footprint of 37 ha, a height of 30 m above grade, and side slopes with a final overall grade of 3 horizontal width to 1 vertical height (3H:1V). The waste rock stockpile will be wholly within property owned by Treasury. Due to the conservative design factors placed on the mine rock stock pile linked to the low seismicity potential in the area of the Project there is an extremely low risk for failure due to a seismic event. The design criteria are considered to be well within a reasonable factor of safety for this purpose.

During production, waste rock will be classified and separated according to acid generation potential. The placement of these stockpiles will fall under a management plan for mine rock management that will detail the methods for classifying rock type for acid generating potential through appropriate testing in order to direct this rock to the appropriate stockpile location. A management plan of this type is standard industry practice for rock that has the potential for acid generation. Where possible, potentially acid generating (PAG) rock will be placed within the completed open pits to provide a long term water cover in order to mitigate potential acid generation.

Ditching and seepage collection will be created around the edges of the stockpile to collect and direct surface water runoff and seepage. This water will be directed to the mine water management system for further treatment, testing and release. The system will be designed to handle the average annual precipitation and will also include provisions for functionality under all climatic conditions. The mine water management system may include directing run-off water into the completed open pits after closure and to facilitate pit flooding.

### 4.4.2 Overburden Stockpile

Overburden will include any topsoil (clay and sand) or organic material that is stripped from the site area to allow for construction or mining to occur. The overburden stockpile will be located directly to the south of the proposed open pits for ease of placement and to accommodate the re-use of this material in the closure process (Figure ES.4.5). The overburden stockpile will have a footprint of approximately 26 ha, a maximum height of 20 m above grade, and a total capacity of 4.3 million tonnes. Slopes will generally follow similar to the mine rock stockpile at a grade of 3H:1V. Due to the conservative design factors placed on the overburden stock pile linked to the low seismicity potential in the area of the Project there is an extremely low risk for failure due to a seismic event. The design criteria are considered to be well within a reasonable factor of safety for this purpose. This stockpile will be temporary as the materials will be used during progressive reclamation of the mine site.

Slopes may be protected from erosion by vegetation until needed for reclamation. Ditching and seepage collection will be installed around the edges of the stockpile to direct and collect surface water runoff and seepage. This water will be directed to the mine water management system for further treatment, testing, and release. If possible, surface water runoff meeting Provincial water quality objectives (PWQO) and MMER requirements will be allowed to discharge directly to the environment. The system will be designed to handle the average annual precipitation and will also include provisions for functionality under all climatic conditions.

### 4.4.3 Low-Grade Ore and Other Stockpiles

A low-grade ore stockpile will be constructed during the open pit phase of mining (Figure ES.4.5). This will be a temporary stockpile to allow the low-grade ore to be blended with the higher grade underground ore to provide a consistent grade and rate of feed to the mill during the underground mining phase. By the end of the mine life this stockpile will be fully exhausted. Ditching and seepage collection will surround this stockpile to collect any surface water runoff or seepage. This water will be collected and directed towards the overall water management system for possible treatment or recycling within the milling process which will be detailed in a specific water management plan.

The location for the low-grade stockpile was selected to minimize travel for mine haulage equipment from the open pit and while providing ease of access to the main crusher. The location is also ideal for topographical purposes in that it is relatively flat, which will facilitate any runoff containment and collection. The total capacity of this stockpile is 2.2 million tonnes. At the maximum extent, the stockpile will have a footprint of 9 ha and a height of approximately 10 m to 15 m. Due to the conservative design factors placed on the low grade stockpile linked to the low seismicity potential in the area of the Project there is an extremely low risk for failure due to a seismic event. The design criteria are considered to be well within a reasonable factor of safety for this purpose.

The general area of the low-grade stockpile may also feature several smaller run of mine piles of varying grade that would be used to create a consistent blend of mine rock to the processing plant or to provide mill feed in a scenario of temporary shutdown of the mining operations. These would be located directly adjacent to the crusher facility. As mentioned, these stockpiles will be much smaller and very temporary in nature. It is anticipated that they may have a capacity on the order of 30,000 tonnes. The footprint would be less than one (1) ha and would be fully contained by the low-grade stockpile water management plan.

## 4.5 PROCESSING

The processing plant at the Project site will consist of a standard gravity/carbon in-leach (CIL) circuit with cyanide destruction of CIL tails (Figures ES.4.9 and ES.4.10). This option was chosen for the Project as it provides the best overall recovery and highest degree of design confidence as it is known as the most standard flow sheet for gold recovery.

Processing facilities for the Project include the process plant and supporting plant site infrastructure, including power distribution systems, water systems, plant air, natural gas supply and distribution, plant fuel storage, sewage systems, site roads and drainage, plant buildings, including offices, plant maintenance workshop, warehouse, administration, plant control room/Motor Control Centers (MCC), plant entry security, assay laboratory, and building services such as HVAC, fire protection and, lighting.

**Figure ES. 4.9 Aerial View of Proposed Processing Plant Location**

## 4.5.1 Site Layout and Infrastructure

The process plant site will be located to the east of the mining pits, and just east of the Tree Nursery Road (Figure ES.4.11). The road will be diverted to the east side of the process plant. The plant security gate and car park access will be from this new section of Tree Nursery Road. The process plant and ancillary buildings will be located outside a 500 m radius blast zone from the edge of the open pit and on property owned by Treasury. The crushing facility will have a tentative clearance of 300 m from the edge of the pit.

In general, all process areas will be housed in a building covered with pre-finished, insulated metal roof and wall cladding. The largest building on the site will be the mill building. Detoxification tanks will sit outside but adjacent to the mill building and will be integrated with the CIL containment area. The control room will be at an elevated location within the mill building.

The CIL tanks will be located outside, with a protective shelter and crane gallery over top of the tanks. The gallery will allow for indoor maintenance and servicing. Containment of CIL area spillage will be achieved via a concrete containment bund that will drain to the event pond.

The air and water services area will include air compressors, dryers and receivers, water treatment plant and water pumps. All piping and cables will feed directly off the main pipe rack.

The gold room will be located against the wall of the workshop, and will be considered a separate and secure area. The gold room will include a small overhead crane for lifting and moving anodes/cathodes.

The workshop/plant offices sit within the main the mill building, and will include: overhead crane, machinery bays, central aisle as working area, plant and maintenance offices, and services against one long wall. A parts store area will be attached. The main warehouse will be located within the former tree nursery facilities.

There will be one main electrical room for the process plant, to be located adjacent to the main pipe/cable rack and positioned close to the center of the plant to minimize cable runs to all plant areas.

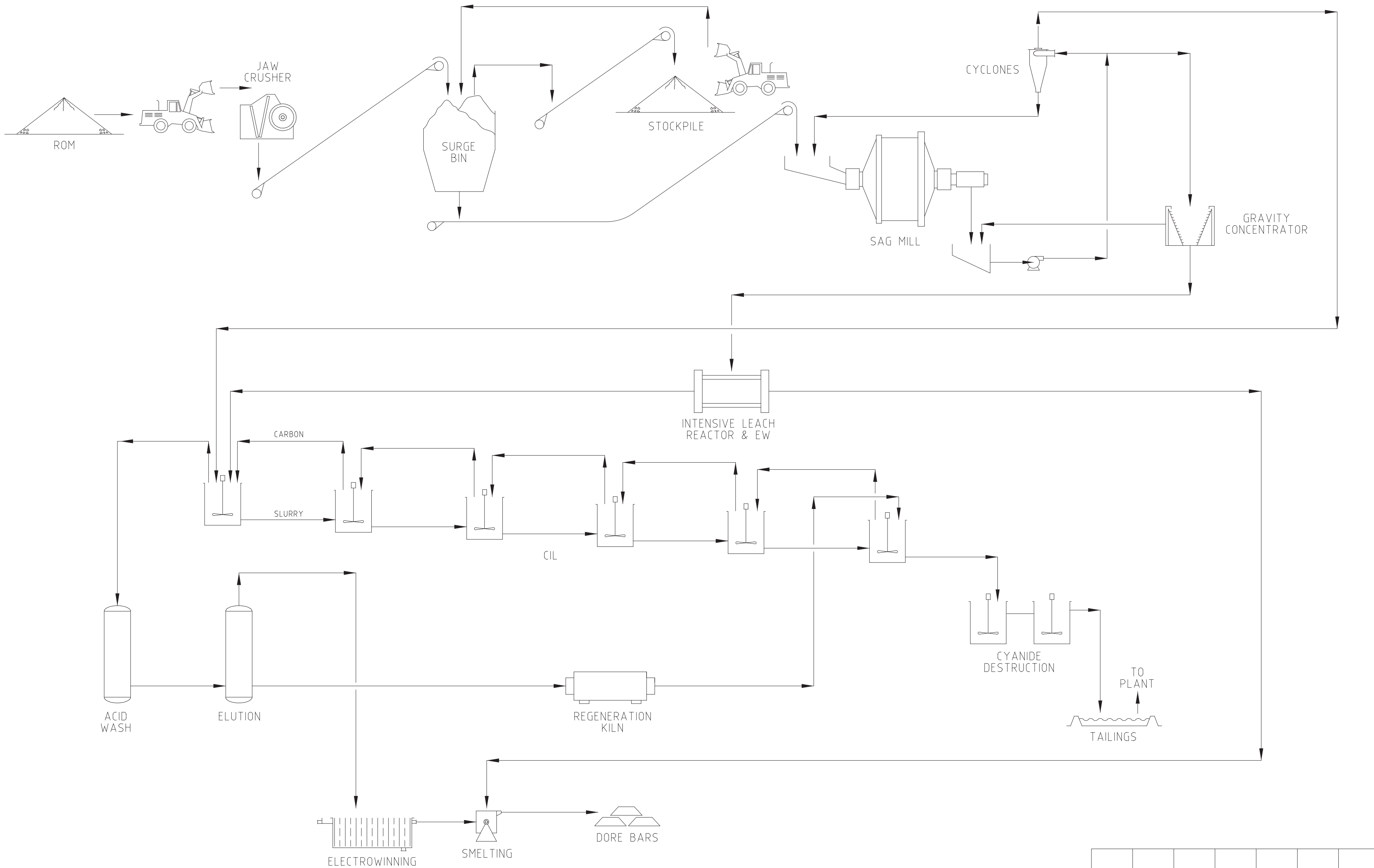



**Figure ES.4.10**

| DRG No | REFERENCE DRAWINGS | No | DATE | REVISIONS | DRN | CHK'D | DESIGN | DESIGN APP'D | PROJ APP'D | CLIENT APP'D |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | 27JUN14 | ISSUED FOR REVIEW | SH | | AC | TF | | |

| DRAWN | CHECKED | DESIGN | SENIOR ENG | DESIGN APP'D | PROJ APP'D | CLIENT APP'D |
|---|---|---|---|---|---|---|
| | | | | | | |

CLIENT TREASURY METALS INC.

PROJECT GOLIATH GOLD

Lycopodium

Lycopodium Minerals Canada Ltd Corp. No: 767 852-5
5060 Spectrum Way, Suite 302, Mississauga, Ontario L4W 5N5
Phone: (905) 206 2600 www.lycopodium.com.au



DRAWING TITLE
OVERALL PROCESS PLANT
PREFERRED OPTION
PROCESS FLOW DIAGRAM

| SCALE | JOB No. | DWG No. | REV. |
|---|---|---|---|
| NTS | 5027 | 000-F-101 | A |

DRAWN SH DATE 11FEB13

A1

### 4.5.1.1 Water Supply

The processing plant will consume an estimated average 600 $m^3$/d of fresh water during operations. This fresh water will be used for makeup of select reagents, various spray nozzles, carbon elution, plant wash down and cleanup, and potable water. Potable water will be produced to provincial standards by clarifying, removing harmful constituents, and disinfecting the raw fresh water as required by the source.

During construction activities, the fresh water supply requirement is expected to be similar to or less during operations depending on the stage of construction. During closure, fresh water consumption will taper to nil. During the start-up of the plant an initial first fill quantity of water will be required; however, this water does not need to be fresh water and as such will be supplied by the mine dewatering activities and taken from the contact water sediment ponds as required. The only fresh water required at plant start-up is the first fill of the raw water tank (includes firewater), potable water tank, and select reagent tanks. This demand is insufficient to warrant additional consideration.

There are two ponds on the proposed Project site, referred to as the tree nursery ponds. These dug ponds were used for irrigation during the historical operation of a tree nursery. These ponds are situated on the creek referred to as Thunder Lake Tributary 3 in the hydrology report (AMEC, 2014). This creek was gauged and the results reported for measurements taken during 2013 indicate sufficient flow to meet the process plant requirements. To meet the processing plant requirements, taking 26% of the flow of Thunder Lake Tributary 3 would be required. If the appropriate permits can be obtained, the tree nursery ponds are the preferred fresh water source.

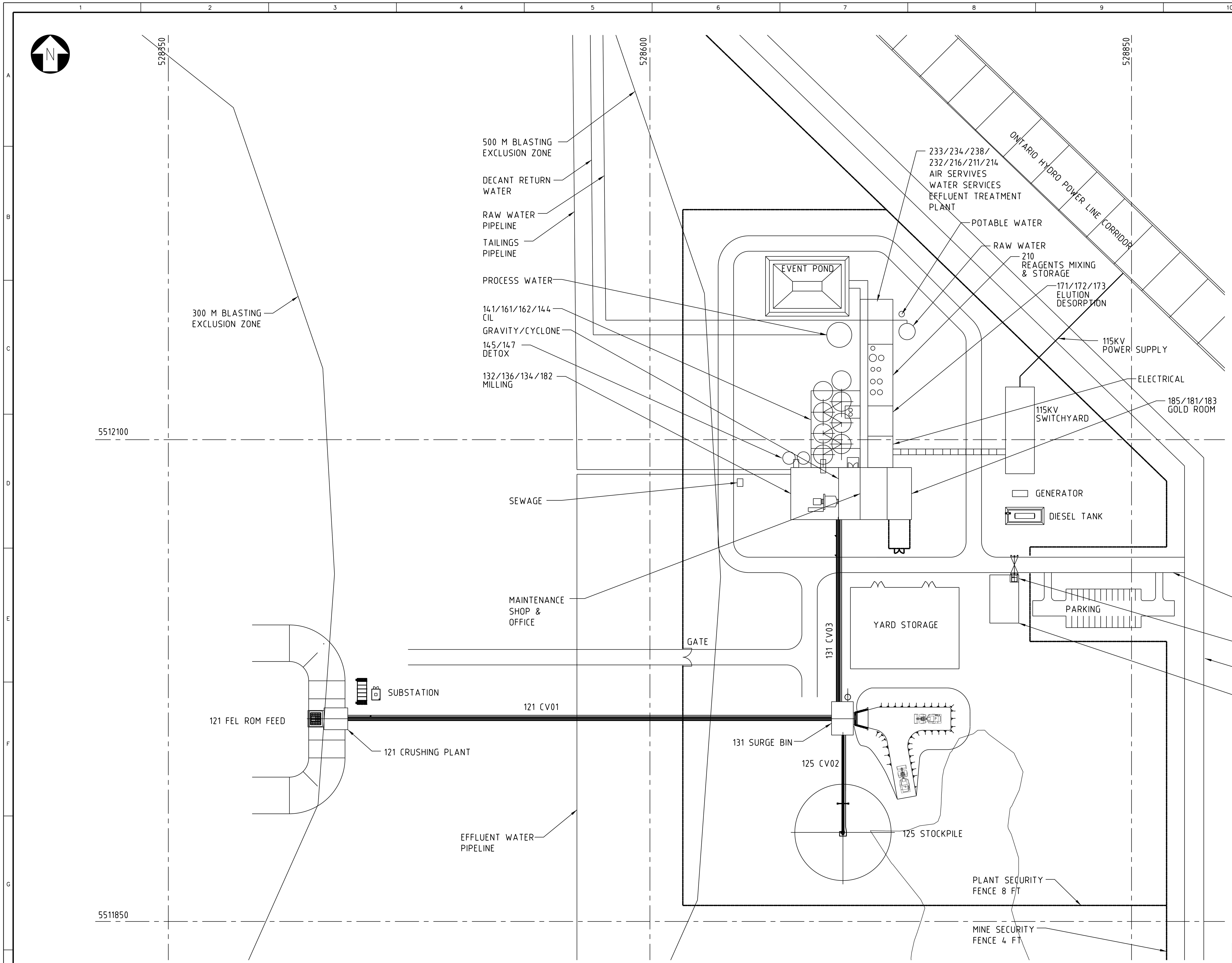
### 4.5.1.2 Building and Fire Protection Systems

Fire protection systems to be provided for personnel and property protection include: smoke/heat detectors and manual pull stations, fire extinguishers, fire hydrant coverage of all process plant areas and internal fire hose coverage for all enclosed building areas.

A sprinkler system will be provided for the gold room, along with fire hose coverage throughout the facility, supplemented by hand held fire extinguishers. Sprinkler systems will be provided for crusher and mill lubrication units with hand held fire extinguishers as backup. A wet sprinkler system will be provided for the control room, with hand held fire extinguishers. Sprinkler coverage will be provided for enclosed conveyors. Sprinkler systems will be alarmed and interlocked with the conveyor drive to stop the belt when fire protection system or alarms are activated. Open transfer conveyors will be protected by hose reels and area hydrants.

For electrical rooms, ionization type very early smoke detection and alarm (VESDA) will be provided with hand held fire extinguishers as backup.

Fire hose cabinets and external fire hydrants will be located so that all interior areas of the buildings are within reach of a fire hose stream. A separate stand pipe system will be installed to provide fire hose coverage throughout the reagent area, with hand held fire extinguishers. Fire hose coverage for the crusher will be provided by site fire hydrants supplemented by hand held fire extinguishers and ionization type smoke detectors in enclosed areas.




| | |
|---|---|
| CRUSHING PLANT BUILDING | 132 $m^2$ |
| TRANSFER BIN BUILDING | 187 $m^2$ |
| MILL BUILDING (1674 $m^2$ ) | |
| MILLING | 648 $m^2$ |
| GRAVITY/CYCLONE | 324 $m^2$ |
| GOLD ROOM | 324 $m^2$ |
| MAINTENANCE | 378 $m^2$ |
| PROCESS BUILDING (1008 $m^2$ ) | |
| ELUTION/DESORPTION | 180 $m^2$ |
| REAGENTS | 372 $m^2$ |
| AIR/WATER SERVICES | 276 $m^2$ |
| ELECTRICAL | 180 $m^2$ |
| CHANGE HOUSE (400 $m^2$ ) | |
| GUARD HOUSE | 16 $m^2$ |
| FIRST AID/ SHOWERS/ CHANGE HOUSE | 384 $m^2$ |

20 0 20 40 60 80 100
SCALE 1:1000

Figure ES.4.11

| DRG No | REFERENCE DRAWINGS | No | DATE | REVISIONS | DRN | CHK'D | DESIGN | DESIGN APP'D | PROJ APP'D | CLIENT APP'D |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | 24MAR14 | ISSUED FOR STUDY | MFJ | | MB | DT | TF | |

CLIENT: TREASURY METALS INC.
PROJECT: GOLIATH GOLD

Lycopodium
Lycopodium Minerals Canada Ltd Corp. No: 767 852-5
5060 Spectrum Way, Suite 302, Mississauga, Ontario L4W 5N5
Phone: (905) 206 2600 www.lycopodium.com.au

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| DRAWN | CHECKED | DESIGN | SENIOR ENG | DESIGN APP'D | PROJ APP'D | CLIENT APP'D |
|---|---|---|---|---|---|---|
| | | | | | | |

DRAWING TITLE: PROCESS PLANT SITE MECHANICAL GENERAL ARRANGEMENT PLAN - ALTERNATIVE 1

| SCALE | DRAWN | DATE | JOB No. | DWG No. | REV. |
|---|---|---|---|---|---|
| 1:1000 | MFJ | 20FEB14 | 5027 | 5027-G-003 | A |

A1

#### 4.5.1.3 Main Control Systems

Plant operations will be controlled by a plant control system (PCS). Equipment interlocking will also be incorporated. Operator control stations will be provided in the crusher control room, elution area and in the main control room in the mill building. All plant variables and motor status will be accessible from any operator station. The crusher station will be capable of operating independently from the main system in case of a communication system link failure. For process control, signals from/to the field instruments will be wired to the centralized input/output (I/O) panels located in the electrical room. Fiber optic communication links will be used to connect remote areas to the control room namely controls and CCTV signals from the crusher building and the recycle water station at the tailings area. The PCS will provide production reports, process computations, alarm logs, process trending and graphic displays.

### 4.5.2 Pipelines

Plant tailings will be transported via pipeline to the tailings storage facility (TSF), and distributed at the TSF via piping and discharge spigots. Reclaim water from the TSF will be returned to the process plant for reuse in the process. All overland water and slurry pipelines will be insulated for freeze protection. A pipeline will bring natural gas from a main pipeline running adjacent to the TransCanada Highway up to the plant area. Discussions are in progress with the natural gas utility supplier regarding the process for having a pipeline tapped from the main and run to the process plant site. Pricing and configuration of the natural gas pipeline will be established in consultations between Treasury and the supplier.

### 4.5.3 Crushing, Ore Storage and Mill Feed

The crushing circuit will consist of a primary jaw crusher and crusher discharge conveyor. The ore storage circuit will consist of a crushed ore surge bin, apron feeder, stockpile feed conveyor, crushed ore emergency stockpile and a front-end loader (FEL) ramp for the reclaim of stockpiled ore. The mill feed circuit will comprise of a Semi-Autogenous (SAG) mill feed conveyor, lime silo, lime feeder and weightometer. The milling circuit will consist of a SAG mill.

The single stage SAG mill will operate in closed circuit with hydro-cyclones and will be fed new ore, process water, and cyclone underflow to ensure a consistent rock grind size for processing. The closed circuit SAG mill provides simple operation and minimizes footprint when compared to 2 or 3-stage crushing, or a Sag and Ball Mill (SAB) circuit.

### 4.5.4 Gravity and Carbon-in-leach (CIL)

The Project will process material using a standard CIL circuit which is considered the base case for the Project. The ore will be primary crushed with a jaw crusher and then ground to the target leaching size using a single stage SAG mill and classifying cyclones. A gravity circuit consisting of a centrifugal concentrator will be fed from SAG mill output. The gravity concentrate will be batch treated in an intensive leach reactor (ILR) with the gold solution treated by electrowinning. All material not contained within the gravity concentrate will be held in agitated leach reactors for 24 hours along with cyanide and carbon. The cyanide will leach gold and silver into a solution, while the activated carbon will move counter current to the slurry and adsorb gold and silver. The loaded carbon containing gold and silver will be passed through electrowinning cells to recover the metals which will then be smelted to produce doré bar. Outflows from the CIL circuit will be processed in a cyanide destruction circuit prior to disposal into the TSF.

#### 4.5.4.1 Cyanide Detoxification

The cyanide detoxification circuit will consist of two stirred reactors with air sparging as well as copper sulphate, sodium metabisulphite, and lime addition. Piping arrangements will allow the reactors to be operated in a series, parallel, or bypass configuration. The detoxification circuit will receive CIL tails and discharge treated slurry to the tailings hopper. The cyanide detoxification circuit is intended to be designed to destroy cyanide to 1 mg/L total cyanide, which is the current MMER limit for maximum authorized monthly mean concentration. Further natural cyanide degradation will take place in the tailings facility prior to discharge to the environment.

### 4.5.4.2 Tails Disposal

The tails hopper will collect various waste streams from the processing plant including tails and spillage. All acidic streams will be directly neutralized prior to entering the tailings hopper. The combined tails slurry will be pumped (at the density it is received) to the tailings pond. The maximum amount of reclaim process water will be pumped from the TSF back to the process plant to minimize the quantity of water to be treated and discharged to the environment while maintaining a water cover.

### 4.5.4.3 Reagent Mixing and Storage

Reagents required for leaching, acid wash, elution and detoxification include lime, cyanide, sodium hydroxide, copper sulphate and sodium metabisulphite. Generally, the reagents will be delivered to the process plant site in concentrated liquid or dry powder form and diluted or dissolved with fresh water in a mixing tank, transferred to a day tank and metered into the process plant using flowmeters and control valves. Three to five days of reagent supply will be housed in the reagent mixing area of the processing plant and additional storage will be provided within the existing Tree Nursery warehousing.

## 4.6 TAILINGS STORAGE FACILITY (TSF)

The objective of the TSF Project is to ensure protection of the environment during operations and in the long-term (after closure), and to achieve effective reclamation at mine closure. The design of the TSF will take into account the following requirements:

- Permanent, secure and total confinement of all solid waste materials within an engineered facility.
- Maintain a water cover over the tailings beach to minimize potential acid generation of the tailings solids as initial studies have indicated that mine waste can be considered as PAG. Excess water directed to the facility will be retained and directed to the plant site as reclaim for use in the operations and any surplus to treatment at a water treatment plant.
- The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved, and the design criteria and assumptions are met.

The TSF will be initially constructed with a Stage 1 dam embankment height at the preproduction stage to accommodate mine start-up and initial operations. The dam will be raised in stages during the operations to the full height required to accommodate the total required tailings solids scheduled to be deposited into the facility as well as allowances for operational, storm water and additional allowances for freeboard. This approach to the construction and operation of the TSF offers a number of advantages:

- Reduces the initial capital costs and defers a portion of the capital expenditures until the mine is operating fully and Non-acid generating (NAG) mine waste rock can be utilized for construction and raising the embankments;
- Reduces construction requirements at pre-production;
- Provides ability to refine design and construction methodologies as experience is gained with local conditions and constraints, and also allows for monitoring and collection of field data on the deposited tailings to optimize tailings parameters for use in design;
- Provides ability to adjust plans at a future date to remain current with “state-of-the-art” engineering and environmental practices; and

- Allows the observational approach to be utilized in the ongoing design, construction and operation of the facility.

The construction and staging of the TSF will be scheduled to ensure that sufficient storage capacity is provided in the facility to avoid overtopping and prevent water from exiting through the spillways during operations. This will be achieved by providing sufficient freeboard to safely accommodate the supernatant pond and design storm event, combined with wave run-up. Aerial view of the proposed TSF area can be seen in Figure ES.4.12.

## 4.6.1 Embankment Height and Construction

The required storage capacity of the TSF will be established to accommodate the total anticipated tonnage of tailings solids scheduled to be deposited over the life of the mine with consideration of the portion being directed to the underground mine workings. The available storage capacity of the TSF is based on the site selection of the facility determined from the Alternatives Assessment and the natural ground topography has been used to align the dam embankments to maximise storage capacity while minimizing embankment fill volumes (Figure ES.4.13). Tailings solids generation for the Project has been identified at 2,700 dry tonnes per day (dtpd) for a total of 11,826,000 dry tonnes, made as a conservative estimate over the life of the mine. An estimated 4,925,500 dry tonnes will be routed to the TSF up until the end of Year 5 of operations followed, after which approximately 40% will be routed to the underground mine workings from Year 6 to end of the operations in Year 12. An estimated 4,139,600 dry tonnes will be routed to the TSF from Year 6 to end of Year 12 of the operations for a total of approximately 9,066,600 dry tonnes requiring storage within the TSF. The actual fraction of tailings solids that can be directed to the underground mine workings as well as the schedule will be confirmed as the mine design is advanced.

A preliminary stage storage for the TSF has been developed that is based on the embankment layout and has been used to identify potential embankment staging and requirements for operational and stormwater management (Figure ES.4.14). The embankment heights have been assigned to provide containment of the required volume of tailings as well as an allowance for operational water, the environmental design storm (EDS) and normal freeboard.  Embankment staging at this time is preliminary and will be revised/optimized as the Project is advanced.

**Figure ES. 4.12  Aerial View of Proposed Tailings Storage Facility Location**

Water management and freeboard allowances have been applied to each embankment stage to ensure that full containment of tailings and water is provided during operations and to protect the dam from overtopping during the occurrence of significant storm events. A Maximum Operating Level has been established to contain runoff as well as water inputs to maintain a water cover over the tailings beach. Water transfer will be required for reclaim to process as well as transfer to treatment of yearly excess volumes.

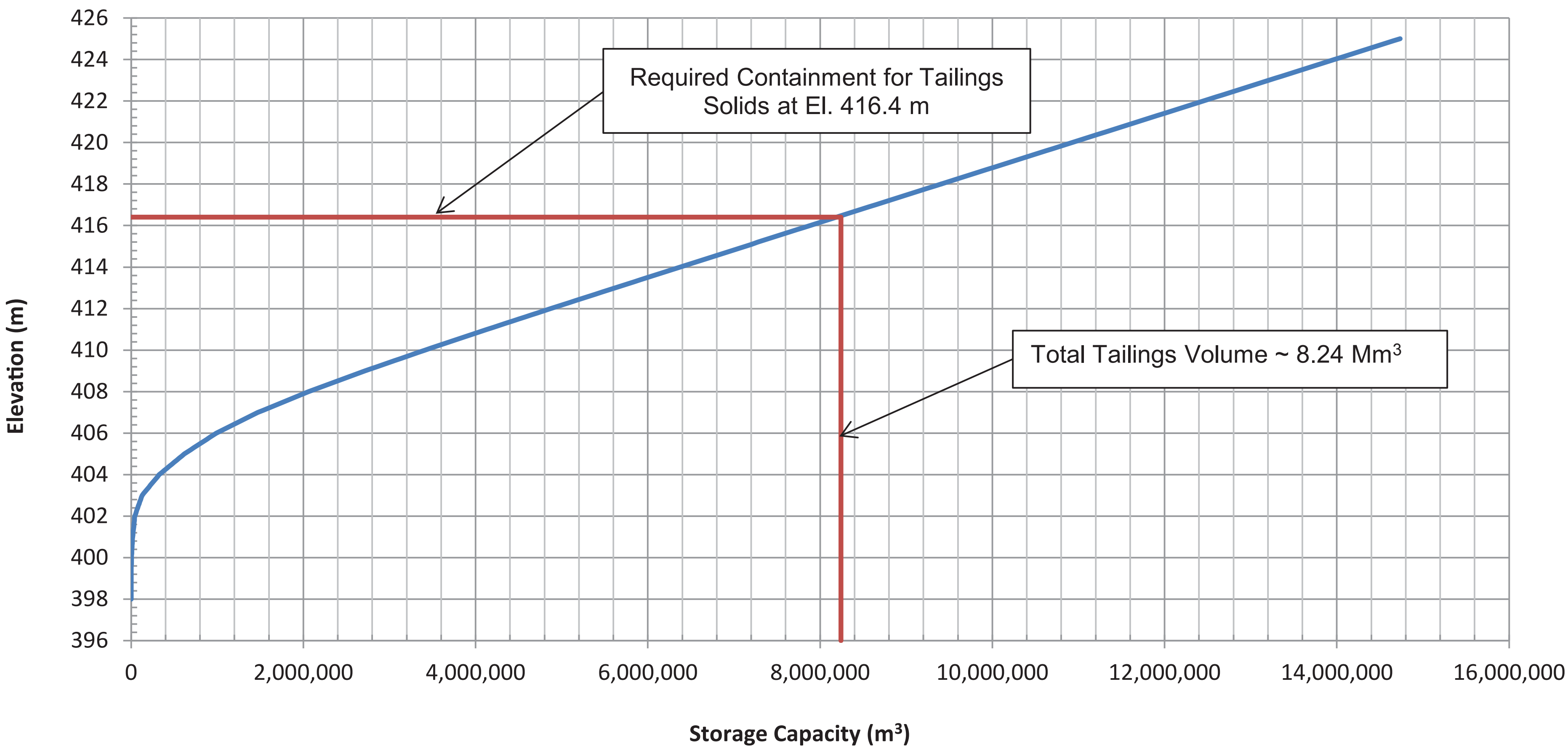
An allowance for the containment of storm water has also been provided that corresponds to the volume of water resulting from the EDS. The EDS that has been adopted for the TSF, is the 1:1,000 year, 24 hour storm event that has a storm depth of approximately 125 mm. The catchment area for the TSF is approximately 70.6 ha and the corresponding volume of water resulting from the occurrence of the EDS is approximately 88,250 $m^3$. A spillway invert for each embankment stage will be assigned to ensure that containment of the volume of water resulting from the EDS is maintained without being released though the spillway.

A freeboard allowance will be included to ensure that water overtopping the dam does not occur in the event that the spillway becomes active. The freeboard will be based on peak water levels occurring within the spillway during the occurrence of the inflow design flood (IDF). The IDF will be based on the hazard potential classification (HPC) as identified by the Canadian Dam Association (CDA) guidelines and also the Ministry of Natural Resources (MNR) Best Management Practices. The freeboard for each embankment stage has been assigned at 1.5 m above the spillway invert.

## 4.6.2 Tailings Storage Facility Embankment

The style of embankment raising is envisaged to consist of a centreline style that would utilize vertical drainage and transition zones for subsequent embankment raising (Figure ES.4.15). The type or style of embankment raising will be confirmed and optimized as the Project is advanced to the subsequent level of design and will be based on stability analysis with inputs from site investigation programs.

The TSF will provide primary and secondary containment of the tailings solids and impounded water as it consists of a zoned earth fill with an upstream low permeable clay zone. The upstream clay zone will be placed on the upstream slope of the embankment and also be keyed into the basin foundation within the key trench. The zoned earth fill section of the dam will provide the secondary containment and also seepage control to maintain dam stability and integrity of the anticipated low seepage flows through the dam.




Notes:

1. Capacity is based on preliminary alignment and flat tailings beach.
2. Tailings storage based on conventional tailings with co-disposal of tailings solids into underground mine working after Year 5 of the operations.
3. Based on Option 1D of Alternatives Assessment.

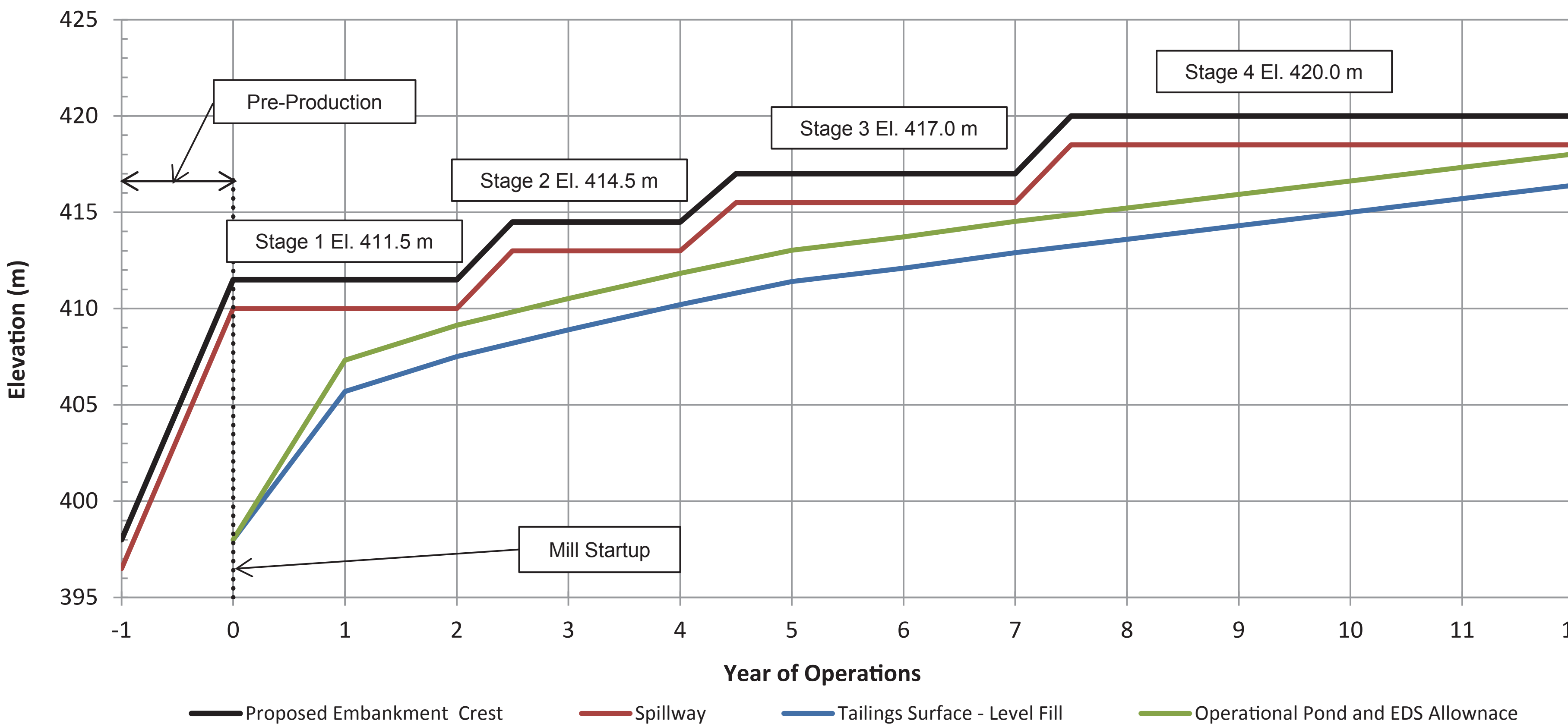
| Prepared By: | BRP | Checked By: | HBW | Approved By: | HBW |
|---|---|---|---|---|---|

**TREASURY METALS INC.**

**GOLIATH PROJECT**

**LOCATION 1**
**STAGE-STORAGE CURVE**

| | | |
|---|---|---|
| **FIGURE ES.4.13** | Project No.: 141-12598-00 | Ref. No.: A |




Notes:

1. Proposed emabnkment staging is preliminary and is based on infomration avaialble.
2. Tailings surface is based on level fill.
3. Allowance for Operational Pond and Environmental Design Storm (EDS) for operatioinal and stormwater management and to maintian water cover over tailings.

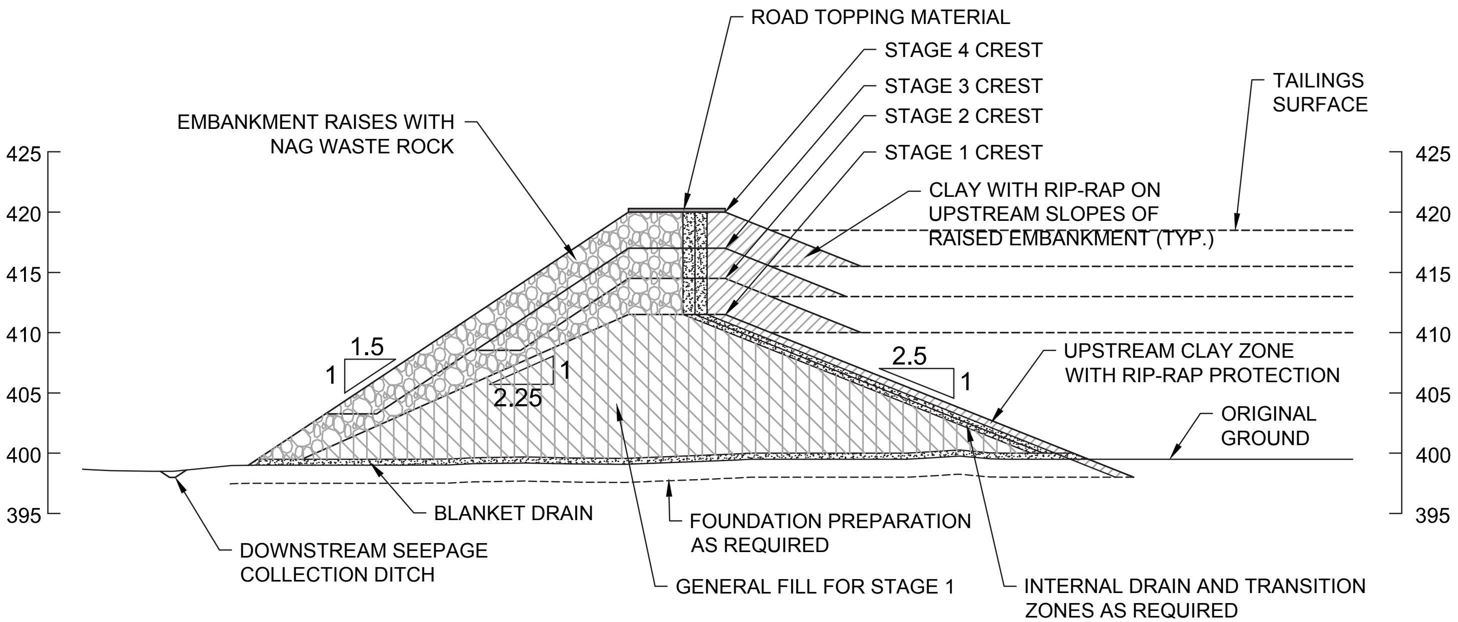
| | | | | | |
|---|---|---|---|---|---|
| Prepared By: | BRP | Checked By: | HBW | Approved By: | HBW |

**TREASURY METALS INC.**

**GOLIATH PROJECT**
**ALTERNATIVES ASSESSMENT**

**LOCATION 1**
**EMBANKMENT STAGING**

| | | |
|---|---|---|
| **FIGURE ES.4.14** | Project No.: 141-12598-00 | Ref. No.: A |




NOTES:

1. DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONCEPT SHOWN IS PRELIMINARY AND NOT INTENDED FOR CONSTRUCTION. THIS CONCEPT ASSUMES CENTRELINE STYLE FOR EMBANKMENT RAISE.
3. EMBANKMENT STAGING AND STYLE OF RAISE TO BE CONFIRMED / OPTIMIZED WITH SUBSEQUENT LEVELS OF DESIGN.
4. CONCEPT SHOWN IS FOR LOCATION 1 ONLY.
5. FOUNDATION PREPARATION TO BE DETERMINED WITH SITE INVESTIGATION.
6. EMBANKMENT DIMENSIONS AND SLOPES TO BE CONFIRMED WITH DETAILED STABILITY. ASSESSMENT.

LEGEND

- GENERAL FILL
- NAG WASTE ROCK
- LOW PERMEABLE MATERIAL (CLAY)
- DRAIN AND TRANSITION

WSP
1269 PREMIER WAY,
THUNDER BAY (ONTARIO)
CANADA P7B 0A3
TEL.: 807 625-6700 | FAX: 807 625-4491
WWW.WSPGROUP.COM

TREASURY METALS INCORPORATED
GOLIATH GOLD PROJECT
P.O. BOX 783
DRYDEN, ONTARIO P8N 2Z4
T: (807) 938-6961
F: (807) 938-6499

| | |
|---|---|
| PROJECT: | TREASURY METALS - GOLIATH PROJECT<br>TAILINGS STORAGE FACILITY<br>ALTERNATIVES ASSESSMENT |
| TITLE: | LOCATION 1<br>POTENTIAL CROSS SECTION |
| PROJECT NO: | 141-12598-00 |
| SCALE: | AS SHOWN |
| DRAWN BY: | G. HOOGWERF |
| CHECKED BY: | B. PLUMRIDGE |
| ISSUE/REVISION: | DRAFT REPORT A |
| ISSUE DATE: | MARCH 28, 2014 |
| FIGURE NO: | Figure ES.4.15 |

#### 4.6.2.1 Foundation Preparation

Foundation areas will require clearing of all standing trees and low level shrubs, grubbing and stripping of topsoil and potentially unsuitable materials prior to fill placement for the embankment. Topsoil that is stripped from the embankment footprint area would be hauled and stockpiled for later use in reclamation activities. Zones of soft or highly saturated and unsuitable foundation material would require removal and replacement with compacted fill material.

The main section of the dam will be constructed on a prepared foundation of native materials, anticipated to consist of clay material. The area immediately underlying the upstream clay zone of the embankment would be excavated to form a key trench. The excavation would extend down as far as necessary to provide a suitable cut off against seepage. Clay zone fill will then be placed in horizontal lifts and compacted into the trench. Foundation preparation and key trench excavation, depending on the required depths, may involve measures for dewatering during excavation activities that will require development of a sediment control plan.

A drain network (blanket drain) would be constructed into the base of the embankments, downstream of the clay zone, to drain groundwater from the foundation and also control seepage flows through the dam. Where necessary some trenching may be required for the drains to ensure gravity flow to the downstream toe of the embankment. Seepage flows will be collected in a perimeter collection ditch and routed back (pumped) into the TSF.

Foundation preparation within the basin area would consist of clearing all trees and shrubs and stockpiling at the site. Cleared trees consisting of merchantable timber can be hauled to forestry operations. Non-merchantable timber can be chipped and spread on-site.

#### 4.6.2.2 Embankment Zones

The embankment zones for the TSF have been preliminarily established based on available site investigation information and indications of fill materials in potential local borrow sources and also material availability from gravel pits in the Dryden area. The internal drain system will be designed as graded filters so that the individual zones function to control the movement of seepage while maintaining stability of the zone by preventing the migration of finer material into the adjacent zone. A non-woven geotextile can be included with the embankment cross-section between the upstream clay zone and adjacent drain that can aid in the prevention of migration of fine material into the drain zone. This will be determined with the filter design when material parameters for the fill materials are determined. Local fill will form the main body of the dam for Stage 1 and also the upstream clay zone for Stage 1 and subsequent embankment raises, and can be provided from local borrow sources. Subsequent embankment staging will utilize any possible NAG mine waste rock from the mining operations in the downstream shell of the dam. An additional transition zone may be required after Stage 1, between the transition zone and the mine waste rock; this will be determined once mine waste rock gradations have been established.

### 4.6.3 Seepage Control

A seepage collection ditch will be located along the downstream toe of the TSF for collection and containment of potential seepage flows through the dam. The ditch will also collect runoff from the downstream embankment of the TSF consisting of Zone E material or NAG waste rock. All water that is collected in the seepage collection ditch will be contained, collected and transferred back into the TSF utilizing a sump, pump and pipeline system. The design of the TSF ditch will include consideration of all potential water inputs as well as seepage estimates, and location, determined from the embankment seepage analysis.

### 4.6.4 Embankment Stability and Seepage

Stability and seepage assessments of the TSF embankments will be completed for each embankment stage of the Project. The assessments will be used to determine the required dam cross section, consisting of upstream and downstream slopes, required zone thicknesses and crest width, to maintain the required Factor of Safety (FoS) against instability during operation and closure conditions. Stability assessment will utilize results from site investigations for foundation conditions and also fill material parameters from laboratory index testing. Design criteria for the embankment stability will utilize the CDA guidelines to ensure the embankments are stable under various conditions and loadings (Table ES.4.1).

**Table ES. 4.1 CDA Guidelines**

| Loading Conditions | Minimum Factor of Safety | Slope |
|---|---|---|
| End of Construction (before reservoir filling) | 1.3 | Downstream and Upstream |
| Long-term (steady state seepage, normal reservoir level) | 1.5 | Downstream and Upstream |
| Full or partial rapid drawdown | 1.2 - 1.3 | Upstream |
| Pseudo-static | 1 | Downstream and Upstream |
| Post-Earthquake | 1.2 - 1.3 | Downstream and Upstream |

Stability assessment will be completed using the program SLOPE/W©, which is a limited equilibrium computer software program developed by Geo-Slope International Ltd. Bishops Simplified Method of Slices will be used to analyze potential failure surfaces through the embankment slopes and underlying foundations. The circular failure mode and the composite (block) failure modes for assessing potential sliding of the overburden on the underlying bedrock, were assessed as part of the stability modeling. Analysis will include static as well as pseudo-static conditions. The required seismic input is based on the HPC of the dam and the design criteria according to the CDA guidelines and the MNR Best Management Practices.

A seepage assessment will be completed to estimate potential seepage flows from the perimeter embankments. The seepage that does leave the facility will be collected in the downstream seepage collection ditch and pumped back into the facility. The modelling will be completed using the computer program SEEP/W®. Seepage models will be developed from site investigation information as well as laboratory index testing of fill materials. The results of the water/solids balance modeling will be used to identify pond elevations as input parameters. Seepage assessment results will be utilized in the design of the seepage return system as well as to identify the location of the downstream seepage collection ditch.

### 4.6.5 Tailings Management

The Stage 1 TSF embankment will be stabilised at the pre-production stage and will be raised over the operational life of the facility to provide containment of tailings solid, operational and storm-water management. Spigotting from the embankment crest will be utilized to fill in the low areas of the basin and will allow the tailings to build a beach against the upstream embankment face that will provide stability to the upstream slope and aid in containment. Monitoring of the tailings placed in Year 1 can also be used to better identify the in situ tailings beach slopes and in-situ densities that can then be used to update the deposition model for the remainder of the life of the facility. Deposition into the TSF is anticipated to consist of sub-aqueous conditions resulting from the ponded water utilized to provide the cover over the tailings solids to prevent acid generation. Deposition will be from the embankment crest by opening a series of spigots and allow the tailings to flow into the basin area. The deposition location(s) will be moved progressively along the deposition line on the embankment crest on a daily basis or as required.

The tailings deposition system will consist of a high density polyethylene (HDPE) delivery pipeline and an HDPE deposition pipeline for routing tailings to the TSF. The delivery pipeline will be aligned from the plant to the crest of the TSF embankment. The tailings deposition line will be aligned along the upstream crest of the embankment. The delivery and deposition pipelines will be connected to a flow control assembly located on the crest of the embankment that will be placed within a heated control building to prevent freezing. The flow control assembly will consist of a concrete pad to support a pipe header and a series of control valves to direct the tailings flow around the perimeter embankment.

Due to the potential erosion of the tailings flow and the potential sanding of the pipeline that can reduce the pipelines integrity, the pipeline will be monitored and routinely inspected for signs of deterioration. Monitoring can consist of installation of pressure gauges along the alignment to monitor changes in pressure resulting from a decrease in cross section. Deteriorated sections can be replaced in the field by cutting the pipeline, removing the deteriorated section and replacing it with a new section butt fused in the field. Pipelines will also be insulated and heat traced to ensure that the lines do not become frozen during winter operations.

### 4.6.6 Monitoring

Monitoring of the TSF will be required during the construction phase as well as during operations. Full-time construction monitoring is recommended to ensure that the facilities are constructed according to the design intent as presented on the drawings and in accordance with the technical specifications. The monitoring program will include a quality assurance and quality control program, consisting of filed inspections and geotechnical laboratory testing, to ensure construction fill materials meet the specifications for the required zones.

Monitoring of the TSF embankments is also required during the operations. The monitoring will include survey pins to check for potential embankment movements, piezometers in the embankment to check for pore water pressures and monitoring wells downstream of the embankment to monitor groundwater quality. Any problems identified will result in an increase in monitoring frequency and the designer will be notified immediately to assess the situation. Regular inspections will help identify any areas of concern that may require maintenance or more detailed evaluation.

The following general inspection schedule will be implemented:

- Daily visual inspection of all embankments and berms, pipelines, pumps, culverts, spillways to look for obvious problems such as pipeline damage, blockage, embankment seepage, slope instabilities. During high precipitation periods or spring freshet, more frequent inspections will be warranted;
- On a monthly basis, a more detailed inspection of all facilities will be conducted to look for any less obvious signs of potential problems;
- During and following any extreme events, including snowmelt and precipitation, a more detailed inspection will be conducted to assess if any damages due to erosion require attention; and

- The facility will be inspected by a qualified geotechnical engineer on annual basis to verify that the embankments are performing as designed and that the operations are being continued as intended. The inspections would likely be carried out during or shortly after the spring melt under snow free conditions.

Seepage monitoring is also recommended during the operations. Groundwater monitoring wells are recommended downstream of the TSF to monitor/identify if the facilities are not performing as required. This will help to ensure that the local environment is protected from seepage in the event that the containment systems are not performing and there is seepage occurring through the foundation and under/into the seepage collection ditches. Each monitoring installation will consist of one shallow hole, extending through into the overburden soils and the near surface horizon and one deep hole; terminating at the underlying foundations. Each borehole will be cased and screened over an interval set in the field during installation, and sealed back to surface with low permeability grout. It is recommended that the boreholes be constructed before commissioning the tailings storage facility to accumulate baseline data specific to the storage location.

Porewater pressures will be monitored at various key locations within the TSF embankment to ensure that stability is not compromised. The monitoring will consist of standpipe piezometers installed at critical areas in the embankment. The base of the piezometer will be contained within the embankment to ensure that the phreatic surface within the embankment is measured. The standpipe piezometers will be installed at Stage 1 and raised with embankment staging. Survey pins will be installed along the embankment crest and downstream face to monitor any movement and the resulting effects on the embankment.

Periodic survey checks of the embankment crests will be carried out to verify that no localized settlement has occurred resulting in the loss of freeboard.

Tailings performance monitoring will be used in the initial years of operation to identify the tailings behaviour related to beach slopes and their *in situ* density. The information collected during the initial years of operation can be applied to improve the calibration of the waster/solids balance and also as design parameters for subsequent stages of design. Monitoring of the following variables on a continuous basis is recommended throughout the life of the facility:

- Solids tonnage to the TSF;
- Water volume to the TSF from process or other streams;
- Rainfall and evaporation at the facility; and
- Water transfer to the plant and treatment.

Monitoring of tailings moisture contents and densities, and surveying of the tailings beach and supernatant pond elevations will be conducted each year. Monitoring of pond levels and water transfer (volume and rates) from the TSF will be required to identify issues with increasing pond levels resulting from issues with the water transfer systems. The following monitoring will be conducted:

- Daily recording of the pond water levels;
- All pumps transferring water in or out of the TSF will be equipped with flow meters to allow pumping volumes to be estimated and compared to the water balance predictions; site-specific meteorological data will be gathered and used in conjunction with the flows and levels to refine the hydrology modelling and improve future prediction;
- Confirmation of ice thicknesses by drilling and measuring; and
- Monthly monitoring of water levels in standpipes installed in the embankments and underlying foundations.

# 4.7 WATER MANAGEMENT

The general approach to water management for the Project will be to conserve the maximum amount in order to limit the volume of water taken and subsequently returned to the environment. To the practical extent possible the water management program is designed to:

- Minimize effluent discharge volumes by way of maximizing recycling of process water;
- Create a reliable source for any required makeup water; and
- Provide appropriate effluent discharge characteristics for release into the natural environment.

The main components of the water management system are:

- Process water for plant and milling operations;
- Mine dewatering for both open pit and underground mining;
- Tailings storage facility;
- Dust control measures;
- Surface water runoff for stockpile areas;
- Water seepage in overburden; and
- General runoff from other site areas.

The overall goal of the water management plan is to ensure that any discharge to the environment is compliant with *Metal Mine Effluent Regulations* and the Provincial Water Quality Objectives.

## 4.7.1 Mine Water Management

Mining dewatering requirements have been estimated to be 1,775 $m^3$/d (base case scenario). Typically mine water will contain suspended solids due to mining and earthmoving activities. Mine water may also contain residual ammonia and/or hydrocarbon from blasting operations with approximately 5% to 10% of the originally present ammonia remaining as residual post blast. General mining activities and specifically blasting activities will be covered under best practices management plans to detail methods to limit the amount of residual ammonia and hydrocarbon. There is a portion of PAG rock within the open pits and it is to be expected that leaching of the exposed bedrock may occur to contribute as a secondary source of solid and dissolved phase metals in the mine water.

Dewatering of this quantity will be done using conventional system of sumps, piping and pumps to move the water from the respective sumps in the pit and underground operations. Mine water will be directed to a dedicated collection system for treatment and use. Where possible this mine water will be directed to the plant for use in ore processing. It is anticipated that any excess water not needed in the processing plant will be sent to the tailings storage facility for further treatment or to a dedicated facility for treatment before release to the environment (Figure 4.8.2).

## 4.7.2 Water Supply for Process Plant Operations

For the initial start up the plant, a higher proportion of intake water will be needed before a sufficient amount of recycled water can be generated. For this initial phase, it is anticipated that water will be piped from the irrigation ponds currently in place at the Project office site.

Once operations are sufficiently advanced to provide recycled water, fresh water will still be required in the processing plant for consumption as potable water, pump gland water, reagent makeup, carbon elution, and firefighting water reserve. The fresh water demand will be met by either ground wells, or surface water drawn from the former tree nursery irrigation ponds (Figure ES.4.16). The total fresh water requirement is estimated to be 600 $m^3$/d.

**Figure ES. 4.16 Tree Nursery Irrigation Ponds for Water Intake**

Overall it is estimated that the plant will require a total of 2,728 $m^3$/day, with an average of 1,986 $m^3$/day of recycled or mine water, or approximately 75% on average being made up of recycled or mine water.

The processing plant will output an average of 2,723 $m^3$/day of tailings to the tailings management facility. There will be sufficient capacity designed into the water management ponds to provide the necessary inputs for operational purposes during both winter freeze periods and possible summer/fall drought periods.

## 4.7.3 Potable Water and Other Water Requirements

A small amount of potable and fresh water will also be required for operational purposes during the production period of the Project. Potable water will be obtained from groundwater wells in the area in order to account for the 600 $m^3$/d required. This water will used for specialized purposes within the plant process along with personnel uses such as showers, sanitary services and drinking water. Due to the relatively close proximity of the Project to available sources, it is anticipated that drinking water will likely be provided in the form of bottled water in large reusable plastic containers.

Fresh water may also be required for truck wash facilities within the maintenance facilities and dust control during summer open pit operations. This water used for these purposes is anticipated to be sourced from any supplemental mine water runoff that does not require further treatment for use.

## 4.7.4 Tailings Storage Facility Water Management

Water management for the TSF will require management of both operational and storm water. The tailings solids have been classified as PAG and therefore the concept of utilizing a water cover over the tailings beach has been adopted for the Project. The water cover will keep the tailings solids submerged to restrict contact with the atmosphere to minimize acid generation.

Water collected in the TSF will consist of runoff from the catchment created by the perimeter embankments as well as operational water delivered to the TSF in the tailings stream that is not locked in the settled tailings. The water inputs into the TSF in addition to tailings have been identified at this stage of the Project as consisting of mine dewatering. Other potential inputs may become apparent as the Project is advanced and these will be included with the water management design. Surplus water collected in the TSF can be stored and directed to a treatment facility prior to being released. The TSF while in operation will therefore contain all operational water and also provide containment of the environmental design storm (EDS) for storm-water management. An emergency overflow spillway will be included to maintain embankment stability during the occurrence of significant storm-water events. Water pond levels will be confirmed for each embankment stage for operational and storm-water management as presented below.

- Maximum Operating Level – required to contain runoff from average and wet precipitation conditions considering the volume of water being removed from the facility (evaporation and water transferred to treatment and process) while maintaining a water cover.
- Spillway Invert Level – Pond level providing storage capacity between the invert of the spillway and Maximum Operating Water Level to contain an EDS, currently assigned as the volume of water resulting from the 1:1,000 year, 24-hour event.
- Embankment Height – Freeboard above the invert of the spillway for each embankment stage to prevent water from overtopping the dam during the occurrence of the prescribed IDF that will be determined once the dam's Hazard Potential Classification has been established.

## 4.7.5 Final Effluent Discharge

Contaminated water will be treated in the cyanide destruction circuit with subsequent attenuation in the tailings storage facility (Table ES.4.2). By destroying cyanide prior to discharging the tailings to the storage facility, potential cyanide contamination situations such as dam seepage or tailings facility overflow during extreme storm events late in the Project life are eliminated. By design, the cyanide treatment circuit will destroy cyanide to a level acceptable for direct discharge to the environment and reduce the environmental safety requirements placed on the TSF. This method ensures that wildlife, including waterfowl and aquatic life, are protected, that cyanide consumption is minimized, and that contingency is in place to prevent the inadvertent release of cyanide into the environment. It also provides for the smallest tailings storage facility footprint.

The Inco $SO_2$-Air process has been selected as the preferred method for in plant cyanide destruction. This method is detailed in the discussion of alternative cyanide destruction methods (see also Appendix F of the EIS).

**Table ES. 4.2 Discharge Qualities**

| Parameter | Predicted Tailings Supernatant (mg/L) | MMER Max Monthly Mean (mg/L) |
|---|---|---|
| Average Solution Hourly Flow m3/h | 61.1 | |
| Aluminum | 0.199 | |
| Ammonia (as N) | 6* | |
| Antimony | 0.002 | |
| Arsenic | 0.018 | |
| Barium | 0.012 | |
| Beryllium | 0.0005 | |

**Table ES. 4.2 Discharge Qualities**

| Parameter | Predicted Tailings Supernatant (mg/L) | MMER Max Monthly Mean (mg/L) |
|---|---|---|
| Bismuth | 0.0005 | |
| Boron | 0.02 | |
| Cadmium | 0.002 | |
| Calcium | 7.15 | |
| Carbonate | 15.88 | |
| Chromium | 0.0001 | |
| Chloride | 0.78 | |
| Cobalt | 0.004 | |
| Copper | 0.018 | 0.3 |
| Cyanide | 0.04 | 1 |
| Iron | 0.358 | |
| Lead | 0.082 | 0.2 |
| Lithium | 0.024 | |
| Magnesium | 1.44 | |
| Manganese | 0.063 | |
| Mercury | 0.0018 | |
| Molybdenum | 0.001 | |
| Nickel | 0.021 | 0.5 |
| Nitrate (as N) | 7.07 | |
| pH | 6.16 | |
| Phosphorus | 0.06 | |
| Potassium | 1.78 | |
| Selenium | 0.0005 | |
| Silicon | 0.099 | |
| Silver | 0.00005 | |
| Sodium | 1.16 | |
| Strontium | 0.032 | |
| Sulphates | 68.67 | |
| Sulphur | 22.94 | |

**Table ES. 4.2 Discharge Qualities**

| Parameter | Predicted Tailings Supernatant (mg/L) | MMER Max Monthly Mean (mg/L) |
|---|---|---|
| Thallium | 0.642 | |
| Tin | 0.0005 | |
| Titanium | 0.003 | |
| Uranium | 0.005 | |
| Vanadium | 0.004 | |
| Zinc | 0.04 | 0.5 |

* Assumed Values, **At least one value used in determination was based on limit of detection

TSF decants will be pumped to the effluent treatment plant for treatment prior to discharge to the polishing pond and ultimately Blackwater Creek (Figure ES.4.17).

In the effluent treatment plant, tailings pond decant water will be treated in three distinct process steps including an advanced oxidation process for residual cyanide destruction, multimedia filtration, and reverse osmosis membrane filtration. The effluent treatment plant will ensure that water discharged meets (or exceeds) the provincial water quality objectives.

### 4.7.6 Water Course Realignment

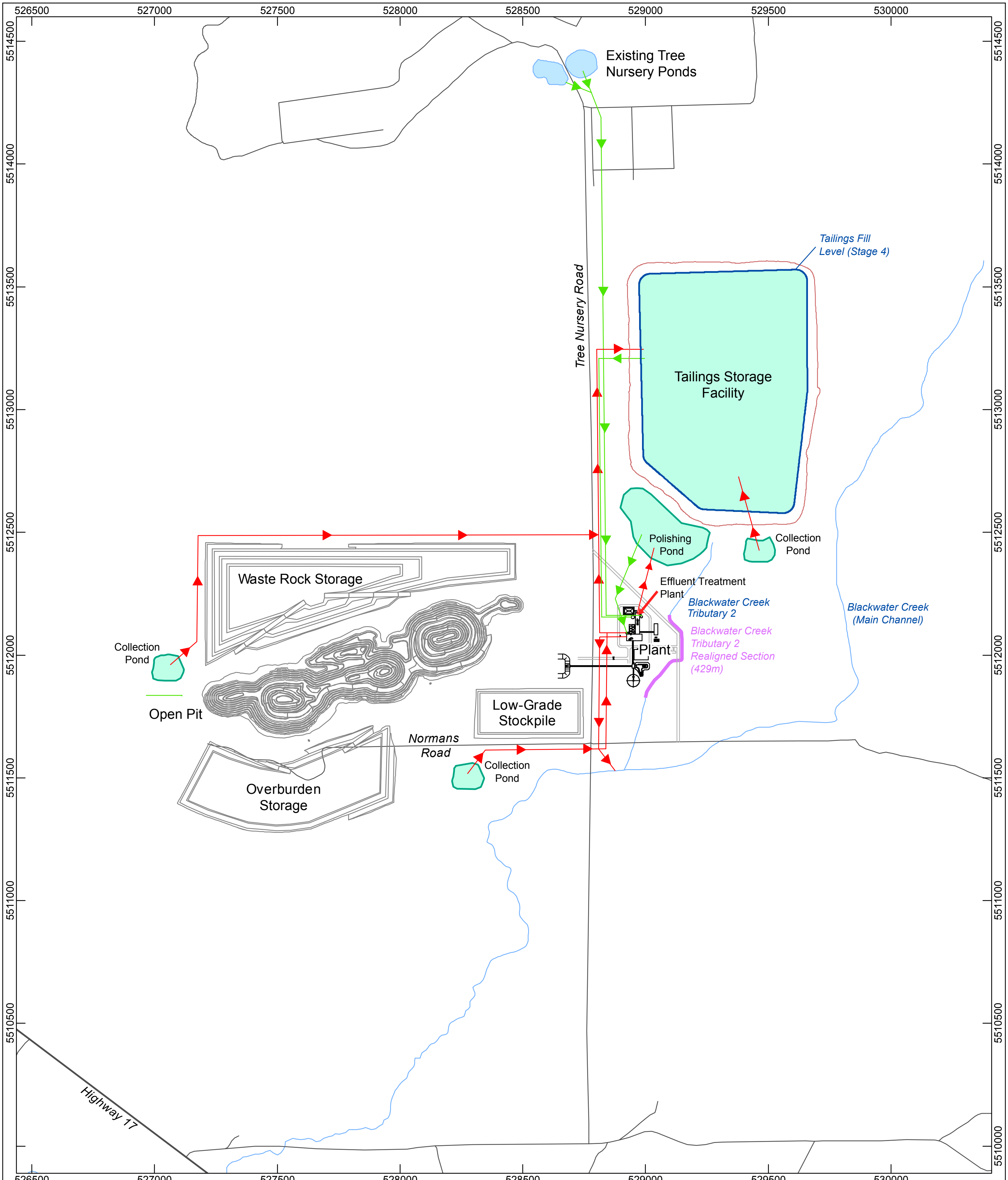
Only one minor water-course realignment will be needed to carry out the Project, being a realignment of Black Water Creek Tributary #2 to by-pass the process plant area. The realignment of this tributary will be to the eastern edge of the plant site area and will include approximately 400 m of channel construction to create the appropriate routing for this Creek Tributary and drainage. In general, flows will be limited in this channel as the headwaters of the Tributary are located in the area where it is anticipate that the TSF will be placed. A portion of these flows will be managed as part of the TSF and water will be part of the reclaim water that is used for processing operations. This diversion will consist of a small trapezoidal channel that would provide like-for-like fish habitat in the process (Figure ES.4.18).

## 4.8 FUEL AND CHEMICAL MANAGEMENT

All fuel and chemical waste will be stored on site in appropriate collection tanks and bins and disposed of in an appropriate off-site facility. Emergency shower and eyewash stations will be located in areas where workers could be exposed to toxic liquids and chemicals due to spillage, mishandling or other accidental causes. Each will have local audible and visual alarms.

## 4.9 DOMESTIC AND INDUSTRIAL WASTE

Non-hazardous solid waste, such as food scraps, refuse, fabric, metal tins, scrap metal, glass, plastic, wood, paper, and similar materials, will be stored temporarily for subsequent transport to an existing off-site landfill facility. The City of Dryden landfill currently has the capacity to support the future Goliath non-hazardous waste requirements.




GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

**Existing and Proposed Water Structures**

FIGURE: ES.4.17 REV.03

NOT FOR CONSTRUCTION

TREASURY METALS INC.

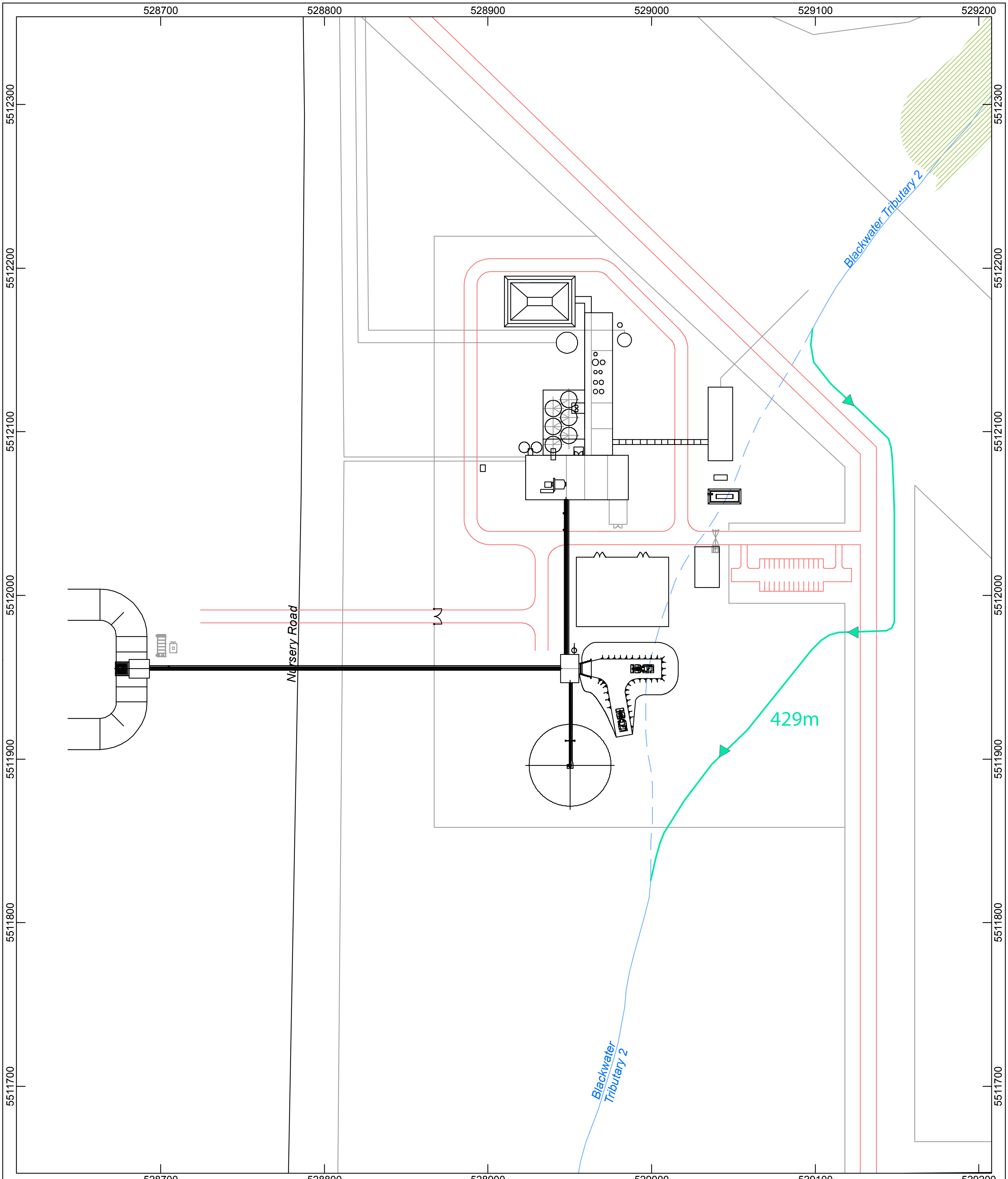
DESIGN: AT 06 FEB. 2014
GIS: AT 21 AUG. 2014
CHECK AT 12 SEP. 2014

Tailings Fill Level
Tailings Embankment Toe
Water Intake
Water Output
Main Processing Plant Structures
Access Roads/Parking
Existing Road
Blackwater Creek (Post Realignment)
Realigned Section of Blackwater Creek
Created Water Structure
Existing Water Structure

0 100 200 300
Meters

N

**Notes:**
1. UTM Zone 15N, NAD83
2. Base Data Source: OBM
3. 1:20 000 scale NTS
4. Non Base Data by TML




GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

*NOT FOR CONSTRUCTION*

*TREASURY METALS INC.*

**Blackwater Creek Tributary #2 Water Course Realignment**

*DESIGN: AT 06 FEB. 2014*
*GIS: AT 21 AUG. 2014*
*CHECK: AT 12 SEP. 2014*

FIGURE: ES.4.18 REV.02

Secondary Processing Plant Structures
Main Processing Plant Structures
Access Roads/Parking
Watercourse Realignment
Wetland Area
Local Road
Watercourse
Realigned Watercourse

0 25 50
Meters

N

***Notes:***
*1. UTM Zone 15N, NAD83*
*2. Base Data Source: OBM*
*3. 1:3000 scale NTS*
*4. Plant and Watercourse realigment by TML*

Waste oil and lubricants will be stored in appropriate containment vessels in bermed areas, and periodically removed by licensed haulers to an off-site licensed facility. Spent solvents, cleaners, and waste anti-freeze will also be stored in similar fashion and disposed of at a licensed facility off-site.

All sanitary waste will be sent to an offsite contractor and will be stored onsite in receiving/holding tanks. The contents of the holding tanks are removed by truck and delivered to an offsite sewage treatment plant. This is the preferred method of sanitary waste treatment for the construction and early operating phases of the Project, with future consideration of onsite treatment, with consultation with provincial regulators.

Outlying facilities may be serviced by septic tile fields or holding tanks for treatment in the on-site plant. The tree nursery facility will continue to use its current septic system and investigation on capacity in support of the Project will be assessed.

## 4.10 ACCESS AND SECURITY

Access to the mine will be from Tree Nursery Road via the Anderson Road turnoff on Highway 17, approximately 2.5 km west of the village of Wabigoon. The final 2.5 km northern section of Tree Nursery Road will be closed to public use at the mine entrance security gate. This effectively eliminates public use of the site circulation road network (Figure ES.4.19). This network will also include a number of stream crossings as defined in Section 3.8. Consequently, neither parking nor the internal site circulation road network is expected to impact Highway 17 operation.

Process plant area access will be controlled and monitored 24 hours per day. The refinery located in the process plant will not be continuously manned by security personnel but motion, vibration and/or temperature sensors will be provided to detect unauthorized intrusion. Security cameras will be located in the goldroom, on the roof of the process plant building, and at the process plant gate house.

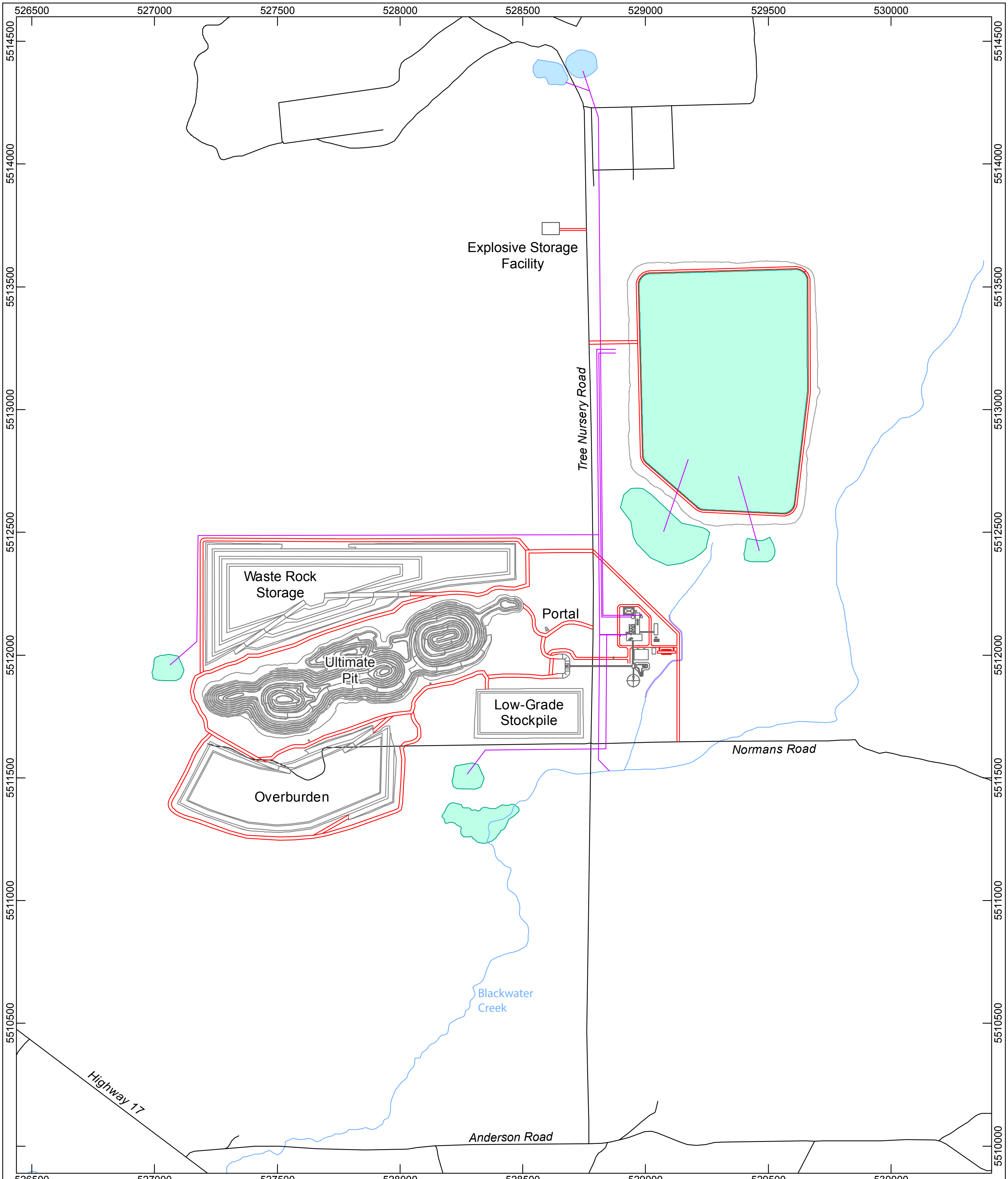
In addition to the security system, an independent CCTV system will monitor the crusher feed chute and crushed ore feeder discharge, with the monitors located in the main control room. A video recorder will capture all relevant entry/exit details in high security areas and log all security alarms in chronological order. Security signals will be transmitted via secure dedicated cables with the system backed up by dedicated UPS.

## 4.11 POWER SUPPLY

The plant shall be supplied from the Hydro One 115 kV power line circuit M2D via one 138 kV 600 A motorized disconnect switch 270-DS-001 in series with one 1200 A, SF6 circuit breaker 270-CB-001.

## 4.12 EXPLOSIVES STORAGE FACILITY

Treasury is in communication with several explosives suppliers for the supply and storage of explosive onsite for open pit operations. Preliminary indications point to a regular delivery of explosives from a regional site storage which would indicate that a relatively low volume of explosives will be stored on site. Two preliminary locations have been identified to date. The first location is situated to the east on the edge of Tree Nursery Road. Currently, this location is the preferred option. The second option is located to the north of the Project office, on the Company’s Tree Nursery land package. Location will be determined though consultation with appropriate regulatory authorities and suppliers.




| | | |
|---|---|---|
| GOLIATH GOLD PROJECT<br>DRYDEN, ONTARIO, CANADA | *NOT FOR CONSTRUCTION* | |
| | *TREASURY METALS INC.* | |
| **Access Routes, Pipeline Access, and Stream Crossings** | *DESIGN: AT 06 FEB. 2014*<br>*GIS: AT 14 NOV. 2014*<br>*CHECK: AT 14 NOV. 2014* | |
| FIGURE: ES.4.19 | REV.01 | |

Pipelines
Main Processing Plant Structures
Access Roads & Parking
Existing Road
Realigned Blackwater Creek
Realigned Section
Created Water Structure
Existing Water Structure

0 100 200 300
Meters

N

***Notes:***
*1. UTM Zone 15N, NAD83*
*2. Base Data Source: OBM*
*3. 1:20 000 scale NTS*
*4. Non Base Data byTML*

# 4.13 CLOSURE AND DECOMMISSIONING

## 4.13.1 Open Pit Mine

Closure of the open pit will occur once operations cease. It is planned that the open pit will begin flooding once dewatering activities cease. Flooding of the final open pit will be achieved passively through natural ground water discharge, precipitation and enhanced active flooding. Active filling may occur by filling the open pit with runoff pumped from the waste rock storage area (WRSA) or recycled water from the TSF. Flooding of the open pit to surface can be achieved in approximately 9 years.

Other measures will be taken to reclaim the open pit progressively or at closure may include, but are not limited to:

- Construction of a boulder or overburden fence around the perimeter of the open pit and a barricade at pit access ramp(s) during or following active mining operations within the pit. This fence will be designed to ensure safety;
- Removal of all infrastructure and equipment within the open pit and clean up any fuels and lubricants such as petroleum hydrocarbons from vehicles and mechanical equipment, if necessary. Policy and procedure regarding spills and containment will be initiated at Project construction phase to limit closure time;
- Removal or stabilization of drainage channels and water management structures constructed for dewatering and diversion purposes;
- Revegetation of non-flood overburden slopes of the open pit, including exterior fencing and barricade. Vegetation will be brought to stable condition with focus on facilitating riparian habitat along open pit margins. Stockpiled overburden will be used to provide growing material; and
- Construction of a permanent overflow spillway to safely convey runoff from open pit to natural drainage of Blackwater Creek. Currently, issues with flooded pit water chemistry are not anticipated.

Consultation will be required to determine the preferred flooding method and approach.

## 4.13.2 Underground Mine

At the completion of mining the underground workings must be closed out in accordance with Ontario Regulation 240/00, Amended O.Reg. 307/12, Subsection 24(2). Infrastructure and equipment of value in the Project underground mine workings will be removed and any waste cleaned up. The underground workings will then be allowed to flood naturally through groundwater inflow and potentially through the flooding of the open pit. It is not expected that any of the surface openings to underground will discharge to the environment during or after flooding.

The entrance or portal to the underground workings will be sealed using NAG rock. The entire ramp opening will be backfilled and overfilled with mine rock to ensure no potential entry point is visible or accessible. After sealing the area will be regarded, covered with overburden and planted with local flora.

Biological benefits of the development will be considered, while still ensuring public safety.

## 4.13.3 Stockpiles

Progressive rehabilitation of mine rock and overburden piles will be undertaken where practical once the maximum height of each stockpile has been reached and as each lift is completed, to minimize the amount of reclamation required upon closure. All stockpiles will be re-shaped, scarified, and stabilized as necessary.

In the area containing only NAG rock, ARD/metal leaching (ML) is not of concern and Treasury proposes to place a re-vegetated layer of overburden.

For the area above surface containing PAG rock, Treasury proposes to use a multi layered cover for reclamation purposes. The main purpose of this cover would be to control long term acid rock drainage/metal leaching (ARD/ML) by achieving encapsulation and limiting oxygen to the PAG rock. This process is further detailed in the Conceptual Closure Plan (Section 11).

Treasury proposes to process all stockpiled ore during operation, therefore reclamation of the low grade or ROM stockpile should not be required. If necessary, the stockpiles will likely be reclaimed in a manner similar to that proposed for the WRSA at final closure.

Revegetation will occur though hydroseeding, seeding, hand planting, and planting of tree seedlings from local vendors where appropriate. Investigations on the colonization by indigenous plant species, and feasibility for establishment of specific wildlife habitats, such as those applicable to species at risk (SAR) will be completed as part of closure. These investigations will also determine the suitability of the overburden for vegetation growth and whether any improvements will be required to improve its suitability to sustain growth.

### 4.13.4 Tailings Storage Facility (TSF)

The principal concerns associated with closure of the TSF are the long-term slope stability, erosion control, drainage, vegetation cover and appearance, as well as prevention of ARD from the tailings.

At the completion of mining the TSF must be closed out in accordance with Ontario Regulation 240/00, Amended O.Reg. 307/12, and the Code. Section 24(2) of Regulation 240/00 states the following:

- *All tailings, rock piles, overburden piles and stockpiles shall be rehabilitated or treated to ensure permanent physical stability and effluent quality.*

Section 35 and 36 of the Code state:

- *The objective of the Part of the Code is to ensure the long term physical stability of tailings dams and other containment structures; and*
- *The procedures and requirements set out in the Dam Safety Guidelines published by the Canadian Dam Safety Association shall be given due regard by all persons engaged in the design, construction, maintenance and decommissioning of tailings dams and other containment structures.*

Section 72 of the Code states:

- *When revegetating tailings surface, the following reclamation measures shall be considered, where appropriate:*
- *Contouring to provide accessibility and good surface drainage while controlling surface erosion.*
- *Removing any crests prone to wind erosion or creating /planting live wind breaks.*
- *The scarification of crusted surfaces.*
- *The incorporation of organic materials and mulches.*
- *Correcting the pH and adding fertilizing based upon soil assessment and vegetation requirements.*
- *Applying soils or gravel barrier.*

It is anticipated that Goliath will produce PAG tailings material. As the tailings waste is predicted to be PAG they must be isolated from oxygen to prevent ARD development. Oxygen exclusion will be used to prevent this reaction from occurring. Exclusion will be achieved by way of water cover, or low permeable overburden cover. The overburden over will be seeded or hydroseeded with a native seed mix or equivalent. All dam structures containing the TSF will be designed with safety factors incorporating overall long term stability and safety. No added physical works are proposed during closure.

### 4.13.5 Aggregate Sources

It is not anticipated that Treasury will construct any aggregate sources during the course of the Project. If quarries or pits are developed as aggregate sources during the construction and operations phases, these will be reclaimed according to Provincial approvals and standards, which include natural flooding to create pond features.

### 4.13.6 Buildings, Machinery, Equipment, and Infrastructure

All disposal of non-hazardous demolition waste will be disposed of to a licensed facility.

Salvageable machinery, equipment and other materials will be dismantled and taken off site for sale or re-use if economically feasible, or cleaned of oil and grease and disposed of in a licensed facility. Gearboxes or other equipment containing hydrocarbons that cannot be readily cleaned will be removed from equipment and machinery and trucked offsite for disposal at a licensed facility.

All above grade concrete structures will be broken up and demolished to near grade elevation. Concrete structures and below grade facilities (if applicable) will be infilled as needed. Affected areas will be contoured, scarified, covered with overburden and vegetated.

### 4.13.7 Petroleum Products, Chemicals, and Explosives

All petroleum products and chemicals will ultimately be removed from the site. Empty tanks will be sold as scrap, reused off-site, or cleaned to remove any residual fuel or chemicals and disposed of in the appropriate off-site facility

An environmental site assessment (ESA) will be conducted at the end of operations or early in the closure phase. The ESA will allow Treasury to identify areas of potential soil contamination, particularly around fuel handling areas. Soil found to exceed acceptable criteria will be remediated on site or transported off site to an approved of off-site facility.

Any remaining explosives will be either detonated on site or disposed of in the appropriate off-site facility.

### 4.13.8 Roads, Pipelines, and Power Distribution

Site roads will be scarified and reseeded when no longer needed to support final reclamation, long term management and environmental monitoring, assuming they are not required to support any developments on site, or local needs. Culverts will be removed and roads will be allowed to breach at the culvert locations to allow natural drainage if practical. Local vegetation will be transplanted at selected sites if practical.

Pipelines will be either sealed and left in place; or purged if needed, dismantled and disposed of in the appropriate off-site facility.

On-site power distribution lines and associated materials that have no salvage value will be dismantled and disposed of in the appropriate off-site facility. Other power equipment and materials will be taken off site for sale or re-use.

### 4.13.9 Site Drainage and Water Structures

The new alignment of Blackwater Creek will naturalize over the life of the mine and will become the permanent creek channel, unless it is determined during closure planning that returning Blackwater Creek to its original route is preferred.

The pattern of general site drainage will remain in place at closure, with the exception of removal of culverts at water crossings during site road reclamation activities. Water intake structure(s) at the OMNRF tree nursery (or any other water bodies) will be removed and the area reclaimed. Components will be sold, reused off-site or disposed of in the appropriate off-site facility.

### 4.13.10 Dewatering Infrastructure

Pumps, pipelines, sumps and associated equipment used for open pit dewatering during operations phase will be removed from the pit will be sold, reused, or disposed of in the appropriate off-site facility.

### 4.13.11 Waste Management

At the end of the operation activities, the on-site waste facilities will be scaled back to support the reclamation activities. At the end of the reclamation activities all temporary works will be removed, dismantled, and disposed of in an appropriate off-site location.

### 4.13.12 Other Facilities and Infrastructure

Improvements to Trans-Canada Highway 17 entrance will remain in place continuing to provide better access to local populace. Access trails built at the Project will remain in place to support local recreational activities. All access roads associated with the site not previously in use will be closed as per Section 3.14.8 of the EIS.

It is expected that the electrical substation constructed to support the Project will not be required by other local users and will be removed at closure. The associated 115 kV lines will also be removed. The option remains open to transfer the transmission line and substation to another owner should the demand exist at Project closure.

Assuming no further demands of electrical needs, electrical equipment will be removed and either reused, recycled or disposed of in the appropriate off-site facility. Poles will be removed or cut at grade, and either re-used or disposed of.

## 4.14 IN-DESIGN MITIGATION

Due to the nature of the infrastructure available to support the Project, Treasury has focused on designing the Project with a number of in-design mitigation features. These features have been incorporated as per the discussions with local and First Nation groups, management, government regulators, and EIS team (as detailed in Section 8.0 (Public Consultation and FN Consultation). The goal of in-design mitigation is to anticipate a potential concern related to the Project and limit the exposure of such an event. In-design mitigation features that have been incorporated into the design of Project are detailed here within. Further mitigation features will be incorporated as per future discussions with First Nations, local community groups, and regulatory officials.

### 4.14.1 Private Land Use

Treasury has designed the Project to be contained primarily within private land parcels wholly owned by Treasury. The project as currently designed is 71% held in these land parcels. This limits encroachment on crown land parcels and mitigates loss of traditional treaty lands as designated by Treaty #3.

### 4.14.2 Use of Existing Infrastructure

Treasury has currently designed the Project to incorporate the former OMNRF tree nursery facility as a Project office. In addition to this Treasury will be incorporating the warehousing facilities, and laydown areas associated with the tree nursery facility. This provides in-design mitigation as a brownfield development, limiting potential biological loss, and mitigate to overall key size.

In addition to the OMNRF tree nursery facility Treasury anticipates the use of the local roads in place (Tree Nursery Road, and Normans Road). Use of these roads provides in-design mitigation as it decreases the development size, and limits any potential biological loss with road construction activities.

Power lines associated with the current OMNRF tree nursery facility will be continued to be used and provide in-design mitigation as it decreases the development size, and limits any potential biological loss in power line construction.

Current processing design calls for intake water to be sources from local source. Treasury has applied in-design mitigation taking advantage of the tree nursery facilities ponds that are tied to the local water shed. These ponds provided irrigation water for the facility over its life. Use of these ponds provides mitigation to water loss from Thunder Lake, or Wabigoon Lake, in addition to limiting biological loss of pipeline construction to lake. Furthermore the ponds provide cleared sections of land for anticipated infrastructure needs to pump water from ponds to plant.

### 4.14.3 Air Quality and Noise Mitigation

Treasury has incorporated a number of designs and practices in anticipation of local concerns regarding air and noise pollution. In-design mitigation strategies and best practice procedures include:

- Surface drilling will be performed with drilling rigs equipped with dust suppression equipment, such as wet suppression or dry filtration systems;
- Blasting conducted in phased manner that optimizes the amount of explosives needed for a given area to be blasted, and that minimizes the area being blasted;
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator buck to the bed of the truck;
- Possible rubber bedding material currently being investigated;
- Proper maintenance of equipment (working particulate filters);
- Water and chemical dust suppressants for dust control on haul roads. Use of dedicated watering equipment;
- Crusher dust suppression;
- Current design will incorporate waste rock storage area and overburden piles as noise berms to Project. In addition to this reclamation efforts will be progressive on waste rock pile though operation leading to additional noise barriers to potential receptors of sound; and
- Best management practices plan for dust to be implemented on the site during construction phase though operations and closure.

### 4.14.4 Domestic Waste

Treasury has designed the current domestic waste structure to be sent to an offsite contractor and will be stored onsite in receiving/holding tanks. The contents of the holding tanks are removed by truck and delivered to an offsite sewage treatment plant. This is the preferred method of sanitary waste treatment and serves as an in-design mitigation as it will provide Treasury with the ability to easily adjust its domestic waste system accommodating additional staff if required, and provide easy closure ability as the system can be completely removed with plant infrastructure.

### 4.14.5 Cyanide Detoxification Circuit

$SO_2$-Air destruction acting on the cyanide recovery thickener underflow has been chosen as the preferred method for cyanide destruction. This process serves as the primary in-design mitigation to cyanide use for the processing process. The $SO_2$/air process is efficient at removing cyanide from slurry solutions, and the cyanide recovery thickener discharge provides the most concentrated slurry stream such that reagent consumption is minimized and higher destruction efficiencies are achieved. , Therefore less risk is associated with the cyanide destruction process and in turn the environment.

## 4.14.6 Waste Rock Storage Area

The key factor for in-design mitigation in regards to the waste rock storage area is the use of in-pit backfilling during the production operations of the open pit mine. As the final pit is comprised of several distinct pit bottoms it is possible to place the waste rock back into the previously completed/adjacent pit bottom. This provides the following benefits to the operations:

- Lowered footprint of waste rock on surface facilities;
- Lowered overall height of final waste storage areas;
- Possibility of separating PAG rock and isolating it within the completed open pits.
- Water management for both operations and closure phases less complicated; and
- Lower overall costs for operations as haul distances are necessarily short.

The company has also specified a limited overall height for the waste rock storage area and any other possible rock or overburden stockpiles on the Project site. Although this creates a larger overall footprint, the lower heights reduce the probability for public offsite to visually see the waste rock storage areas. Further to this, the dump designs have been specified to an overall slope of 3H:1V. This low slope helps to create a more natural appearance to offsite public.

Treasury also plans to progressively reclaim any mine rock areas. Where possible, if the final dump design has been achieved, the company can begin reclamation immediately. The waste rock storage area has been envisioned such that dumping will begin on the far western edge and proceed in the easterly direction. This would allow the company to provide a final slope on the western edge (closest and possibly visible to Thunder Lake residents) which in turn would allow for overburden placement and re-vegetation. The company also envisions the placement of a berm at the crest (top edge) of the final dump limit at the earliest reasonable opportunity. This would aid to impede sound and would provide a further visual obstruction to open pit mine equipment.

# 5.0 SCOPE OF THE PROJECT AND ASSESMENT

## 5.1 PHYSICAL WORKS

The proposed physical workings of the Project are summarized in Table ES.5.1.

**Table ES. 5.1 Proposed Physical Workings of the Goliath Gold Project**

| Physical Work | Description |
|---|---|
| Open Pit | - 31.85 hectares (ha) in size;<br>- Depth of 140 m; and<br>- Mining will occur at a rate of approximately 2700 tpd of ore production over an approximately 3 to 5 year period. |
| Underground | - Depth to approximately 600 m;<br>- Mining will occur at a rate of approximately 2000 tpd of ore production over an approximately 7 to 8 year period. |
| Ore Processing Plant | - Ore will be crushed and processed on site to produce dore bars.<br>- Plant will utilize conventional gravity/CIL processes. |
| WRSA | - Approximately 26.6 million tonnes (Mt) of mine rock, not suitable for construction purposes, will be stored in a surface stockpile;<br>- Stockpile will included water management facilities such as berms, and collection ponds; and<br>- A low-grade ore stockpile will also be developed. |
| OB Stockpile | - Approximately 5.9 Mt of overburden material, not suitable for construction purposes, will be stored in a surface stockpile. |
| TSF | - The current design of the TSF covers an area of approximately 76 ha and will provide capacity for the storage of approximately 10 $Mm^3$ of tailings over the expected Project life; and<br>- The maximum dam heights are expected to be in the range of 10-15 m above grade. |
| Water Management System | - The drainage flows at the Project site will be managed with drainage works, pipelines, and collection ponds;<br>- Water treatment facility for discharge to the environment; and<br>- Small watercourse realignment to Blackwater Creek around the processing facility. |
| Power | - A substation will be built connecting to the existing 115 kV transmission line, connecting to the Hydro One power network. |
| Ancillary Buildings | - Expected to include a maintenance garage, an explosives storage facility, a fuel storage facility, potable and process water facilities, and solid and domestic waste storage facility.<br>- In addition to this the Project will incorporate the existing infrastructure at the current Project office within the former OMNRF tree nursery facility. |

## 5.2 PROJECT PHASES

The total lifespan of the Project is approximately 17 years beginning with site preparation and ending with the completion of the closure activities (Figure ES.5.1). Some of the phases and activities will overlap.

The estimated duration of each key Project phase is as follows:

- Site Preparation Phase: 1 year;
- Construction Phase: 1 years;
- Operations Phase: 10 to 12 years;
- Closure and Post-closure Phase: 6 years.

### 5.2.1 Site Preparation Phase

Before ore production can commence, a number of activities must occur (Table ES.5.2):

- Establish and implement environmental protection and monitoring plans;
- Dewater ponds and wetlands within footprint of proposed infrastructure;
- Establish water management and flood protection infrastructure for mine components;
- Construct surface drainage diversion structures and water realignment channels/ditches;
- Construction of any access roads for planned infrastructure;
- Initiate overburden stripping over the ore body, TSF location, and mill site; and
- Construction of support buildings and infrastructure required for the construction phase.

The site preparation activities will be scheduled to minimize the potential disturbance of wildlife (e.g. avoid nesting season for birds).

### 5.2.2 Construction Phase

Some of the construction activities may overlap with the site preparation phase. Construction activities will be coordinated according to manpower and equipment availability, scheduling constraints, and site conditions. Some activities, particularly those involving work in wet or poorly accessible terrains are best carried out under frozen ground conditions.

Construction phase activities will include (Table ES.5.2):

- Expansion of existing environmental protection and monitoring plan(s) for construction activities;
- Procurement of materials and equipment;
- Movement of construction materials to identified laydown areas and site;
- Construction of additional site access roads and realignment of existing roads;
- Development of aggregate source(s) anticipated to be principally for possible concrete manufacturing, foundation work and TSF dam filter zones;
- Construction of the TSF;
- Establishment of site drainage works, including pipelines from freshwater/recycled water sources;
- Development and installation of construction facilities;
- Construction of associated building and facilities;
- Preparation of on-site mineral waste handling facilities; and
- Construction and energizing of a 115 kV transmission line including on-site electrical substation.

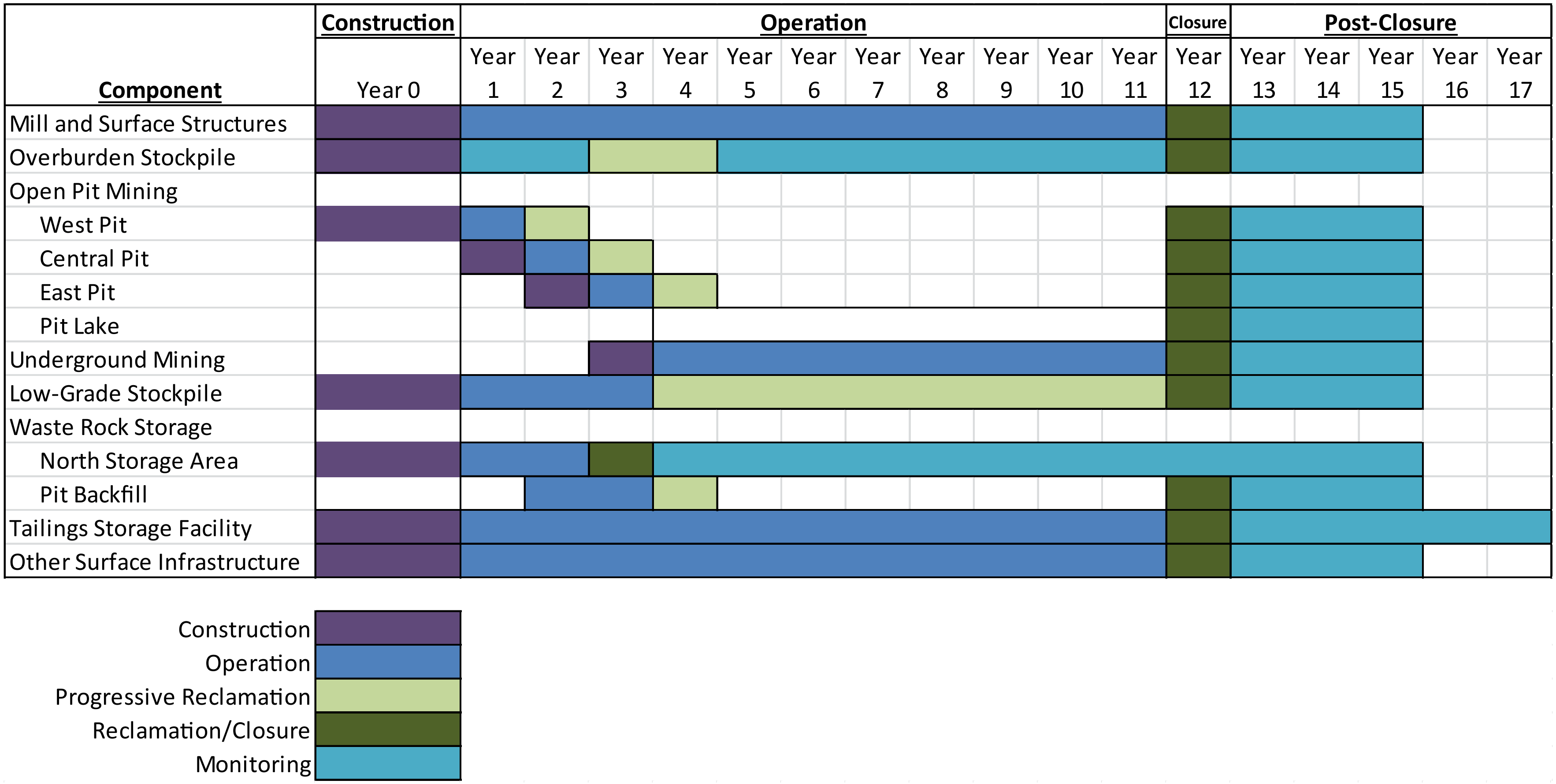



**Figure ES.5.1 Goliath Gold Project Phases and Schedule.**

## 5.2.3 Operations Phase

The operation phase will start as soon as ore production is initiated (Table ES.5.2). Initial mining will be by open pit methods with underground development activities starting immediately thereafter. Ore will begin to be produced immediately by processing incoming material from the open pit. The process plant will operate at approximately 2,700 tpd to process a total of approximately 5,500,000 tonnes of open pit ore and 3,500,000 tonnes of underground ore over the 10 to 12 year operational phase of the mine.

As the operations phase continues, the open pit will become progressively deeper. Approximately one half of the waste rock will be used to backfill the mined-out areas of the pit. The TSF capacity will be increased as required through dam raises.

Solid and liquid wastes/effluent will be managed to ensure regulatory compliance. Environment related activities that will be carried out during the operations phase are anticipated to include:

- Ongoing management of chemicals and wastes;
- Water management/treatment;
- Air quality and noise management;
- Biological monitoring;
- Environmental monitoring and reporting;
- Follow up environmental studies; and
- Progressive site reclamation, where practical.

## 5.2.4 Closure and Post-closure Phase

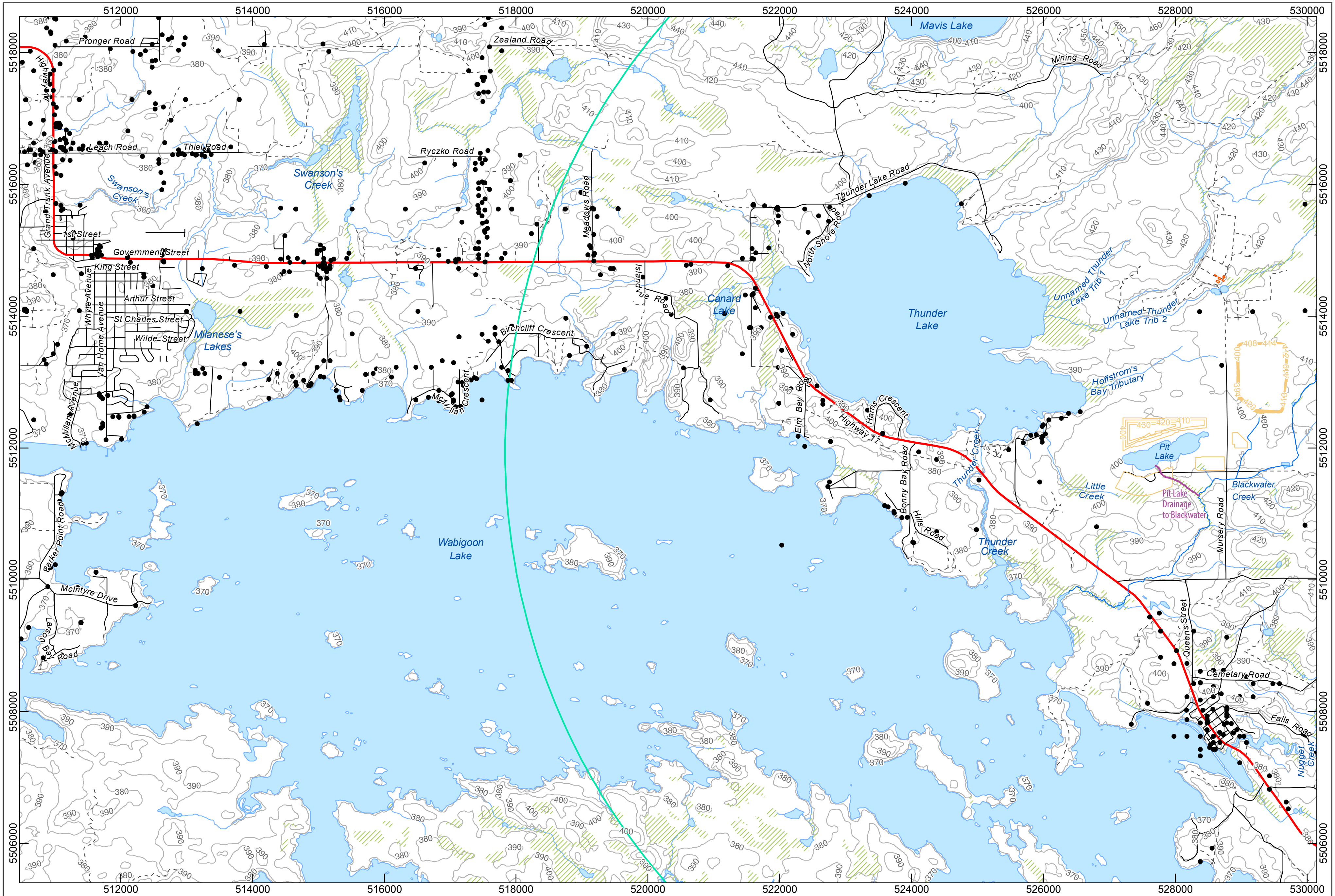
Closure of the Project will be governed by the Ontario *Mining Act* (the *Act*) and its associated regulations and codes. The *Act* requires that a closure plan be filed before the Project is initiated. Financial assurance is required before any substantive development takes place to ensure that funds are in place to carry out the closure plan.

The objective of this is to reclaim the Project site area to a naturalized and productive biological state when mining ceases (Table ES.5.2). The terms naturalized and productive are interpreted to mean a reclaimed site without infrastructure, which while different from the existing environment, is capable of supporting plant, wildlife and fish communities, and other land uses (Figure ES.5.2).

Treasury expects the active closure period at the Project will take approximately two years after operations cease. Until such time that the final pit is fully flooded, Treasury will hold the site in care maintenance. Environmental monitoring and potentially effluent quality management will occur during this passive period of reclamation of post-closure. Once the pit is flooded, an additional period of active reclamation may occur to remove remaining Project infrastructure that was retained to facilitate the maintenance, monitoring, and final post-closure activities.

**Table ES. 5.2 Key Activities by Project Phase**

| Project Phase | Duration | Key Components |
|---|---|---|
| Site Preparation Phase | 1 year | - Water management and flood protection infrastructure<br>- Surface drainage diversion structures and water realignment channels/ditches<br>- Access roads for planned infrastructure<br>- Support buildings and infrastructure required for the construction phase |
| Construction Phase | 1 year | - Additional site access roads and realignment of existing roads<br>- Construction of the Tailings Storage Facility<br>- Site drainage works, including pipelines from freshwater/recycled water sources<br>- Construction facilities<br>- Associated building and facilities<br>- 115 kV transmission line including on-site electrical substation |
| Operations Phase | 12 years | - Open pit<br>- Underground development<br>- Process plant<br>- Waste Rock Storage<br>- Overburden Storage<br>- Low-Grade Stockpile |
| Closure Phase | 2 years | - Project site area reclaimed to a naturalized and productive biological state<br>- Site is without infrastructure |




GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

**Goliath Project Site in Post-Closure**

FIGURE ES.5.2 | REV.00

*NOT FOR CONSTRUCTION*

*TREASURY METALS INC.*

*DESIGN: AT 29 JUL. 2014*
*GIS: AT 05 SEP. 2014*
*CHECK: AT 12 SEP. 2014*

10km Radius from Pit Centroid
Blackwater Creek
Tree Nursery Buildings
TSF
Highway
Local Road
Recreational Road
Waterbody
Wetland Area
Regular Elevation Contour
Watercourse
MOE Registered Well

0 1,000 2,000
Meters
N

***Notes:***
*1. UTM Zone 15N, NAD83*
*2. Base Data Source: OBM*
*3. 1:75 000 scale NTS*
*4. Well Data from MOE*

TREASURY METALS INCORPORATED

# 6.0 DESCRIPTION OF THE ENVIRONMENT

## 6.1 CLIMATE

The Project site is located in the west-central portion of the Boreal Shield Ecozone, experiencing a continental climate, generally characterized by short mild summers and long cold winters with relatively low precipitation. The terrain is generally flat and absent of orographic features which can block air masses or produce localized increases in precipitation. Long-term climate statistics for the regional climate stations maintained by Environmental Canada are monitored in Dryden.

Air temperature in the region follows an annual sinusoidal pattern typical of northern continental climates at mid-latitude with minimum average daily temperature occurring in January and maximum average daily temperature occurring in July. Mean daily temperature in July is approximately 19°C with an average daily maximum near 24°C and an average daily minimum near 13°C. Mean daily temperature in January is -18°C with average and daily maximum near -13°C and an average daily minimum near -23°C.

Based on historical observations at Dryden, mean annual precipitation at the Project site is 705 mm, of which, between 20% to 24% falls as snow. Precipitation recorded at Dryden is considered as representative of the local study area (LSA) due to the proximity and the lack of significant elevation differences or geographic features.

## 6.2 AIR QUALITY, NOISE, AND VIBRATION

The Project is located in a rural area of Northern Ontario and is at least 10 km from any existing sources of significant air emissions. Regional air quality data was attained from Ministry of the Environment and Climate Change stations in Thunder Bay. As the stations are located in a more urbanized area compared to the study area, they are likely to capture higher concentrations of the contaminants of concern. The ambient monitoring data collected from these stations are therefore likely to be conservative estimates of the future background conditions experienced in the study area. There are no anthropogenic sources of air emissions located proximal to the development.

The measured ambient sound levels at the Project site were similar to background ambient sound levels characteristic of remote areas (25 dBA to 45 dBA). The noise measurement results indicate that the existing baseline sound levels did not exceed the guideline sound level limits. The existing baseline noise levels are typical of Northwestern Ontario conditions.

Vibration levels for blasting are presented in NPC-119 and are limited to 1.00 cm/s. The nearest receptors are located at a sufficient distance away from areas where blasting is likely to occur such that vibration is predicted to be in compliance with NPC-119 at all sensitive receptors.

## 6.3 GEOLOGY

The Project area is located within the volcano-plutonic Eagle-Wabigoon-Manitou Greenstone Belt in the Wabigoon Subprovince of the Archaean Superior Province, and is on the north side of the regional Wabigoon fault. This Greenstone Belt consists of a 150 km-wide domain that has an exposed strike extent of 700 km. The full strike length of the Greenstone Belt is unknown since it is overlain by Palaeozoic strata on both ends. The geology on the northern side of the Wabigoon Fault is characterized by generally southward-facing, alternating panels of metavolcanic and metasedimentary rock.

Three major rock groupings are consistently recognized from south to north at the Project site:

- A hanging-wall unit of altered felsic metavolcanic rocks (sericite schist, biotite-muscovite schist) and metasedimentary rocks.

- A central unit of approximately 100 m to 150 m true thickness, which hosts the most significant gold concentrations and consists of intensely deformed and variably altered felsic, fine to medium grained, quartz-feldspar-sericite schist and biotite-quartzfeldspar-sericite schist (BMS) with minor metasedimentary rocks.
- A footwall unit of predominantly metasedimentary rocks with some porphyritic units and minor felsic gneiss and schist.

The gold mineralization is located primarily in the central unit, and is concentrated in a pyritic (phyllic) alteration zone, consisting of the muscovite sericite schist, quartz-eye gneiss and quartz-feldspar gneiss. This area of mineralization appears to extend to a maximum drill-tested depth of 805 m below grade, over a strike length of approximately 2,300 m, with the possibility of this strike length extending to greater than 5,000 m.

## 6.4 GEOCHEMISTRY

A preliminary geochemical assessment was completed in 2011 as part of the baseline studies for the site and involved the characterization of 54 drill core samples. An additional 112 drill core samples representing potential mine rock material were selected and characterized in June 2012. The samples included the four dominant mine rock types; Biotite Muscovite Schist (BMS), Biotite Schist (BS), Muscovite Sericite Schist (MSS), and Meta-Sediment (MSED). A sample of the tailings material, produced in metallurgical tests completed by ALS-Kamloops, expected to be produced during the mill process was also characterized in August 2012. The mine rock and tailings samples were assessed as outlined in the prediction guidelines by Price (2009).

Static testing on the mine rock samples and one composite tailings sample consisted of metals analysis, acid base accounting (ABA), and shake flask extraction tests. Kinetic testing, included humidity cell tests (HCT) and field-scale barrel tests with representative samples of the BMS, BS, MSS, MSED rock types as well as one composite tailings sample. Subsequently, loading rates were calculated for constituents of potential concern (COPC). The metals that exceeded the ten-times the average crustal abundance screening values in mine rock samples included antimony, arsenic, cadmium, cobalt, lead, molybdenum, selenium, silver, and zinc. All four mine rock types were generally classified as PAG with neutralization potential (NP) to acid potential (AP) ratios (NP/AP) that are less than one. However, several samples were shown to be have NP/AP ratios greater than 2 which indicate there may be opportunity for further testing to define subsequent areas of NAG rock within specific areas of the Project area.

Generally for all mine rock HCTs, pH values decreased from approximately 8.0 to 6.0 over the initial 20 weeks, increased slightly between weeks 20 and 50, and then decreased to below 5.0 at termination on week 85. Sulphate concentrations exhibited initially elevated values, which decreased rapidly between approximately weeks 1 to 5. Similarly, several dissolved metals demonstrated initial elevated concentrations followed by substantial decreases over the first 5 to 18 weeks. Some COPCs exhibited increasing concentrations between weeks 60 and 85. Seven of the HCTs were terminated at week 63 after stabilization of COPC concentrations in the leachate and the remaining four at week 85, prior to the establishment of stable conditions.

Duplicate humidity cells were initiated for the tailings composite sample. Measured pH values exhibited steady and consistent declines, from approximately 7.8 to 3.7 over 78 weeks. Sulphate concentrations exhibited initially elevated values, which decreased rapidly over approximately weeks 1 to 10 and increased slightly between week 40 and 78. Similarly, a majority of metal constituents demonstrated initial elevated concentrations followed by substantial decreases over the initial 20 weeks. Higher initial concentrations are related to an initial flush of tailings, while lower values at later times are representative of a relatively constant, natural, rate of release associated with oxidation or other weathering reactions. In addition to arsenic, a majority of the acid soluble trace metal concentrations began to increase at approximately week 20, including cadmium, cobalt, copper, nickel, lead, and zinc. The duplicate tailings HCT was terminated at week 59 and the first tailings HCT at week 78.

The four barrel tests initiated for the BMS, BS, MSS, and MSED mine rock samples had been operating for approximately two years as of this report. The leachate pH values were typically between 4.7 and 6.7 with the exception of values for the MSED field cell which exhibited pH values up to 9.5 in July 2014. Sulphate concentrations in the water collected from the barrels varied between approximately 11 and 90 mg/L. Dissolved arsenic, cadmium, cobalt, lead, nickel, and zinc concentrations were similar among the four mine rock types and appear to be exhibiting a cycling behaviour, with peak values associated with samples collected between March and April. However, dissolved sulphate, cobalt, and nickel concentrations were relatively higher for the BS barrel test, compared to the BMS, MSS, and MSED barrels.

Loading rates were calculated from the available HCT results for the BMS, BS, MSS, and MSED samples. The evaluation of the HCT results for each mine rock type indicated that loading rates for some COPCs were correlated to either sample sulphide content, solids metal contents, or were related to geochemical equilibrium. A good correlation was observed between sulphate loading rates and sulphide content for BMS, BS, and MSS samples. Correlations with either sulphide or metal contents were observed for the BMS (aluminum, cadmium, lead), BS (iron, lead, uranium, zinc), and MSS (cobalt, iron, lead, nickel, zinc) mine rock samples. Correlations were not determined for MSED as results for only two HCTs were available. Loading rates for tailings HCT results were also calculated. The loading rates from all tests were also scaled to field conditions by accounting for the assumed temperature and particle size differences between the laboratory test conditions and field conditions.

The loading rates from the humidity cells and barrel tests are suitable for incorporation into a water quality model to assess the effects of contact water with pH values above 5 on downstream water quality or to determine what mitigation may be required for contact waters. If acidic conditions evolve, the loading rates may be expected to increase for several COPCs and the effects on contact water will need to be re-evaluated.

The conclusions from this ongoing assessment are as follows:

- The majority of the rock samples, including representative samples from all rock types, that were characterized in this investigation can be classified as potentially acid generating, with specific areas that warrant further follow-up for confirmation of possible NAG status;
- The one tailings sample that was characterized can be classified as potentially acid generating; and
- Mitigation strategies will likely be required to manage mine rock and tailings and to prevent acidic drainage and negative effects on downstream water quality at the site post closure and potentially during operation.

# 6.5 SURFACE WATER QUALITY, HYDROLOGY, AND SEDIMENT QUALITY

Surface water quality samples have been collected in or near the Project area beginning November 2010 through 2013. Sites were initially selected to capture pre-development site conditions and, during the planning process, considered the distribution of catchments, creeks, rivers, and other water bodies to characterize the spatial and/or temporal variability in water chemistry. The regional study area includes areas of Blackwater Creek, Hughes Creek, the Thunder Lake sub-catchment and its associated tributaries. Following the 2010-2011 survey, the specific location of sampling sites evolved as additional information about the Project footprint was developed. Nine locations were added and three locations were discontinued during the 2012-2013 sampling program.

Surface water flows at the Project site are limited to creeks which flow ultimately to Wabigoon Lake. The Project area is located in a catchment with an area of approximately 122 $km^2$ located within the Wabigoon watershed. The average slope within the Project area is approximately 4% and the elevations vary from 370 m to 495 m. Surface water flow at the Project site is currently monitored by seven hydrological stations distributed throughout the Wabigoon Lake and Thunder Lake sub watersheds.

Sediment analysis on site has indicated good sediment quality, with the majority of parameter concentrations below Provincial Sediment Quality Guidelines and Federal Canadian Environmental Quality Guidelines. Metal parameters were detected at higher concentrations include chromium, copper, iron and magnesium, zinc and nickel. Exceedance in Total Organic Carbon were also seen across the site.

## 6.6 HYDROGEOLOGY, AND GROUNDWATER QUALITY

An assessment has been made of the occurrence of private water wells within a 5 km radius of the proposed pit using geographic location data from the Ontario Ministry of the Environment and Climate Change's (MOECC) water well information system (WWIS). A total of 139 wells identified within this area based on the UTMs provided on WWIS with ten being removed from the data set for being identified as outside of the study area. 70% of these wells derive their water from the shallow bedrock.

The closest water wells outside of the company's property are those on Thunder Lake, approximately 1.5 km from the proposed pit. Otherwise, there are no wells within 2 km of the proposed pit and no wells identified to the north or east.

Overburden thickness in the Project area averages approximately 7.5 m thick with thickness rarely exceeding 15 m. The overburden material is comprised of mainly clay with subordinate silt (i.e. clay; silty clay; clay; layered clay and silt). A relatively thin basal sand layer may occur at the bottom of the clay and has an average thickness of 3 m to 4 m.

The Project is located in the Wabigoon Subprovince with rock structure dipping at approximately 70 to 80 degrees to the south-southeast. The Wabigoon Fault is located approximately 2 km to 3 km to the south of the Project.

Hydrolgeological data were collected on the property from spring 2012 to early 2014 using methods of:

- Hydraulic conductivity testing using existing boreholes,
- Three additional deep holes drilled to specifically target further test areas,
- Installation of vibrating wire piezometers,
- Eight overburden monitoring wells for water quality and level testing,
- 9 existing exploration holes for water level monitoring; and
- 20 geotechnical boreholes across the Project area.

From a hydrogeological perspective, the surficial deposits can be subdivided into five units:

1. Clay – Clay is the dominant overburden deposit at elevations generally below 430 m above sea level (masl), the most common overburden in the Project area and occurs to the south of the Project site and also to the north of the site within the watershed of the Hoffstrom's Bay tributary. The clay is expected to act as an aquatard in the Project area, or in general terms it will act as a confining layer that slows but does not prevent the flow of water to or from an adjacent aquifer.
2. Basal Sand – a discontinuous sand layer at the base of the clay that when present is on average 3 m to 4 m thick;
3. Bedrock knolls – bedrock exposure or very thin sand. These occur at higher elevations above 395 masl to 400 masl and are scattered throughout the Glaciolacustrine Plain;
4. Sand-Clay/Silt-Sand – generally silty sand overlying a largely continuous clay/silt overlying the basal sand; and
5. Sand and Gravel – the coarser glacial deposits within the Project area that include the Glaciofluvial Outwash deposits associated with the Hartman Moraine and the Kame deposit south-east of the Project site.

Slug testing of the majority of the groundwater quality wells was conducted by Treasury under direction from AMEC in February 2014. Overall the majority of values obtained appear to be representative of the overburden bedrock contact when silty sand is present.

Groundwater levels in the groundwater quality wells and also a selection of open exploration boreholes were measured in 2013. Water levels measured were consistently within 7 m of ground surface and on average within

3 m of ground surface. Groundwater level fluctuations are typically of the order of 1 m to 2 m. Two of the exploration holes measured were flowing intermittently and two of the 2014 geotechnical holes had water levels at surface after the 2014 freshet.

Overall it appears that groundwater levels are relatively close to surface and approximately follow topography. Groundwater flow from the Project site follows the surface drainage with flow both to the west towards Thunder Lake and to the south towards Wabigoon Lake.

Most of the groundwater flow that occurs around the Projects site is expected to follow the topography with greatest flows along the contact between the upper weathered and fractured bedrock and the basal sand. Rates of groundwater flow are expected to be much lower in the deeper bedrock. The following four hydrostratigraphic units have been identified for the bedrock:

1. Shallow Bedrock – this is expected to occur within 10 m of the bedrock surface due to near-surface weathering and fracturing;
2. Intermediate Bedrock – this refers to bedrock from approximately 10 metres below grade (mbg) to a depth of around 400 mbg (~ 0 metres above sea level [masl]);
3. Deep Bedrock – this refers to bedrock where there are very few fractures (rock quality designation [RQD] > 90%) and very low hydraulic conductivities, which is expected to occur below 400 mbg (~ 0 masl);
4. Deformation Zone of the Central Unit – this is a steeply inclined zone that occurs in all three of the above units. It is expected to have half to one order of magnitude higher conductivities in the units not affected by near-surface weathering (i.e. intermediate and deep bedrock).

These aspects of the conceptual hydrogeological model have been used to build a numerical model to estimate groundwater inflows to the mine, its zone of influence, base flow depletion at sensitive creeks and leakage from the tailings management area (TMA) and WRSA to groundwater and the potential location of discharge of this water.

Long-term seepage rates into the proposed open pit and underground mine workings were simulated using a steady-state groundwater flow model corresponding to the fully developed and dewatered mine. Under the base case scenario, the stabilized seepage rates into the proposed fully dewatered mine (i.e. open pit and underground mine workings) were estimated to be about 1,320 $m^3$/d.

**Predicted Effects on Dewatering of Wells**

In total 77 wells as recorded on the Ministry of Environment (MOE) WWIS are located within the zone of influence (ZOI) as defined by the predicted 1 m drawdown contour. A preliminary qualitative risk assessment has been undertaken for these 77 wells with the following results:

- Twelve wells within the 5 m base case drawdown contour located on the Thunder Lake shore to the east of Thunder Lake have moderate to high risk of dewatering. These are relatively shallow wells (< 25 m) that likely source most of their water from the basal sand and shallow bedrock;
- Five wells within the 5 m base case drawdown contour also located on Thunder Lake shore have low risk of dewatering. These are deeper wells (> 30 m) that likely source the majority of their water from deeper bedrock;
- 55 wells outside of the 5 m base case drawdown contour are assessed to have low risk of dewatering due to their proximity and likely good hydraulic connection with a recharge boundary and/or recharge source.

The five remaining wells within the 1 m ZOI are within the property boundaries of Treasury.

**Predicted Effects on Groundwater Discharge to Surface Water**

Little Creek and Hoffstrom's Bay Tributary are located on clay overburden and have very limited base flow. These creeks will not be affected by mine dewatering. Blackwater Creek is also predominantly on clay overburden and similarly has limited base flow. This creek will be the recipient of discharges from the mine and TMA perimeter ditches, which will be far greater than any losses in base flow.

Thunder Lake Tributary #2 and #3 and Hughes Creek are the water courses closest to the Project site with significant base flow from groundwater discharge. These creeks are predicted to have base flow reductions of around 5% and below 1% respectively.

**Predicted Effects on Groundwater TMA and WRSA Leakage**

During operation the majority of leakage from the uncapped TMA to groundwater is predicted to be shallow horizontal flow that will be intercepted by perimeter drainage ditches. The remaining 10% to 30%, or about 70 $m^3$/d to 90 $m^3$/d for the TMA at full capacity, is predicted to bypass the ditches, migrating underneath them, and eventually discharging either into the flooded open pit, nearby creeks (Hoffstrom's Bay Tributary, Thunder Lake Tributary #3 and Blackwater Creek) or Thunder Lake/Thunder Creek. Following capping the leakage from the TMA is predicted to reduce to about 50 $m^3$/d for the Base Case scenario with Blackwater Creek receiving around 60% of this water, around 20% discharging in the flooded open pit, 20% discharging to Hoffstrom's Bay Creek with the remainder discharging at much lower rates to Thunder Lake Tributary #3 and Thunder Lake.

Groundwater sampling was completed on six occasions during 2013 by Treasury from the 2013 groundwater quality wells. The wells are screened predominantly to the basal sand and/or shallow bedrock. In general it was found that the groundwater comprised typical calcium-magnesium-bicarbonate type water. The dissolved metal concentrations from field filtered samples have been taken and compared to the PWQO.

The following dissolved metal concentrations were noted to exceed or meet the Ontario PWQO for the Protection of Aquatic Life at one or more of the eight monitoring wells that were sampled on one or more sampling occasion: aluminum (three sites), chromium (two sites), cobalt (six sites), copper (two sites), iron (six sites), tungsten (one site), vanadium (two sites) and zinc (two sites). It should be noted that groundwater cannot be directly compared to the PWQO, but the objectives can nevertheless be used for description purposes. Groundwater was also found to exceed the Canadian Environmental Quality Guidelines (CEQG) for the protection of aquatic freshwater life for similar metals including: aluminum (three sites), chromium (two sites), copper (three sites), iron (six sites) and zinc (two sites).

## 6.7 VEGETATION

The Project is located within the Ontario Shield Ecozone, the largest ecozone in Ontario. This ecozone is typified by extensive wetlands and boreal forests. Within the ecozone, the Project is situated within the Lake Wabigoon Ecoregion (Ecoregion 4S), within the Lower English River Section of the Boreal Forest Region. This ecoregion is characterized by a range of forest types (mixed forest 25%, sparse forest 24%, and coniferous forest 14%) and open water (24%). Typical tree species include trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), spruces (*Picea glauca*, *Picea marina*), white birch (*Betula papyrifera*) and willows (*Salix* spp.). Biologists detected 270 vascular plant species in the LSA during the course of field survey activities, 25 of which were introduced species commonly associate with disturbed habitats. Most of the remaining species are typical of Ontario's boreal forest. The only plant species at risk observed within the LSA (during all field work activities) was the floating marsh marigold (*Caltha natans*) observed in the Thunder Creek wetland near the mouth of Thunder Creek.

Wild rice (*Zizania palustris*) communities were detected at the mouths of Thunder, Blackwater, and Nugget creeks and at Hughes Pond. These communities occupy an estimated area of 12.8 ha within the LSA. Wild rice is a traditional food source for many First Nations.

Landcover in the regional Project area is 61% forest, 20% wetland, 14% water, 5% development land and <1% barren land. Locally land cover is 62% forest, 21 % water, 9% developed land, 8% wetland, and <1% barren land. The diversity of underlying landforms within Ecoregion 4S has resulted in a wide diversity of habitats within the regional area.

## 6.8 WILDLIFE

Wildlife surveys conducted between 2011 and 2012 identified species of birds, reptiles and amphibians, mammals and species at risk. The area exhibits a relatively high diversity of avian and mammalian species that reflect the diversity of available habitats. Species observed during surveys in the regional and local study areas are considered to be largely abundant and common to region.

Two terrestrial mammalian SAR were observed within the LSA during field survey efforts: Little Brown Myotis (2011 and 2012) and Northern Myotis (2012). Seven bird SAR were observed within the LSA during the field survey efforts. Bald Eagle, Peregrine Falcon, Black Tern, Common Nighthawk, Barn Swallow, Canada Warbler, Olive-sided Flycatcher. Seven additional bird SAR are potentially present (at least in some years) but have not yet been reported from the LSA:  American White Pelican, Bobolink, Eastern Whip-poor-will, Golden Eagle, Least Bittern, Short-eared Owl, and Yellow Rail. Snapping Turtles, Northern Leopard Frog, and Green Frog are known to occur in the Dryden vicinity but were not observed during field survey efforts within the LSA.

## 6.9 AQUATIC BIOLOGY

The Project is located within the Lake Wabigoon Ecoregion (Ecoregion 4S) which is within the Lower English River Section of the Boreal Forest Region. It is also within the northern limits of Fisheries Management Zone (FMZ) 5. This zone covers 44,360 km$^2$ from the Manitoba border east to Quetico Provincial Park and the United States border north to the Wabigoon River Watershed.

A total of 10,236 fish were captured at 130 sample sites: 8,265 fish were captured by Klohn Crippen Berger (2012) at 66 sample sites and (DST 2014b) captured a total of 1,971 fish over 68 sites. Thirty-six fish species were identified during a review of historical records while presence of only thirty one fish species, including two identified to the genus level, was confirmed by field sampling. Fish indicated in historical reviews but not confirmed by field surveys include: Cisco, Lake Trout, Lake Whitefish, Longnose Sucker, Muskellunge and Nine-spine Stickleback. Fish captured in field surveys but not included in the historical records include Brassy Minnow. No records of fish SAR were found within the regional study area (RSA) and none were encountered during field surveys.

Benthic invertebrate community samples were collected in October of 2011 and 2012. Samples from 2011 were only collected from areas associated with Blackwater Creek; however, 2012 samples included areas associated with Blackwater Creek as well as Wabigoon Lake, Thunder Bay, and throughout the creek located at either side of a former tree nursery which is located within the Project area.

Results of benthic invertebrate sampling from Blackwater Creek in 2011 indicated a general increase in mean number of taxa and taxa richness from upstream to downstream sites with mean number of taxa ranging from approximately four to 14. Additionally, approximately 61% of the total specimens within all samples consisted of chironomids (family Diptera) which is typical of slow moving streams with silt and clay substrates or where oxygen availability is limiting too many other taxa.

## 6.10 LAND AND RESOURCE USE, TRADITIONAL KNOWLEDGE AND LAND USE

Land use within the regional area has been driven by resource development (mineral exploration, forestry), outdoor recreation, and wilderness pursuits such as canoeing, trapping, hunting and fishing. Historically, northwestern Ontario's economy has been tied to its landscape and the abundant natural resources, particularly in forestry and mining as well as commercial tourism operators.

Traditional land uses, and traditional knowledge related to the Project area from the First Nation communities, and Metis Nation of Ontario has not been received. Traditional food uses on the property include mushrooms, and berries. Hunting practices are limited on the property due to private ownership but the regional area supports important hunting species of wildlife including grouse, deer, moose, deer, bear, ducks and geese. Fish species on site are limited to small bodied species however Wabigoon Lake and Thunder Lake support traditional use species such as trout, pike, walleye, and whitefish.

## 6.11 BUILT HERITAGE RESOURCES

No built heritage resources have been identified in the Project area. The regional area has a number of historical mine sites due to turn of the century mining activities.

## 6.12 ARCHEOLOGY

The Project is located in the DgJc Borden block. A site registration database information request made through the Ministry of Tourism, Culture and Sport resulted in no reported archaeological sites within two kilometres of the Project.

Archaeological sites are most often associated with well-drained, sandy soils. The soils within the Project area are silt and wet clay over bedrock which suggests low archaeological potential. Site inspection of disturbances and access roads with disturbed exposures found no cultural material. The several small areas of elevated topography were observed to have been disturbed by past wood harvesting activities. The Project site therefore does not have topological, surface water, or soil characteristics that would indicate any archaeological potential. This has been confirmed by an on-site Archaeological Assessment completed by a qualified archaeologist.

## 6.13 VISUAL AESTHETICS

The landscape of the Project is typical of northern Ontario. The landscape is characterized by densely populated coniferous and deciduous trees, creeks, and lakes. Identified receptor sites during the winter and summer present a natural setting with views of Thunder Lake, and trees.

## 6.14 SOCIO-ECONOMICS

The regional study area of the Project includes the following communities within the Kenora and Thunder Bay Districts:

- Thunder Bay;
- Kenora;
- Dryden;
- Wabigoon;
- Ignace;
- Sioux Lookout; and
- Municipality of Machin.

Historically, Northwestern Ontario's economy has been tied to its landscape and the abundant natural resources contained therein, particularly in forestry and mining as well as tourism. Locally, the Domtar pulp mill is the major employer of the area with approximately 330 mill employees and 250 woodland contractors. Due to the reliance upon resource-based industries, local communties have taken proactive measures to strengthen and diverisfy.

This includes the development of strategies that promote continued recreational activities and tourism opportunities, and investment and attractive incentives for new businesses.

Regionally the area is accessible by road, rail and air services. Infrastructure and social services within the local communities provide adequate services for current demands and needs.

# 7.0 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

## 7.1 ALTERNATIVES TO THE PROJECT

As part of the development of the Project and the environmental assessment process and in compliance with the CEAA (2012) EIS guidelines, Treasury is committed to assess alternatives to and for the Project. Three alternatives to the Project have been identified:

- Proceed with the Project development and planning, as identified by Treasury;
- Formally delay the Project planning and development until circumstances are more favourable; and
- The “do nothing” alternative (development of the Project is cancelled).

Proceeding with the Project is the preferred alternative as the Project has been assessed to be technically feasible, economically viable and has community and government support. Failure to develop the Project would fail to fulfill the need and purpose of the Project, by foregoing employment opportunities for the local and First Nation communities.

## 7.2 PROJECT ALTERNATIVES

The assessment of alternative methods of carrying out the Project was focussed on those aspects of the Project that have the greatest potential for adverse environmental effects. Treasury evaluated the alternatives using a process in which the basis for the final selection of alternatives is understood at all levels. The approach considers alternatives that are not only technically and economically feasible but would also satisfy Treasury Metals requirements for environmental and socio-economic acceptability. The following objectives were used in the comparison of alternatives:

- Overall cost for the life of the Project;
- Technical feasibility and technical reliability;
- Effects to the environment, including human, physical and biological environments; and,
- Potential ability for future closure/reclamation processes.

The performance of each alternative is evaluated based on three criteria: preferred, acceptable, or unacceptable. The alternative that is both technically and economically feasible and has the least possible potential adverse effects on the biophysical and socio-economic environment will be selected as the preferred option. In addition to the above considerations, an alternative is considered unacceptable if any of the following criteria are met:

- An alternative cannot meet the needs of Treasury;
- The alternative is not financially viable to the Project as a component of total costs for the alternative over the life of the Project, including capital, operating and closure costs; and
- The alternative would cause damage to environmentally sensitive areas when compared to other viable alternatives.

Several potential alternative methods for Project development were eliminated from consideration during a pre-screening process, prior to preparation of the alternative assessment on the basis only one viable alternative was clearly suitable to the Project.

Alternatives for the Project have been considered with respect to the following components:

- Mining;
- Mine Water Management;
- Mine Rock and Overburden Management;
- Ore Processing;
- Infrastructure Location and Layout;
- Process Effluent Treatment
- Tailings Storage Facility;
- Water Supply;
- Water Discharge
- Watercourse Realignments;
- Aggregate Supply;
- Non-hazardous Waste Management;
- Domestic Sewage Treatment; and
- Closure.

For some Project elements, technologies or processes were selected due to the technical suitability of those to the Project conditions and those that can be financially sustained by the Project (Table ES.7.1).

**Table ES. 7.1 Summary of Alternatives**

| Project Element | Alternative | Assessed in the EA | Rationale |
|---|---|---|---|
| Mining | Open Pit Mining | Yes | Ore body is near surface which is suited to open pit mining. |
| | Underground Mining | Yes | Ore body is near surface, and at depth indicating that underground mining is feasible. |
| | Open Pit and Underground Mining | Yes | Ore body is near surface, and at depth indicating that using both open pit and underground mining is feasible. Combination mining is also the most economically viable mining method. |
| Minewater Management | Separate Minewater System | Yes | Integrated site water management system will be fully capable of providing capacity for effective minewater treatment, irrespective of whether or not it receives minewater. |
| | Integrated Minewater System | Yes | Development of a separate minewater treatment pond system will add considerable and unnecessary costs to the Project with no tangible technical or performance benefit. |

**Table ES. 7.1 Summary of Alternatives**

| Project Element | Alternative | Assessed in the EA | Rationale |
|---|---|---|---|
| Processing Methodology | Gravity and CIL | Yes | The EA considered proven methodology for the recovery of gold. Cyanide and non-cyanide methods were considered. |
| | Gravity and Floatation with Off-site Concentrate | Yes | |
| | Gravity, Flotation, and ILR | Yes | |
| Mine Rock and Overburden Management | Place and Management the mine rock and overburden in stockpile adjacent to open pit | Yes | Minimizing mine rock movement is critical to cost performance for the Project. Placing mine rock as close to pit as practicable is commonly used standard within the industry. Alternatives to storage include backfill to the pit though sequence development of open pit. |
| | Establish temporary location for mine rock and overburden and return to pit upon closure | Yes | Moving large amounts of overburden and mine rock would lead to excessive costs, and render the Project uneconomical. |
| Effluent Treatment | Natural Cyanide Degradation and Metals Removal | Yes | The use of natural degradation to destroy cyanide presents greater environmental risk. |
| | In-Plant Cyanide Destruction and Metals Removal Followed by Natural Degradation | Yes | Natural degradation with cyanide destruction ensures that wildlife, including waterfowl and aquatic life, are protected, that cyanide consumption is minimized, and that contingency is in place to prevent the inadvertent release of cyanide into the environment. |
| | In-plant Cyanide Destruction, Natural Degradation Followed by Effluent Treatment | Yes | Natural degradation with cyanide destruction will ensure minimal environmental impact, and that contingency is in place to prevent the inadvertent release of cyanide. |
| Tailings Storage Facility | Conventional Slurry Tailings | Yes | Clay lined earthfill dam with a natural clay basin integrated with an internal drain system with a secondary downstream seepage and pump-back system. Minimal cost required as existing roads will assist with construction of pipeline alignments and access to site. No additional open bodies of water will be directly impacted. |
| | Thickened Tailings | Yes | Due to the greater density of the tailings, this alternative is very |

**Table ES. 7.1 Summary of Alternatives**

| Project Element | Alternative | Assessed in the EA | Rationale |
|---|---|---|---|
| | | | costly. A lower dam embankment is required than that of slurry tailings, however some diversions of excess water from seasonal runoff will be required. Existing roads will assist in construction, and no additional open bodies of water will be directly impacted. |
| | Dry Stack Tailings | Yes | Tailing waste will be stockpiled on surface. Runoff will be collected and routed to a facility for containment and reclaim. Dust and emissions are very likely. Low cost for remediation. No additional open bodies of water will be directly impacted. |
| | Co-Disposal | Yes | Natural clay basin and clay lined dam. Local topography anticipated to reduce embankment heights. Underground co-disposal will occur during the underground phase which will decrease the amount of tailings. Low complexity of water containment and reclaim, however closure requires complex reclamation. No additional open bodies of water will be directly impacted. |
| Water Supply | Nearby Creeks | Yes | The method and location of meeting fresh waters needs for the Project was considered with the EA. |
| | Groundwater | Yes | |
| | Nearby Lakes | Yes | |
| Water Discharge | Wabigoon Lake | Yes | Discharge locations were evaluated based on the current water balance anticipated, and the effect on the receiver based upon hydrological characteristics, and quality modeling. Also in conjunction to this economic and social parameters were analyzed. |
| | Thunder Lake | Yes | |
| | Hartman Lake | Yes | |
| | Tree Nursery Ponds | Yes | |
| | Blackwater Creek | Yes | |
| Infrastructure and Buildings | Power plant facility | Yes | As the Project designing phase continues, the optimal locations for these are further reviewed and defined. |
| | Fuel and energy locations | Yes | |
| | Temporary storage facilities | Yes | |
| | Explosive storage facility | Yes | |

**Table ES. 7.1 Summary of Alternatives**

| Project Element | Alternative | Assessed in the EA | Rationale |
|---|---|---|---|
| Aggregate Supply | Overburden and Mine Rock | Yes | Project aggregate needs and sources were identified and assessed within the EA. |
| | On-site Aggregate Pit | Yes | |
| | Commercial Off-site Aggregate Pit | Yes | |
| Non-hazardous Solid Waste Management | | Yes | EA considered alternatives for disposal of non-hazardous solid waste. |
| | | Yes | |
| Hazardous Solid Waste Management | | Yes | EA considered alternatives for disposal of hazardous solid waste. |
| | | Yes | |
| | | Yes | |
| Domestic Sewage Management | Sewage Treatment Plant | Yes | EA considered proven methods of treating domestic sewage waste. |
| | Septic System | Yes | |
| | Off-site Treatment | Yes | |
| Open Pit Closure | Natural flooding | Yes | EA considered proven methods of open pit closure. |
| | Enhanced flooding | Yes | |
| | Backfill with mineral waste | Yes | |
| Mine Rock and Overburden Stockpile Closure | Re-use | Yes | EA considered proven methods of mine rock and overburden stockpile closure. |
| | Stabilize, Cover and Vegetate | Yes | |
| | Backfill | Yes | |
| | Engineered Cover | Yes | |
| Minewater Management Closure | Leave in place | Yes | EA considered proven methods of minewater infrastructure closure. |
| | Partial removal | Yes | |
| | Full removal | Yes | |
| TSF Closure | Permanent Flooding | Yes | EA considered proven methods of closure of TSF. |
| | Capping and Reclamation | Yes | |
| Buildings and Equipment Closure | Disassembly and removal | Yes | EA considered proven alternatives for the closure of buildings and equipment developed and used by the Project. |
| | Re-use | Yes | |
| Infrastructure Closure | Decontamination and removal | Yes | EA considered proven alternatives for the closure of infrastructure developed by the Project. |
| | Leave in place for future use | Yes | |
| | Reclaim in place | Yes | |
| Drainage Closure | Stabilize and leave in place | Yes | EA considered proven alternatives for the closure of drainage structures developed by the Project. |
| | Removal | Yes | |
| Alternatives to the Project | Proceed with the Project | Yes | EA considered alternatives to development of the Project. |
| | Delay the Project | Yes | |
| | “Do Nothing” | Yes | |

Table ES.7.2 lists the preferred methods for carrying out the Project as selected through the alternatives assessment included in the EIS.

**Table ES. 7.2 Alternative Assessment and Preferred Methodology**

| Alternative | Preferred Methodology |
|---|---|
| Mining | Open pit mining in combination with underground mining is the only economically viable strategy for developing the Goliath Deposit. Use of these methods will also result in employment and business opportunities that will benefit both the local and regional economies. |
| Mine Water Management | Use of an integrative site water management system is the preferred alternative. An integrated mine water management system will be fully capable of providing capacity for effective mine water treatment. Development of a separate mine water treatment pond system will add unnecessary costs with no technical or economic benefit. |
| Mine Rock and Overburden Management | The preferred option for the mine rock waste dump is located along the northern side of the open pit. The south side of the open pit is the preferred location for the overburden stockpile. Locations were selected due to haulage factors, property ownership concerns, offsite receptors, and water management. |
| Ore Processing | The preferred option for ore processing with gravity concentration with carbon in-leach circuit. Other alternatives have certain inherent disadvantages compared to the preferred option. |
| Infrastructure Location | The preferred option for infrastructure location, including processing facility is to the east of the open pit, located on land wholly owned by Treasury Metals. |
| Process Effluent Treatment | Due to the minimal assimilative capacity of the preferred discharge location of Blackwater Creek and Treasury Metals commitment to discharge effluent at Federal and Provincial water objectives the preferred process effluent treatment will be subject to a cyanide destruction circuit, and effluent treatment plant. |
| Tailings Storage Facility | The preferred location of the TSF was determined using a values based decision process yielding a location northeast of the proposed open pit. This option will consist of conventional tailings disposal with future co-disposal of the tailings back into the underground mine workings. |
| Water Supply | The use of surface water from the tree nursery ponds is the preferred fresh water source. The tree nursery ponds are technically feasible, economically viable, and would result in minimal impact to baseline flows in the creek. Due to the technical uncertainty with capacity, groundwater supply is not considered viable at this time. Due to the costs associated with pipeline development fresh water supply sourced from Thunder Lake or Wabigoon Lake has been discounted. |

**Table ES. 7.2 Alternative Assessment and Preferred Methodology**

| Alternative | Preferred Methodology |
|---|---|
| Water Discharge | The preferred effluent receiver is Blackwater Creek. Discharge to Blackwater Creek will require on-going environmental impact monitoring due to lack of assimilative capacity. Using this waterway will present the ongoing operating cost to the Project allowing for the Project to quantify its environmental impact. Blackwater Creek provides additional benefits due to its proximity to processing facility, tailings storage facility, and eventual destination to Wabigoon Lake opposed to Thunder Lake. |
| Watercourse Realignments | The preferred watercourse realignment is the realignment of Blackwater Creek around the proposed Processing Plant. This realignment is consistent with Treasury guidelines of minimizing aquatic habitat destruction, and disturbance of the existing hydrologic network. |
| Aggregate Supply | The preferred source of aggregate supply is the use of current operating aggregate supply opposed to the development of an on-site source. Current geochemical understanding of mine rock indicates that much of the deposit area is potentially acid generating, creating an unsuitable supply for construction on site, as it would create unacceptable environmental risk. Further study will assess whether there is sufficient mine NAG rock. |
| Non-hazardous Waste Management | Trucking non-hazardous waste is the preferred alternative for managing non-hazardous waste. Due to the proximity of landfill site in Dryden, the development of an on-site landfill creates unnecessary closure and operation costs. |
| Domestic Sewage Supply | Trucking of domestic sewage supply is the preferred alternative for managing sewage waste. Due to the proximity of Dryden and its suitable Water Treatment Plant, the development of an on-site treatment creates unnecessary closure and operation costs. Septic and tile fields are not considered due to land use and closure concerns. |
| Closure | Preferred closure options include: capped TSF, capped WRSA, graded and vegetated overburden pile, filling of the open pit, removal of processing infrastructure, and stabilizing drainage and creek realignments. |

# 8.0 PUBLIC ENGAGEMENT

A critical component of bringing the Project through permitting and into production is the proactive consultation and engagement with potential stakeholders and government agencies. Treasury throughout the development of the Project has strived to inform and engage these respective parties about the development of the Project, responding to their interests and concerns, and continuing to build and maintain positive relationships.

The goal of consultation for the Project is to provide stakeholders and government agencies with information and gather their feedback about:

- The Company;
- Mining related activities;
- The EA processes and related documents including the Federal Project Description;
- The environmental baseline studies
- Anticipated environmental effects and management strategies; and
- Closure plan concepts.

Engagement surrounding the Project was completed though a series of activities, including holding meetings, hosting open houses, conducting site visits, and issuing Project-related documents and material. Treasury is committed to ongoing discussions with stakeholders about potential effects, mitigation strategies, and opportunities.

Comments and questions received from stakeholders about the Project were primarily regarding:

- Effects on water quality and use (e.g., water intake and discharge, use of cyanide);
- Effects on local water systems;
- Effects on fish and wildlife habitat;
- Effects on fishing;
- Location and function of the WRSA and the TSF;
- ARD study results and management on site;
- Effects related to noise;
- Effects related to air quality;
- Effects related to property value decrease for residents on East Thunder Lake Road, Thunder Lake Road;
- Future access to and land use of the Project area;
- Concerns with blasting (noise and air quality);
- Increased traffic on Tree Nursery Road, Anderson Road and Trans-Canada Highway 17 turn-off;
- Development and training of workforce;
- Effects related to the use of cyanide and tailings discharge on land use, water quality, and fish populations;
- Closure of the Project; and
- Consultation plans for the local community.

Comments and questions received from government agencies about the Project were primarily regarding:

- Technical guidance and on baseline studies;
- Water quality and use;
- Effects on the local water system including groundwater;
- Effects on fish and wildlife habitat;

- Effect on land and resource users;
- Effects on socio-economic conditions;
- Results of acid rock generation studies;
- Coordination of the Provincial and Federal EA processes and permits;
- Noise effects;
- Air quality effects;
- Archeological and built heritage studies;
- Location and alternatives for hazardous, non-hazardous, and domestic waste management;
- Abandoned and rehabilitated mine hazards;
- Power requirements and the construction and operation of the 115 kV substation; and
- Location and function of the WRSA, overburden pile, low-grade stockpile, and TSF.

Further to the topics listed above, the following are some of the key comments received as of March 2015 about the Project from the general public, leadership representatives and government agencies and how Treasury has proposed to address them with the EIS and development of the Project.

## 8.1 POTENTIAL EFFECTS ON WATER RESOURCES, WATER QUALITY AND WATER BODIES

Stakeholder groups have raised concerns about the nature and extent of potential effects of the Project on water. Treasury understands this is the key issue surrounding the Project and has strived to answer concerns from a technical and transparent standpoint. The questions regarding effects on water include: impact on aquatic habitat, impact on aquatic life, impact on water quality, impact on water quantity in wells, and impact on water quality in wells.

Treasury is committed to designing the Project using best practices and will design water course realignment to convey flows in a natural manner, and where possible enhance the ecological function of Blackwater Creek and the watershed. Treasury will look to offset the loss of fish habitat within the area within adjacent lakes or streams in order to maintain fish population. Aquatic life and habitat will be monitored throughout the life of the Project and through post-closure to ensure the population and environment for fish remains healthy.

Stakeholders have expressed significant concern regarding the release of unintended tailings releases and potential surface water contamination. Treasury has committed to designing and managing the Project using proven and effective systems for containment and storage to avoid unintended releases. Treasury has also committed to satisfying Provincial and Federal standards for mine effluent release, and to significant monitoring of treated discharge to Wabigoon Lake via Blackwater Creek. As part of satisfying the concerns of stakeholders, Treasury has mitigated potential concerns with the inclusion of a cyanide destruction circuit and water treatment facility.

Additionally, stakeholders have identified the potential effect on water quality, and quantity in water wells. Treasury has committed to the implementation of a monitoring plan for groundwater resources in proximal distance to groundwater users in the local area. Treasury will provide monitoring of groundwater quality and quantity throughout the life of the Project and continued until the TSF and WRSA are capped. Termination of the program will only occur following full review of data collection by regulatory authorities.

## 8.2 BUSINESS, EMPLOYMENT, AND TRAINING OPPORTUNITIES

Discussions between Treasury and stakeholders highlight the desire for an increased labor and training capacity in the region and the need to integrate job creation with supporting academic institutions in the community. Treasury has been actively discussing education and training in addition to employment and procurement opportunities with local community and educational facilities. Further funding and training programs will be initiated as developmental prospects for the Project are determined.

## 8.3 MINE CLOSURE

Stakeholder groups have inquired about Treasury's closure procedures and what assurances would be in place for rehabilitation of the Project. Treasury has assured stakeholders that the closure plan details will be vetted by Provincial representatives and qualified consulting firms will provide details in a clear and transparent fashion.

Prior to mine construction, Treasury must file Closure Plans and post financial assurance with Provincial authorities so the funds are available for closure and reclamation. Current closure plans are to return the Project site to a naturalized state; however, throughout the consultation phases of the EA, Treasury is interested in hearing feedback on the management objectives of the Closure Plan.

## 8.4 MINE ROCK MANAGEMENT AND TAILINGS STORAGE FACILITY

Stakeholders have identified concerns regarding the plans to store mine rock (waste rock), and tailings specifically related to acid rock drainage, water quality, location, and size. As part of the alternatives assessment required for the Project, Treasury considered multiple locations for mine rock areas and tailings management facilities. Based on technical suitability, cost, and environmental effects, locations were narrowed down and selected. Further details were not available for review prior to EIS submission and will form the basis of consultation throughout the EA period.

## 8.5 POTENTIAL EFFECTS ON NOISE QUALITY, AIR QUALITY, AND LIGHT QUALITY

Stakeholders have expressed concerns about an increased amount of noise, as well as impacts to air quality and light quality potentially effecting residents on Thunder Lake, and within the community of Wabigoon. Potential effects of the Project and noise levels have been assessed within the EA. Treasury is committed to continuing engagement with the residents on Thunder Lake and the community of Wabigoon to ensure that appropriate mitigation strategies (e.g., timing of blasting in open pit to limit noise and vibration to home owners, dust suppression strategies) are developed.

## 8.6 VISUAL AESTHETICS

Stakeholders have expressed concern about the visual disturbance the Project may present. Treasury has committed to designing the Project to limit the visual disturbance to the stakeholders on Thunder Lake. Treasury additionally is committed to a progressive rehabilitation process to limit visual impacts of mine rock areas. Treasury is committed to continuing engagement with the residents on Thunder to ensure that appropriate mitigation is developed.

# 9.0 ABORIGINAL ENGAGEMENT

A critical component of bringing the Project though permitting and into production is the proactive consultation and engagement with Aboriginal communities. Treasury throughout the development of the Project has strived to inform and engage the Aboriginal communities about the development of the Project, responding to their interests and concerns, and continuing to build and maintain positive relationships.

The goal of consultation for the Project is to provide Aboriginal communities with information and gather their feedback about:

- The Company;
- Mining related activities;
- The EA processes and related documents including the Federal Project Description;
- The environmental baseline studies
- Anticipated environmental effects and management strategies; and
- Closure plan concepts.

Engagement surrounding the Project occurred though a series of activities, including holding meetings, hosting open houses, conducting site visits, and issuing Project-related documents and material. Treasury is committed to ongoing discussions with Aboriginal communities about potential effects, mitigation strategies, and opportunities.

Comments and questions received from Aboriginal groups about the Project were primarily regarding:

- Effects on water quality and use (e.g., water intake and discharge, use of cyanide);
- Effects on local and regional water systems;
- Effects on fish and wildlife habitat;
- Effects on land use such as fishing, hunting, trapping, and traditional land uses;
- Gathering plants and berries;
- Noise pollution;
- Dust/air pollution;
- Flooding and weather related disasters;
- Cumulative loss of section 35 harvesting rights;
- Access restrictions (e.g., vehicle and snowmobile routes);
- Property values;
- Risks associated with the TSF;
- Traditional knowledge and traditional land use studies;
- Closure planning and financial assurances; and
- Business, training and employment opportunities.

The following are some of the key comments received as of March 2015 about the Project from the Aboriginal communities and how Treasury has proposed to address those concerns with the EIS and the development of the Project.

## 9.1 POTENTIAL EFFECTS ON WATER RESOURCES, WATER QUALITY AND WATER BODIES

Aboriginal communities have raised concerns about the nature and extent of potential effects of the Project on water. Treasury understands this is the key issue surrounding the Project and has strived to answer concerns from a technical and transparent standpoint. The questions regarding effects on water include: impact on aquatic habitat, impact on aquatic life, impact on water quality, impact on water quantity in wells, and impact on water quality in wells.

Treasury is committed to designing the Project using best practices and will design water course realignment to convey flows in a natural manner, and where possible enhance the ecological function of Blackwater Creek and the watershed. Treasury will look to offset the loss of fish habitat within the area within adjacent lakes, or streams in order to maintain fish population. Aquatic life and habitat will be monitored throughout the life of the Project and through post-closure to ensure the population and environment for fish remains healthy.

Aboriginal communities have expressed significant concern regarding the release of unintended tailings releases and potential surface water contamination. Treasury has committed to designing and managing the Project using proven and effective systems for containment and storage of tailings to avoid unintended releases. Treasury has also committed to satisfying Provincial and Federal standards for mine effluent release, and to significant monitoring of treated discharge to Wabigoon Lake via Blackwater Creek. As part of satisfying the concerns of Aboriginal communities, Treasury has mitigated potential concerns with the inclusion of a cyanide destruction circuit and water treatment facility. The development of the Project is not anticipated to adversely impact known spring water sources that are used for drinking water due to the distance of the springs from the site.

Additionally, Aboriginal communities have identified the potential effect on water quality, and quantity in water wells. Treasury has committed to the implementation of a monitoring plan for groundwater resources in proximal distance to groundwater users in the local area. Treasury will provide monitoring of groundwater quality and quantity throughout the life of the Project and continued until the TSF and WRSA are capped. Termination of the program will only occur following full review of data collection by regulatory authorities.

## 9.2 EFFECTS ON FISHING

The proposed Project site does not include any lakes, rivers or significant streams that are suitable for fishing. There are small intermittent streams present which do support some baitfish but species fished for food or sport are not present on the proposed mine site or in the immediate area.

Fishing opportunities close to the Project site include Wabigoon and Thunder Lakes. The fishery in Wabigoon and Thunder Lakes is significant to First Nations, Métis, and the general public.

Fishing on Wabigoon and Thunder Lakes is of particular significance to Naotkamegwanning First Nation as Naotkamegwanning holds commercial fishing licenses on both lakes. Project-related development will not occur on the shoreline or near the shoreline of either Thunder or Wabigoon Lake.

Treated water from the Project will be discharged to Blackwater Creek which flows into Wabigoon Lake. Since there will be no discharge of water from the Project to Thunder Lake, no impacts on the fishery in Thunder Lake are anticipated. As previously indicated, with the measures in place to ensure that water quality of Blackwater Creek is not adversely affected, such as treatment of discharge and monitoring, no adverse impacts to fishing in Wabigoon Lake are anticipated.

Similarly, the development of the Project site will not impact on lake levels on Wabigoon or Thunder Lakes since process water and other water required for the operation will not be drawn from those water bodies. The water levels in Wabigoon Lake and Thunder Lake are controlled by dams located at the Domtar mill in Dryden and on

Thunder Creek, respectively. As lake levels will not be impacted by the Project, lake level impacts on fish habitat or populations are not expected.

It is anticipated that after completion of mining at the Project site, a portion of the open pit will fill with water to create a small but very deep lake. Such a lake has the potential to support populations of trout and other fish species following closure of the Goliath Mine.

## 9.3 POTENTIAL EFFECTS ON HUNTING AND TRAPPING

Treasury acknowledges the right of First Nations and other Aboriginal groups to hunt fish and gather within the area of Treaty 3. However, no issues relating to hunting, fishing or gathering have been identified that are specific to the Project area.

The proposed Project falls within Wildlife Management Unit 8 which has a total area of 539,400 hectares and is adjacent to Wildlife Management Unit 5 which has a total area of 1,076,300 ha. The Project will occupy a total area of approximately 188 ha. Of the total area associated with the Project, approximately 55 ha is anticipated to fall on Crown land. Therefore, there is a low likelihood that such a small area will impact the overall ability to hunt within the area.

The development of the Project is not anticipated to adversely impact the rights of Aboriginal People to hunt within the general area. Treasury has made a concerted effort to place mine infrastructure including the processing plant, other mine buildings, and the TSF on private properties and thereby reduce potential impacts to Crown Lands.

Additionally, under Treasury's ownership, much of the former tree nursery is reverting to a natural forest condition and can be expected to contribute to the habitat of a variety of wildlife species. This will to a significant degree offset some of the habitat impacted by the development of the mine site.

In Ontario, the opportunity to trap is controlled by the OMNRF through a system of registered trap lines. Every trapper on Crown land is assigned a specific trap line and given the exclusive rights for that area. Each trapper can then manage the furbearer resources on a long-term, sustainable basis.

Trapping on Crown lands in the vicinity of the Project site will not be altered as a result of the development of the Goliath Gold Mine. No additional actions related to trapping are anticipated.

## 9.4 GATHERING PLANTS AND BERRIES

Potential impacts of the Project on the ability of First Nations and other Aboriginal Groups to gather plants and berries has been identified as a concern.

Treasury recognizes that the gathering of plants and berries by Aboriginal people is part of a traditional life style which continues to this day. However, the presence of the plants and berries to be gathered is dependent on a wide variety of factors. Consequently, although the gathering of plants and berries may be ongoing from year to year, the specific area where gathering may take place can change within a very short time.

Blueberries are one type of berry known to be of interest to First Nations and other Aboriginal people. No specific areas associated with the Project have been identified as areas from which blueberries have been gathered. In consideration of the amount of private land associated with the Project as well as the type and stage of forest development it is unlikely that many blueberries would have been picked on the proposed mine site. However, if there is a desire to pick blueberries, excellent picking opportunities exist very close to the Project in areas recently logged on the Dryden Forest. It is expected that blueberries will continue to be available on these harvested areas for the next few years. Future logging in this area will result in ongoing picking opportunity.

Other plant species may require different conditions to thrive than do blueberries, but virtually all plant species have particular conditions (eco-site and stage of forest development) under which their abundance is optimal and other conditions where they may be absent from the site.

The development of the Project is not expected to adversely impact the gathering of plants or berries within the general area. As a result, no specific measures are currently proposed to address this concern. Should concerns specific to the project area be brought forward during the EA review process, these will be dealt with at the time.

## 9.5 FLOODING AND WEATHER RELATED DISASTERS

A concern has been raised relating to the potential contribution of the Project to once in a century flooding or weather-related disasters becoming more common because of human industrial activity.

Treasury does not have the expertise to comment on the causes of climate change and weather patterns. However, the effects of climate change tend to be global in nature. Individual industrial projects do not generally have large impacts. As a result of the small size of the Project and the relatively short period over which the Project is expected to be in operation, it is extremely unlikely that the Project will have any significant impact on flooding or other weather related disasters.

The only potential for a significant flooding incident directly associated with the Project would be through failure of the TSF. Since the TSF will be designed and built following recommended CDA factor of safety and undergo regular inspection, such a failure is highly improbable.

## 9.6 CUMULATIVE LOSS OF SECTION 35 HARVESTING RIGHTS

This concern relates to the provision outlined in section 35 of the Constitution Act (1982), which provides for the protection of Aboriginal rights. The opportunity to practice section 35 harvesting rights in the general area of the Project will continue. In consideration to the very small amount of land impacted and the potential to practice section 35 harvesting rights in the vicinity of the project, no measures are proposed.

## 9.7 ACCESS RESTRICTIONS

Concerns were identified related to the land acquired by Treasury and the possibility of having existing roads blocked by security gates which would result in loss of access to areas currently not restricted. For safety and security reasons, it is anticipated that access to the Project site will be restricted and gated as required. However, the Project is located near the end of existing roads that do not provide access to any locations beyond the immediate Project site. Therefore, the impact on access to Treaty 3 lands will be small.

Treasury does not anticipate implementing any measures to facilitate public access beyond the Project site. However, if there are specific requirements for access beyond the site, such requirements will be considered on a case by case basis. A concern has been raised relating to the potential loss of access to snowmobile routes to Thunder Lake (and on to Ghost Lake and Mavis Lake) that have been used by Wabigoon Lake Ojibway Nation for harvesting, fishing and recreation. The specific location of snowmobile routes to Thunder Lake have not been identified.

Treasury has requested clarification of the location of snowmobile routes between Wabigoon and Thunder Lake. Treasury does not wish to unduly impair access to such routes and will cooperate with snowmobilers to find alternative routes to the extent possible.

The development of the Project will not impact any snowmobile routes between Thunder and Mavis or Ghost Lakes.

## 9.8 PROPERTY VALUE

Concerns have been raised that the value of properties in Wabigoon and close to the project area may drop due to proximity of the mine and associated noise/air/water quality issues.

For the most part, noticeable impacts to properties in the vicinity of the Project and associated impacts to property values are anticipated to be minimal. The increased employment in the area associated with the Project may result in greater demand for housing and potentially create higher real estate values in the Wabigoon/Dryden Area.

There are a few homes in the immediate vicinity of the Project primarily along Tree Nursery road which may be more affected by the Project than others. Treasury is committed to working directly with these specific homeowners to ensure that their concerns are addressed.

## 9.9 BUSINESS, EMPLOYMENT, AND TRAINING OPPORTUNITIES

Discussions between Treasury and Aboriginal communities highlight the desire for an increased labor and training capacity in the region and the need to integrate job creation with supporting academic institutions in the community. Treasury has been actively discussing education and training in addition to employment and procurement opportunities with Aboriginal communities and educational facilities. Further funding and training programs will be initiated as developmental prospects for the Project are determined.

## 9.10 MINE CLOSURE

Aboriginal communities have inquired about Treasury's closure procedures and what assurances would be in place for rehabilitation of the Project. Questions also have arisen to what the Project would look like after closure and whether Aboriginal groups could be involved in the reclamation process. Treasury has assured Aboriginal communities that the closure plan details will be vetted by Provincial representatives and qualified consulting firms will provide details in clear and transparent fashion.

Prior to beginning mine construction, Treasury must file Closure Plans and post financial assurance with Provincial authorities so the funds are available for closure and reclamation. Current closure plans are to return the Project site to a naturalized state; however, throughout the consultation phases of the EA, Treasury is interested in hearing feedback on the management objectives of the Closure Plan.

## 9.11 MINE ROCK MANAGEMENT AND TAILINGS STORAGE FACILITY

Aboriginal communities have identified concerns regarding the plans to store mine rock (waste rock), and tailings specifically related to acid rock drainage, water quality, location, and size. As part of the alternatives assessment required for the Project, Treasury considered multiple locations for mine rock areas and tailings management facilities. Based on technical suitability, cost, and environmental effects, locations were narrowed down and selected. Further details were not available for review prior to EIS submission and will form the basis of consultation throughout the EA period.

## 9.12 POTENTIAL EFFECTS ON NOISE QUALITY, AIR QUALITY, AND LIGHT QUALITY

Aboriginal communities have expressed concerns about an increased amount of noise, as well as impacts to air quality and light quality potentially resulting from construction and mining activity. Potential effects of the Project and noise levels have been assessed within the EA. Treasury is committed to continuing engagement with the Aboriginal communities to ensure that appropriate mitigation strategies (e.g., timing of blasting in open pit to limit noise and vibration to home owners, dust suppression strategies) are developed.

Measures to address noise levels resulting from the Project will include:

- retention of treed buffers between the mine site and residential areas;
- full enclosure of mine processing buildings;
- selection of mobile equipment with suitable sound suppression options; and
- scheduling of blasting to specific times so as to be as unobtrusive as possible.

Adverse impacts to wildlife in the vicinity of the project are not anticipated. The measures noted above to reduce noise for area residents will also serve to reduce noise levels experienced by wildlife.

Treasury will implement measures to control dust and air emissions originating from the Project site. Some measures to be implemented include:

- dust collector units provided with drills;
- emission controls provided on drills, trucks and other mobile mine equipment;
- exhaust systems on drills, trucks and other mobile mine equipment;
- scheduled maintenance on mine equipment; and
- road dust reduction controls including use of water trucks and commercially available dust suppressants.

## 9.13 VISUAL AESTHETICS

Aboriginal communities have expressed concern about the visual disturbance the Project may present. Treasury has committed to designing the Project to limit the visual disturbance. Treasury additionally is committed to a progressive rehabilitation process to limit visual impacts of mine rock areas. Treasury is committed to continuing engagement with the Aboriginal communities to ensure that appropriate mitigation is developed.

# 10.0 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

Treasury commissioned a screening level risk assessment (SLRA) to evaluate the potential for human health and ecological risk. The human health component of the SLRA focused on two contaminants of concern (COC; mercury and lead) and two human exposure pathways to contamination: direct soil contact (ingestion, dermal contact, dust inhalation) and surface water (ingestion, dermal contact). A Country Foods assessment was conducted and the results were incorporated into the overall effects assessment. The results of the human health component of the SLRA indicated that risk estimates did not exceed the acceptable threshold for both mercury and lead during the operations phase of the Project.

The ecological SLRA focused on the potential for contamination of wildlife that may use the Project area or watercourses receiving effluent from the Project. Using the same COCs, the ecological SLRA focused on four key receptors regularly hunted or trapped by the local community: Snowshoe Hare (*Lepus americanus*), White-tailed Deer (*Odocoileus virginianus*), Moose (*Alces alces*) and Ruffed Grouse (*Bonasa umbellus*). Estimated risk was below risk thresholds for Snowshoe Hare, White-tailed Deer and Moose, but just exceeded thresholds for Ruffed Grouse (largely due to an assumption of percentage of diet from tailings-based plants or invertebrates).

# 11.0 ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions were identified using a Failure Mode and Effects Analysis (FMEA) process. The FMEA is a risk analysis procedure used to identify and characterize accidents and malfunctions based on the likelihood of occurring and the severity/magnitude of the failure. Through the FMEA process, a total of 463 failure modes were identified and analyzed within the environment, safety and health, and reputation impact categories.

Once all risks were identified, Treasury focused on the potential effects of accidents and malfunctions identified in the environment impact category. The environment impact category had a total of 137 failure modes; 123 of these failure modes are considered low-risk and 14 are considered medium-risk. There were no high-risk failure modes identified during the FMEA process as shown on the risk matrix.

The medium risks identified within the environment category were selected for analysis and were placed into broader failure modes for further assessment (Table ES.11.1). There were three categories of failure modes considered for further environmental assessment: failure of tailing storage facility, releases to land and water, and cyanide releases to land, water, and air. Potential primary environmental effects of the three categories of failure modes were generally to the terrain and soil and surface water. Potential secondary effects were generally determined to be to aquatic resources, groundwater, fish and fish habitat, and wildlife habitat. As per the EIS guidelines, preventative procedures were identified to minimize impacts to the identified valued components (VCs), as well as contingency/emergency response procedures and follow-up monitoring for each failure mode.

Overall, the residual effects of the failure modes on the environment were determined to be not significant if all preventative procedures are adhered to throughout all phases of the Project.

**Table ES. 11.1 Description, Prevention, and Responses to Potential Medium Environmental Residual Risk Failure Modes**

| Potential Failure Mode | Potential Environmental Effects | Control Measures and Preventative Procedures | Emergency Response and Contingency Procedures | Follow-up Monitoring |
|---|---|---|---|---|
| Failure of tailing storage facility | The potential primary effects would be to soil, terrain, and surface water in the vicinity of the release with potential secondary effects on aquatic resources and fish and fish habitat. | • Dam Safety Management Plan<br>• CDA Dam Safety Guidelines<br>• MNR Best Management Practices<br>• Provincial Lakes and Rivers Improvement Act<br>• Operational and storm water management<br>• Existing site conditions and historical climatic data incorporated into the predictive hydrological modelling<br>• The spillway will be designed to route flows resulting from the Inflow Design Flood as prescribed by the HPC of the dam.<br>• The embankment heights will also be designed with the required freeboard allowances, for normal and minimum freeboard, as prescribed by the guidelines listed above.<br>• The embankments will be designed with zoned earth fill raises and meet the standards set forth by the applicable guidelines. The embankments will be designed to be stable and meet the required minimum Factors of Safety under the required conditions.<br>• A qualified Engineer will inspect the system as part of the annual Dam Safety Inspections and routine Dam Safety Review.<br>• Operations, Maintenance and Surveillance (OMS) Plan will be developed for the TSF. The OMS will include items such as<br>○ Operational pond levels will be established and an allowance to hold the volume of water resulting from the EDS will be developed.<br>○ Dam inspections will be completed as required by guidelines and best managements practices.<br>○ The seepage collection system will be inspected as part of the daily visual inspections to identify early potential problems or concerns.<br>○ Ground movement sensors will be used to detect any early movement on TSF<br>• Emergency Preparedness Plan (EPP) will be prepared to include the proper procedure for dealing with a failure of the TSF. This Plan will be updated as required by the current operating plan.<br>• A compliance monitoring program will be developed prior to construction to assess the performance of the TSF and collection | In the event of a dam breach, the following must occur as outlined in the EPP<br>• The seepage reclaim system would be shut down to prevent water from being routed to the containment area.<br>• The reclaim system would be re-routed to transfer water back to the plant site if capacity is available, or alternatively it could be pumped to the open pit for temporary storage if worker safety is not compromised.<br>• In the event of a pump failure, a temporary pump can be installed during repairs. The standby pump can also be diesel-powered in the event of power loss at the site.<br>• In the event that water breaches the seepage collection system; the area would be cleaned up by removal and proper disposal of the potentially impacted material into the TSF. | If the TSF was to fail as in-depth review will be conducted which may warrant design changes, procedure changes, or need for additional measures.<br>A compliance monitoring program would be developed to ensure that cleanup activities are effective. |
| Spills/Releases | Primary effects would be to the soil, snow and surface water. Potential secondary effects on aquatic resources, fish and fish habitat and wildlife habitat. | • Operations, Maintenance and Surveillance (OMS) Plan will be developed mine operations. The OMS will include items such as<br>○ Regular maintenance of fuel trucks;<br>○ Speed limits are to be strictly adhered to, to be posted and enforced by Treasury security personnel;<br>○ Strict adherence to national trucking hour limits and other applicable requirements;<br>○ Drivers will be required to meet all applicable regulatory training requirements, be trained in spill response procedures | The emergency response protocols will be followed as outlines in the ERP and SMP in the event of a worst-case scenario fuel release include the following:<br>• Identify immediate hazards to human life and health;<br>• Identify source of spill and control source;<br>• Contain the released material;<br>• Notify appropriate personnel and reporting to applicable government agencies;<br>• Conduct clean-up area impacted by release;<br>• Incident investigation; and | Review of reported spill will be conducted periodically which may warrant design changes, procedure changes, or need for additional measures.<br>Compliance monitoring programs would be implemented to assess clean-up requirements and |

**Table ES. 11.1 Description, Prevention, and Responses to Potential Medium Environmental Residual Risk Failure Modes**

| Potential Failure Mode | Potential Environmental Effects | Control Measures and Preventative Procedures | Emergency Response and Contingency Procedures | Follow-up Monitoring |
|---|---|---|---|---|
| | | for the materials they transport, and carry the appropriate MSDS;<br>○ Right-of-way procedures will be defined and haul trucks and loaded vehicles will be given preference;<br>○ Traffic will be required to yield to wildlife as observed;<br>○ Where possible, heavy traffic will be limited to site haul roads and other traffic limited to site access roads;<br>○ Transportation of material (i.e., fuel) during times of limited visibility will be avoided where possible;<br>○ All vehicles transporting fuel to site will be required to maintain a supply of basic emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and<br>○ Penalties for infractions.<br>• All materials will be stored and handled according to manufacture specification or MSDS<br>• All liquid containments will be designed to include a secondary containment area which will hold 150% the contained volume.<br>• All personnel on the project site will be trained in the proper handling proper handling of chemicals.<br>• Spill Management Plan (SMP) will be prepared to include the proper procedures for handling spills to land and water, locations of spill containment equipment, safe areas to access spills, disposal of spill contaminated material and reporting requirements. This plan will be updated as required by the current operating plan.<br>• Emergency Preparedness Plan (EPP) will include the proper procedure for dealing with spills. This Plan will be updated as required by the current operating plan. | • Further assessment of effected environment, including surface water bodies in vicinity of the release. | disposal of impacted soil/snow, if required. |
| Cyanide | Primary effects would be to the terrain and soil, as well as surface water if the release occurs near a surface water body. Potential secondary effects on aquatic resources, fish and fish habitat and wildlife habitat. | • Cyanide, cyanide compounds and related chemicals will each have an MSDS in order to comply with the best practices in the industry for health and safety, and to provide relevant regulatory standards for the safe use of these materials. All materials will be stored and handled according to manufacture specification or MSDS<br>• All liquid containments will be designed to include a secondary containment area which will hold 150% the contained volume.<br>• All personnel on the project site will be trained in the proper handling proper handling of cyanide chemicals and associated PPE.<br>• Regular inspections of holding tanks and operational procedures will be carried out. This program will have continual reviews and updates to remain current. These will also be used in the training programs conducted by the health and safety department personnel. | The contingency and emergency response plan for transport related emergencies will ensure the following:<br>• Best route for access to incident site, including an evaluation of transportation route condition<br>• Specific remediation measures are implemented and followed including:<br>○ Recovery and treatment of contaminated soil;<br>○ Decontamination or management of soil and other contaminated material;<br>○ Disposal of clean-up debris; and<br>○ If possibility of contamination to drinking water, appropriate emergency response measures will be enforced to protect drinking water users.<br>Emergency response plans for $SO_2$-Air cyanide destruction process failure:<br>• Ore processing plant will be shut down and all pumping outputs and inputs to the plant will cease. | After any major release or accident from cyanide use, transport, storage or handling an in-depth review will be conducted which may warrant design changes, procedure changes, or need for additional measures.<br>Compliance monitoring programs would be implemented to assess clean-up requirements and disposal of impacted materials, if required. |

**Table ES. 11.1 Description, Prevention, and Responses to Potential Medium Environmental Residual Risk Failure Modes**

| Potential Failure Mode | Potential Environmental Effects | Control Measures and Preventative Procedures | Emergency Response and Contingency Procedures | Follow-up Monitoring |
|---|---|---|---|---|
| | | • Operations and designs for hazardous materials, such as cyanide transport, will comply with applicable regulatory requirements for the transportation of dangerous goods.<br>• Operational safeguards for compressed gases will be enforced, operations personnel will be trained to use appropriate health and safety safeguards, and infrastructure will be regulatory maintained and inspected as per standard operating procedures.<br>• Operations and designs for hazardous materials, such as cyanide transport, will comply with applicable regulatory requirements for the transportation of dangerous goods.<br>• All vehicles and drivers involved with transport will be licensed, trained, and inspected for competency.<br>• Proper transportation containers and proper transport vessels (appropriate vehicle) will be used. If liquid cyanide must be transported, containers will have appropriate hydraulically controlled internal valves.<br>• All trucks will have their needed MSDS, will be properly maintained to company and Transport Canada standards, and will have all safety equipment on hand (including medical and spill response material).<br>• All incidents and near-misses will be reported, and regular audits will be conducted.<br>• Drivers will maintain constant communication and/or GPS tracking during the transportation of cyanide.<br>• Spill Management Plan (SMP) will be prepared to include the proper procedures for handling CN spills to land and water, locations of spill containment equipment, safe areas to access spills, disposal of spill contaminated material and reporting requirements. This plan will be updated as required by the current operating plan.<br>• Emergency Preparedness Plan (EPP) will include the proper procedure for dealing with Cyanide. This Plan will be updated as required by the current operating plan. | • Body and eye wash stations will be established at the ore processing plant as a first response measure.<br>• Personnel and the ore processing plant area will be equipped with HCN gas sensors with an alarm system, should gas reach unacceptable ambient levels.<br>• All workers will be provided notification and cease all work and be evacuated as per established emergency response procedures.<br>• Any gas plume present will be allowed to dissipate to ensure worker safety. Notification to workers downwind of the incident and ore processing plant shutdown may be required in order to secure the area.<br>• $SO_2$-Air cyanide destruction process will remain closed until full operational ability is restored. | |

# 12.0 ENVIRONMENTAL EFFECTS ASSESSMENT

## 12.1 EFFECTS ASSESSMENT PROCESS

The evaluation of potential environmental effects of the Project followed five steps:

1. Evaluation of potential Project effects (Section 12.2);
2. Selection and evaluation of Valued Components (VCs; Section 12.2);
3. Identification of potential interactions between the Project and VCs (Section 12.2);
4. Development of measures to avoid, minimize and mitigate potential Project effects (Section 12.3); and
5. Characterization of residual effects and their significance (Section 12.4).

VCs are those aspects of the natural and socio-economic environment that are particularly notable or valued because of their ecological, scientific, resource, socio-economic, cultural, health, aesthetic, or spiritual importance, and which have a potential to be adversely affected by project development or have the potential to have an effect on the Project.

## 12.2 POTENTIAL PROJECT EFFECTS ON VALUED COMPONENTS

### 12.2.1 Biophysical

#### 12.2.1.1 Terrain and Soils

The Project is located near public residences along Thunder Lake and Wabigoon in a relatively flat area within low relief surroundings with a 140 m vertical variability within 20 km of the site. Addition of surface features such as the WRSA, the TSF, the overburden storage area and the low-grade stockpile could contrast with the natural terrain viewscapes. Overburden stripping over the ore body and cut and fill in the vicinity of facilities requiring a leveled surface may result in susceptibility to wind and water erosion as a result of disturbing the stable state of the soils (removal of vegetation and alteration of consolidated state of the soils). The stored mine waste and low-grade stockpile could potentially affect soil chemistry.

Treasury considered three Terrain and Soils VCs for inclusion in the environmental assessment:

- Natural landscape (geomorphologic features such as hills, plains, and other notable landforms)
- Overburden
- Bedrock

The bedrock VC was not retained since it is mostly covered by overburden or relatively flat where exposed (eastern area of the proposed pit). Due to its inconspicuous or buried state, the bedrock in the Project area is not providing a significant habitat or a valued interest to society. Accordingly, Treasury retained the following Terrain and Soils VCs:

- The natural landscape, mostly as a visual feature. Since the Project area is relatively flat lying, there is no need to alter protruding landforms. However, protruding features such as the TSF, WRSA, the overburden storage area and the low-grade ore stockpile may be perceived as a visual contrast with the natural landscape to nearby residents and other individuals (e.g. residents and cottagers on Thunder Lake).

- The overburden acts as a medium to sustain plant growth, filters/retain precipitation and is part of the wildlife habitat. It will be stripped to access the proposed pits. In addition, the surficial soils will be disturbed through cut and fill process where facilities require a leveled surface.
- Soil chemistry - Once disturbed the soil may be eroded or chemically altered before reused in the reclamation process.

### 12.2.1.2 Geology and Geochemistry

There are no direct potential effects from geology and geochemistry. The mine materials have intrinsic geochemical properties that are important factors considered for Project design and planning, mitigation development, and water management and effluent quality. Potential effects can occur through secondary geochemical processes acting on exposed mine materials during construction, operation, and closure of the Project. Mine materials may potentially turn acid and in turn leach metals. ARD/ML from mine materials in the WRSA, TSF, and low-grade ore stockpile could potentially affect surface water quality, groundwater quality, fish and fish habitat, and human health and ecological risk. The potential effects to these VC are assessed in the relevant sections.

### 12.2.1.3 Noise

Treasury considered the sound level limits provided by the Ministry of Environment and Climate Change “Stationary Source” guidelines set out in MOE Publication NPC-300 for Class 3 areas (rural or recreational). These guidelines state that one-hour sound exposures (A-Weighted hourly $L_{EQ}$ values) from stationary noise shall not exceed that of the background, where the background is defined as the sound level present in the environment produced by noise sources other than those associated with the Project under assessment. The MOE Publication NPC-300 sound level limits at the façade (or plane of window) are outlined as follows:

- The higher of 45 dBA or background noise, during the daytime hours (0700-1900h);
- The higher of 40 dBA or background noise, during the evening hours (1900-2300h); and
- The higher of 40 dBA or background noise, during the night-time hours (2300-0700h).

The MOE Publication NPC-300 sound level limits at an outdoor point of reception (POR) are applicable during the daytime and evening hours only. These limits are summarized as follows:

- The higher of 45 dBA or background sound, during the daytime hours (0700-1900h); and
- The higher of 40 dBA or background sound, during the evening hours (1900-2300h).

High levels of environmental noise can affect people by impairing their enjoyment of using the land. High noise levels can also affect wildlife, causing changes in behaviour or avoidance of affected areas, for at least temporary periods of time.

In light of this information, two Noise VCs were identified for inclusion in the environmental assessment:

- Ambient noise levels at key regional receptors (e.g., residential developments along Thunder Lake)
- Noise disturbance to locally occurring wildlife, including SAR.

### 12.2.1.4 Light

The development of the Project will require the use of exterior lighting for operations, safety and security. The results of the Project baseline light assessment (Appendix I) concludes that nearby occupied properties should not experience measureable increases in illuminance (i.e., the amount of ambient light). However, to be conservative and in response to the potential for light trespass to be a nuisance factor for Project neighbors, Treasury has included  light trespass from the Project to nearby occupied properties as one of the Light VCs.

In addition, night-time lighting of structures (e.g., work lights) has been shown to act as an attractant to wildlife, thereby increasing the probability of Project-wildlife interactions. Accordingly, Treasury has included the potential for wildlife attraction to novel light sources as a second Light VC.

### 12.2.1.5 Air Quality

Potential effects of the Project on the local Air Quality are expected to be limited to increases in the concentrations of products of combustion and fugitive particulate matter based contaminants of concern. Based on the criteria prescribed in the Ontario Ambient Air Quality Criteria (OAAQC), the primary adverse effects of these contaminants are expected to be:

- Impaired visibility (TSP, PM10, PM2.5)
- Soiling (Dust fall)
- Human Health (CO, PM10, PM2.5, NOx, $SO_2$)
- Damage to vegetation (from $SO_2$)

Seven primary contaminants of concern present in particulate / dust fall) have been identified as air quality VCs:

- Total Suspended Particulate (TSP)
- Particulate Matter < 10 microns in diameter (PM10)
- Particulate Matter < 2.5 microns in diameter (PM2.5)
- Dust fall – accumulated particulate deposition per surface area over time
- Sulphur Dioxide ($SO_2$)
- Nitrogen Oxides (NO) – Primarily (>98%) $NO_2$
- Carbon Monoxide (CO)
- Metals (e.g. Lead, Manganese, Phosphorous.

These VCs were selected because they are protected by Federal Standards (National Ambient Air Quality Objectives [NAAQO] 1999; Canadian Ambient Air Quality Standards [CAAQS] 2013) and Provincial Regulations (Ontario Ambient Air Quality Criteria [OAAQC] prescribed by O.Reg.419/05) and the Project has the potential to cause significant impacts in the local study area (i.e. impairment of local air quality).

Ammonia emissions were excluded from the air quality assessment because the emissions are very minor. Although there is a fairly significant amount of ammonia generated from the breakdown of tailings solution, the resulting ammonia tends to stay in aqueous solution and is not released to air. Further ammonia has a very short life in the atmosphere and would not reach the fence line in significant quantities.

Air quality and the above retained indicators were selected because they are protected by Federal Standards (NAAQO 1999 & CAAQS 2013) and Provincial Regulations (OAAQC prescribed by O.Reg.419/05) and the Project has the potential to cause significant impacts in the local study area (e.g., impairment of local air quality).

### 12.2.1.6 Climate

Climate change is a widely, often distantly, occurring effect resulting from numerous sources of greenhouse gases (GHG). Therefore, the potential effect of the Project on climate change is not something that can be quantified with any reasonable precision. The only reasonable method to determine significance is to compare Project emissions to national, provincial, and mining industry statistics. Project effects, in the form of GHG emissions, will occur during the construction and operation phases and result from the operation of mining and mine support equipment.

One climate VC was identified during the EA: GHG emission compliance with CEAA and MOECC climate change guidelines.

### 12.2.1.7 Surface Water Quality and Quantity

During construction and closure, physical alteration of the surrounding landscape could result in increased sediment loading to receiving waters associated with the Project which could result in increased total suspended solids (TSS) in surface waters. Alteration of water quality could occur from accidental release of deleterious substances (e.g., chemical/fuel spills). During operation, release of tailings storage facility effluent is unlikely to result in exceedances of MMER, CCME and/or PWQO criteria due to anticipated mitigation measures. Runoff and seepage from WRSA, TSF, and low-grade ore (LGO) could enter surface waters. Without mitigation, exposed waste rock and pit wall is expected to go acid within several decades potentially affecting water quality of runoff and pit lake.

During construction, operation, and closure physical alteration of the landscape will result in an increased runoff coefficient in the Blackwater creek watershed. This will result in higher peak flows but without changes to the minimum flows in the creek. During the development of the open pits, mine dewatering and raw water sourced from outside the Blackwater Creek watershed will add to the flow when the treated effluent is discharged into the creek. During the development of the underground mine in years 4 to 12 the treated effluent will be directed to the open pit. Total runoff in Blackwater Creek will be reduced as surface runoff from the developed areas will be collected, treated, and discharged to the pit lake rather than to Blackwater Creek. Average flows, peak flows, and minimum flows in Blackwater Creek are likely to be reduced during the development of the underground operations. At closure the drainage patterns within the Blackwater Surface runoff from developed and disturbed areas result in higher peak flows in Blackwater Creek but without changes to the minimum flows.

Treasury considered those water quality protections provided by the Ministry of Environment and Climate Change PWQOs. In particular, the PWQOs provide for the protection of aquatic life and recreation in freshwater from inorganics and dissolved and total metals in surface water (MOEE 1994). Although a firm objective for total phosphorus in surface water is not provided in the PWQOs, general guidelines are provided to avoid nuisance concentrations of algae in lakes, excessive plant growth, and general aesthetic deterioration. Additionally, there are MMER for deleterious substances (e.g., metals, TSS and radium) for the protection of water quality (and CEQG provided by the CCME.

Water quality protections (including protection of potable surface water) provided by the PWQO, MMER, and CCME were selected as VCs because activities associated with Project construction, operation and closure have the potential to alter the surrounding landscape and could result in increased sediment loading (e.g., TSS) to receiving waters associated with the Project. Alteration of water quality could also result from accidental release of deleterious substances from construction, operation, or closure of the Project.

Treasury included two Surface Water Quantity VCs for inclusion in the environmental assessment:

- Alteration of flow rates in Blackwater Creek throughout Project operations and closure; and
- Alteration of flow rates in the Hoffstrom's Bay tributary during operations.

Treasury selected these VCs for regulatory considerations. The *Fisheries Act* s.35(1) prohibits activities which result in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support these fisheries.

### 12.2.1.8 Groundwater Quality and Quantity

Baseline groundwater quality sampling and analyses determined that groundwater in the basal sand and silt water bearing units are generally in compliance with the PWQO for the Protection of Aquatic Life, with the exceptions of some naturally occurring elevated metals (aluminum, arsenic, chromium, cobalt, copper, iron, tungsten, vanadium and zinc). Based on the use of groundwater from both the overburden and bedrock aquifers for domestic use in areas to the south and west, water quality in those areas is also expected to be generally compliant with Ontario Drinking Water quality Standards, although some private in home water treatment equipment (filters, softeners, chlorinators, etc.) may be necessary. Therefore, Treasury considered the protection of water quality for future discharge or private use to be a VC to be considered through the construction, operation and closure processes in order to ensure there are no adverse impacts to the surface water environment, or current or future groundwater resource development in populated areas.

Groundwater quantity is a potential valued quantity relating to both discharge to surface water environments and as a source of domestic water for developed urban and rural areas to the south (Wabigoon Lake) and west (Thunder Lake). Previous assessment of surface water hydrology in the watersheds surrounding the proposed mine development area have found that aquifer discharge provides for a negligible amount of creek base flow so depression of the groundwater surface would likely not impact the surface water regime to any significant extent.

There are records for about 140 private water wells in the general area, mostly to the south and west, the majority of which are assumed to be private drinking water wells. Approximately half of these wells are expected to be within the potential zone of influence on groundwater elevations caused by the proposed groundwater drawdown component of the Project. Accordingly, Treasury considered the maintenance of (a) groundwater contributions to surface flow patterns and (b) groundwater elevations in private wells as VCs in the environmental assessment.

### 12.2.1.9 Wildlife and Wildlife Habitat

Potential effects to wildlife and wildlife habitat include:

- Potential changes in population abundance and distribution due to habitat removal; and
- Direct mortality as a result of human activity (e.g., clearing, vehicle collisions, increased access leading to increased hunting and trapping pressure).

The primary potential effect to wildlife and wildlife habitat will result from the physical alteration or removal of existing habitat. Constructing access roads, mine infrastructure, tailing storage, pit excavation and waste rock storage areas will require disturbance or alteration of terrestrial and wetland/riparian habitats. In total, it is expected that 242 ha of wildlife habitat will be lost due to Project activities.

A secondary potential effect to wildlife and wildlife habitat is direct mortality as a result of human activity. Direct mortality could occur during site clearing (e.g., removal of tree with active bird nest or bat roost), vehicle collisions, human-wildlife interactions (e.g., nuisance bears on site), and increased hunting and trapping pressure that may result from increasing access to previously inaccessible.

Treasury considered a wide range of potential Wildlife and Wildlife Habitat VCs for inclusion in the environmental assessment including:

- Wildlife Species at Risk (especially bats)
- Migratory and non-migratory birds (and associated habitats)
- Ungulates (and associated habitats)
- Furbearers (and associated habitats)
- Amphibians (and associated habitats); and
- Small terrestrial mammals (and associated habitats).

After review of available baseline data and data from additional sources (e.g., Ontario Breeding Bird Atlas), Treasury selected all but two of these candidate VC for inclusion in the environmental assessment. Amphibians and small terrestrial mammals were not retained as VCs for two reasons: the low probability of an amphibian or small terrestrial mammal SAR occurring in the Project area and the assumption that any mitigation planning for wetlands and terrestrial habitats would benefit these groups as a matter of course.

#### 12.2.1.10 Fish and Fish Habitat

Potential effects to fish and fish habitat include:

- Mortality of individuals due to physical disturbances;
- Mortality of individuals due to release of deleterious substances (e.g., sediment, chemicals, fuel, effluent);
- Noise and vibration disturbances to fish due to blasting and heavy equipment;
- Loss of habitat due to physical disturbances;
- Habitat quality degradation due to release of deleterious substances (e.g., sediment, chemicals, fuel, effluent);
- Changes to fish species abundance and distribution due to changes in habitat quality and/or availability;
- Changes to water quantity and subsequent habitat availability/quality due to Makeup Water Pipeline.

The primary effects to fish and fish habitat will result from the physical alteration of existing watercourses. Constructing access roads, mine infrastructure, tailing storage, pit excavation and waste rock storage areas will require disturbance or alteration of local watercourses. In total, it is expected that approximately 6 ha of fish habitat will be lost due to Project activities. The tailing pond dam is expected to cut off natural flow from a Blackwater Creek Tributary, which has only seasonal flow. Culverts across existing watercourses may be installed to manage surface water flow. Liquid discharges from the Project, including treated tailing water and site runoff, are expected to meet all regulatory requirements before it is released to the natural environment. Water discharges are expected to be directed into the Blackwater Creek system, which ultimately flows into Wabigoon Lake.

Makeup water may be required for operation of the processing plant and may be obtained from groundwater wells or via pipeline from the old tree nursery irrigation ponds located on the Hoffstrom's Bay tributary on the Treasury offices site which has potential to reduce water quantity and, indirectly, habitat quality.

Both construction and operation activities will require blasting and heavy equipment use, which can cause noise and vibration impacts to fish.

Treasury considered those fish species in the region that are subject to the Federal *Fisheries Act*. Two Fish and Fish Habitat VCs were identified during the environmental assessment:

- Fish (Northern Pike, Walleye, Yellow Perch and White Sucker; and coarse fish species that support Northern Pike, Walleye and Yellow Perch)
- Fish Habitat Conditions for all activities and fish life stages (spawning, incubating, rearing, feeding, respiration, migration, refuge, overwintering):
  - physical: cover features (e.g., large woody debris, pools, boulders, undercut banks), water quantity/flow, temperature, dissolved oxygen, riparian zone health, substrate composition, channel morphology;
  - chemical: water quality (e.g., total and dissolved metals, nutrient balance); and
  - biological: trophic structure (benthic invertebrates, periphyton, macrophytes, zooplankton, phytoplankton), predator/prey dynamics.

These were selected as VCs because they are protected by the Federal *Fisheries Act* 2012 and the Project has potential to cause significant effects (i.e., serious harm to fish – death of fish or any permanent alteration to, or destruction of, fish habitat).

#### 12.2.1.11 Wetlands and Vegetation

Potential effects to wetlands and vegetation include:

- Reduction in the ability of wetlands to provide key ecological and hydrological services (e.g., floodwater attenuation, filtration);
- Alteration of water quality leading to loss of wetland function and indirect effects (e.g., potential storage of polluted runoff creating an attractive nuisance for waterfowl); and
- Changes in the abundance and distributions of vegetation Species at Risk (including Species of Special Concern and Provincially Rare Species).

The primary effects to wetland and vegetation will result from the physical alteration of existing watercourses. Constructing access roads, mine infrastructure, tailing storage, pit excavation and waste rock storage areas will require disturbance or alteration of local watercourses.

Treasury identified two wetland and wetland vegetation VCs during the environmental assessment, as described below. Although additional VCs that may be associated with wetlands were identified, they were more directly related to other resource topics such as water quality, fish and fish habitat, and wildlife and wildlife habitat, and are discussed in those sections:

- Wetlands are an integral component of the overall hydrologic system of a given watershed. Wetland functions including water storage and delay contribute to year-round flow of streams that are connected to them by either surface or sub-surface flow. These flows in turn support year-round habitat for aquatic species. Intact, functional wetlands help to ensure that downstream flow rates are moderated and the hydroperiod extends as long as possible into the dry season.
- Vegetation Species at Risk, Species of Special Concern and Provincially Rare Species – The only "listed" plant species detected within the LSA is the floating marsh marigold (provincially rare). This species is considered a VC as it is found only in wetlands, its presence serves as an indicator of wetland health, and it is a rare species, both regionally and in the ecosystem type in which it is found.

### 12.2.2 Socioeconomic

#### 12.2.2.1 Land Use

Potential effects to land use include:

- Direct impacts to land and resource use associated with the Project footprint;
- Indirect impacts associated with changes in the landscape and environment; and
- Impacts to transportation because of population change and logistics associated with Project development.

The primary effects to land use will result from noise and visual disturbance from mining operations that could affect recreation and tourism activities and the increased traffic levels as a result of the transportation of personnel, equipment and materials during all phases of the Project. Depending on the proximity of recreational and tourism activities, increased industrial activity and traffic related to the proposed Project could result in a degradation of land use enjoyment based on the potential for increased noise levels.

Two land use VCs were identified and retained during the socioeconomic assessment:

- Land and Resource Use; and
- Transportation.

Both of these VCs have been evaluated in recent mining EAs and are key areas of interest for regulators and Aboriginal and local communities.

### 12.2.2.2 Social Factors

Potential effects to social factors include:

- Impact to the population demographic because of economic opportunities associated with Project development;
- Impacts on education because of changes in population and motivation to stay in or leave school;
- Impacts on infrastructure and services because of population change associated with Project development;
- Impacts on housing because of population change associated with Project development; and
- Impacts of the crime rate and type.

The primary effects to social factors will result from the modification and adaptation on regional demographics, which in turn strongly influences other social value components such as education; regional infrastructure; regional services; housing; and family and community wellbeing. Not all previously mentioned factors are relevant to the Project construction, operations, and decommissioning and closure stages.

Five social factors VCs were identified and retained during the socioeconomic assessment:

- Population demographics;
- Education;
- Regional infrastructure and services;
- Housing; and
- Crime.

All of these VCs have been evaluated in recent mining EAs and are key areas of interest for regulators and Aboriginal and local communities.

### 12.2.2.3 Economic Factors

Potential effects to economic factors include:

- Impacts on employment opportunities because of availability of training and education and sourcing of workforce;
- Impacts on the regional and labour income; and
- Impact on provincial revenues and finances that will, in turn, affect economic development.

The primary effects to economic factors will result from the purchasing of labour, goods and services increasing employment rates, household incomes and federal, provincial and local tax revenues. Not all previously mentioned factors are relevant to the Project construction, operations, and decommissioning and closure stages. Indirect and induced Gross Domestic Product (GDP), employment and income effects of proposed Project expenditures are a normal consequence of direct Project spending on labour, goods, and services working its way through the provincial economy.

Three economic factors VCs were identified and retained during the socioeconomic assessment:

- Employment;
- Income; and
- Economic Development.

All three of these VCs have been evaluated in recent mining EAs and are key areas of interest for regulators and Aboriginal and local communities.

#### 12.2.2.4 Heritage Resources

Potential effects to heritage resources include:

- Impacts to undocumented sites through new construction; and
- Impacts to undocumented sites through removal of surficial sediments or burial of original surface.

The primary effects to heritage resources will result from land altering processes as part of the Project's development activities. Construction activities such as clearing and grading, maintenance of existing access roads, and construction of new mine site roads could potentially result in disturbance or loss of historic and cultural resources. Neither an archaeological assessment nor consultation efforts with Aboriginal Communities have identified any historic settlements or historic transportation routes, topological, surface water, or soil characteristics that would indicate any archaeological potential on or in proximity to the property.

Two heritage resources VCs were identified during the archeological and heritage assessment:

- Archaeological sites; and
- Historic heritage sites.

Both of these VCs were selected based on their importance to local and Aboriginal communities and on their regulatory support (e.g., Ontario *Heritage Act*).

#### 12.2.2.5 Aboriginal Peoples

Potential effects to Aboriginal or treaty rights and traditional activities include:

- Limitations to the gathering of country foods (e.g., berries, wild rice, mushrooms);
- Negative effects on surface water quality (and attendant health effects); and
- Limitations on the ability to hunt, fish and trap.

These potential effects were further evaluated using pre-existing reports and publically available information and the results of engagement with local communities. People that harvest country foods from the study area may include:

- Local residents (i.e., residents of the local area, Wabigoon, Dryden), including both Aboriginal and non-Aboriginal peoples; and

Residents from other communities that have travelled to the area to engage in hunting or fishing activities.

Treasury evaluated three VCs with respect to Aboriginal peoples and their use of the Project area:

- Health effects related to potential air and water contamination;
- Gathering of country foods and traditional plants; and
- Hunting, trapping, and fishing access.

## 12.3 MITIGATION MEASURES

Treasury will develop and apply a wide range of avoidance, minimization and mitigation measures to address potential Project effects on identified VCs (Table ES.12.1). The mitigation measures have been characterized as design, engineering and management. Design mitigation has been implemented through the change in project design to reduce or eliminate the effects. Engineering mitigation has been implemented through the use of technology or equipment design to reduce or eliminate hazards. Management mitigation has been implemented through the use of adaptive management such as Environmental Management Plans.

**Table ES. 12.1 Summary of Proposed Measures to Avoid, Minimize, and Mitigate Potential Project Effects to Valued Components**

| Mitigation Measure | Type of Mitigation Measure | VC/Effects Targeted |
|---|---|---|
| Backfilling of the pits with waste rock minimized the volume of waste rock to be stored above grade. | Design Engineering | Terrain and soils<br>Surface water quality and quantity<br>Groundwater quality and quantity |
| Storage of waste rock underwater in the pit lake are expected to mitigate potential changes to soil chemistry. | Design Engineering | Terrain and soils<br>Surface water quality and quantity<br>Groundwater quality and quantity |
| Encapsulation of the WRSA and TSF at closure | Design Engineering | Terrain and soils<br>Surface water quality and quantity<br>Groundwater quality and quantity |
| Development of a Noise Monitoring Plan | Management | Noise pollution<br>Wildlife disturbance |
| Timing of scheduled blasting activities | Design Engineering | Noise pollution<br>Wildlife disturbance |
| Project lighting management | Design Engineering | Light pollution<br>Limiting wildlife attraction |
| Dust Suppression / Management Program | Management | Air quality |
| Wildlife Observation Monitoring Plan / Wildlife Management Plan | Management | Limiting wildlife attraction<br>Limiting direct wildlife mortality |
| Waste Management Plan | Management | Limiting wildlife attraction |
| Reduction in Project footprint to reduce impact to terrestrial habitats | Design Engineering | Wildlife and wildlife habitat |
| Reduction in Project footprint to reduce impact to local waterbodies | Design Engineering | Surface water quality and quantity<br>Groundwater quality and quantity<br>Wetlands and vegetation<br>Fish and fish habitat |
| Adherence to water quality guidelines and discharge limits | Management | Surface water quality and quantity<br>Groundwater quality and quantity<br>Wetlands and vegetation<br>Fish and fish habitat |
| Water Treatment Plant for Discharged Water (Process and Potable) | Design Engineering | Surface water quality and quantity<br>Groundwater quality and quantity<br>Wetlands and vegetation<br>Fish and fish habitat |
| Environment Effects Monitoring | Management | Surface water quality and quantity<br>Groundwater quality and quantity<br>Wetlands and vegetation<br>Fish and fish habitat |
| Surface Hydrology Monitoring | Management | Surface water quantity |
| Groundwater Monitoring | Management | Groundwater quality and quantity |
| Traffic and access management plans | Management | Land use |

**Table ES. 12.1 Summary of Proposed Measures to Avoid, Minimize, and Mitigate Potential Project Effects to Valued Components**

| Mitigation Measure | Type of Mitigation Measure | VC/Effects Targeted |
|---|---|---|
| Employment plans and policies | Management | Land use<br>Social factors<br>Economic factors<br>Aboriginal peoples |
| Training Policies and Job Transfer Plans | Management | Economic factors<br>Aboriginal peoples |
| Archaeological and Cultural Heritage Resource Management Plan | Management | Heritage resources<br>Aboriginal peoples |

# 12.4 RESIDUAL EFFECTS ASSESSMENT AND SIGNIFICANCE

## 12.4.1 Assessment Procedures

Following the implementation of the mitigation measure, any remaining residual effects of the Project were characterized using the following criteria:

- Magnitude – expected size or severity of the residual effect
    - Level I – No measurable residual effect
    - Level II – Residual effect is measurable but within range of natural variation
    - Level III – Residual effect is outside range of natural variation
- Geographic Extent – the spatial scale of the residual effect
    - Level I – Residual effect restricted to Project footprint
    - Level II – Residual effect extends into LSA
    - Level III – Residual effect extends into RSA
- Duration – the temporal scale of the residual effect
    - Level I – Residual effect is temporary or not measurable beyond given Project phase (e.g., construction)
    - Level II – Residual effect could persist up to 10 years after Project initiation
    - Level III – Residual effect could persist beyond 10 years after Project initiation
- Frequency – how often the residual effect is expected to occur
    - Level I – Residual effect is expected to occur infrequently
    - Level II – Residual effect is expected to occur intermittently
    - Level III – Residual effects occurs frequently or continuously
- Reversibility – whether or not the residual effect can be reversed once the disturbance or activity has ended
    - Level I – Residual effect is readily reversible over a relative short time period
    - Level II – Residual effect is partially reversible (i.e., mitigation cannot guarantee a return to pre-disturbance conditions).
    - Level III – Residual effect is not reversible

A determination of the significance of any potential residual effects of the Project on VCs, after the application of all proposed mitigation measures, is a specific requirement of CEAA. The mitigation measures to be applied to this Project have been integrated into the Project design; consequently, it is only the residual effects of the Project which require significance assessment.

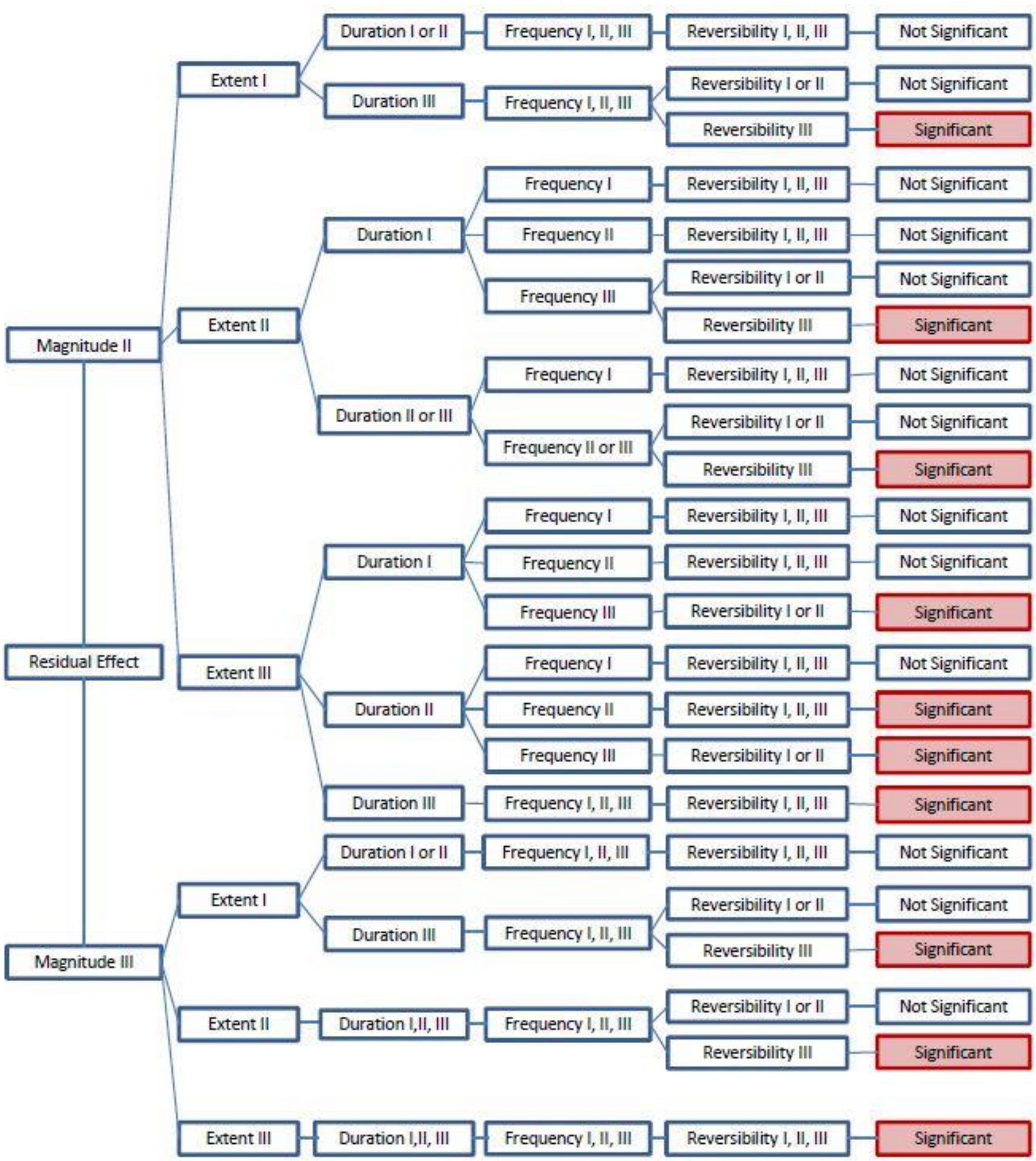
In keeping with exiting guidance (e.g., Government of Canada 1994),Treasury evaluated the potential significance of residual effects by examining the level of each residual effect characteristic in the context of existing baseline data, relative literature, and consultation with experts. In general, the following logic was applied:

- If the magnitude of a potential residual effect is categorized as Level I, then the residual effect is considered not significant regardless of the levels assigned to other effect attributes.
- If the magnitude of a potential residual effect is categorized as Level II or III, a decision tree was used to evaluate significance (Figure ES.12.1).

Once the potential significance was assessed, Treasury assigned each residual effect a likelihood of occurrence:

- Level I – Residual effect is unlikely to occur
- Level II – Residual effect could reasonably be expected to occur
- Level III – Residual effect will occur

**Figure ES. 12.1 Decision Tree for the Determination of Significance for Residual Effects**



## 12.4.2 Potential Residual Effects to Biophysical Valued Components

### 12.4.2.1 Terrain and Soils

The height of permanent terrain alterations such as the WRSA and TSF will be limited and contoured to blend in with other terrain features. The backfilling waste rock into the open pit will limit the amount of waste rock requiring above-grade storage. The WRSA may be observed during the early development of the pits (years 1 and 2) but progressive reclamation of the WRSA by covering it with soil and vegetation will soon assist in blending this visible feature with the surrounding landscape. Eventually the surrounding forest is expected to colonize the WRSA. The TSF will be more distant from the residences and lakes and will not extend above the surrounding terrain features. During construction and operations, the residual effects of terrain alterations have been characterized as Level I for Magnitude (minimal to no measurable residual), Level III for Geographic Extent (extends into RSA), Level II for Duration (effect will continue in the next Project phase), Level III for Frequency (frequent or continuous), and Level II for Reversibility (partially reversible). At closure, the TSF will be covered and vegetated and the surrounding forest is expected to colonize the surface. The residual effects at closure have been downgraded for most characteristics. No significant residual effects are anticipated for the terrain VC.

The overburden will be stripped to access the pit area. During this process, the soil will be susceptible to wind and water erosion as its protective vegetation is damaged and its consolidated state is disturbed. During the construction process, site drainage will be re-established with grading, ditches and culverts to minimize runoff which would promote soils erosion. Industry best practices to minimize fine particles suspension will be followed such as loading the soils into trucks in a manner that minimizes drop height. Residual effects during construction have been characterized as Level I for Magnitude (minimal to no measurable residual), Level I for Geographic Extent (restricted to Project area), Level I for Duration (restricted to construction), Level II for Frequency (intermittent), and Level I for Reversibility (fully reversible). No significant residual effects are anticipated for the overburden VC.

The WRSA and TSF are proposed for the long-term storage of mine waste. Left unattended the rock could be expected to go acid within several decades. Mitigation measures include collection of any seepage from the WRSA and TSF during operation, progressive reclamation of the WRSA with a water-shedding cap, storage of the remaining waste rock under water, and covering the TSF at closure with a water-shedding cap. The water-shedding caps and water cover will be in place well before the waste rock could be expected to go acid. During operations, the residual effects have been characterized as Level I for Magnitude (minimal to no measurable residual), Level II for Geographic Extent (residual effect extends into LSA), Level I for Duration (restricted to operations), Level II for Frequency (intermittent), and Level I for Reversibility (fully reversible). During closure, one effect characteristic has been upgraded: Level II for Duration (effects will persist past closure). No significant residual effects to the soil chemistry VC are anticipated.

### 12.4.2.2 Geology and Geochemistry

Geology and geochemistry do not provide endpoints for the effects assessment but rather provide parameters for the effects assessment of VCs for other components such as surface water quality, groundwater quality, fish and fish habitat, and human health and ecological risk. Conservative estimates for geochemistry parameters such as ARD/ML, and onset to acid, were significant considerations in the project design, from construction through to post-closure, so as to prevent or mitigate potential effects to the VCs of other components.

Mine materials were characterized for ARD/ML potential. Although characterization studies are ongoing, results to date indicate that the majority of waste rock, ore, and tailings samples tested are classified as PAG. From the same results, it was conservatively estimated that the time to acid onset for the PAG rock will range between a few tens of years to many tens of years. The ARD/ML potential along with the onset of acid estimate were identified as significant parameters informing the development of mitigation strategies that were incorporated into the Project design, from construction through to post-closure. Although the mine materials are not expected to go acid until well after mine closure, a conservative approach to project design was used to ensure that all mine materials will be encapsulated, secured, or contained before the end of operations and well before the expected onset of acid. Project features incorporating this conservative approach include:

- Perimeter ditching to collect runoff and seepage from the WRSA, low-grade ore stockpile, and TSF during construction and operation;
- A water management system that includes containing and collecting seepage and runoff from Project components, recirculation of collected water to minimize mine water effluent, and a secondary treatment plant for any water to be released to the environment;
- Immediate encapsulation of WRSA with a water-shedding cover to minimize waste rock exposure and seepage;
- Backfilling pit with waste rock and accelerated flooding to minimize waste rock and pit wall exposure;
- Accelerated pit flooding with treated mine effluent to minimize discharges to the environment;
- Establishing a pit lake surface elevation above pit walls to ensure PAG pit walls are not exposed; and
- Encapsulation of TSF at closure with a water-shedding cover to minimize seepage.

A secondary effect of incorporating conservative geochemistry parameter estimates into the project design through the practice of containing and collecting runoff and seepage and installing a secondary treatment plant has been to reduce the raw water needs for the process plant through recirculation of treated water. This has reduced the raw water requirements from the environment from 600 $m^3$/d to 150 $m^3$/d which can be met using the existing storage ponds at the former tree nursery site rather than constructing an intake line to a larger waterbody (e.g., Thunder Lake, Wabigoon Lake). Similarly, the lower raw water requirements and recirculation from the secondary treatment plant have reduced the discharge to Blackwater Creek from 1,917 $m^3$/d to 1,467 $m^3$/d. During the accelerated pit refill, all treated mine effluent will be directed to the pit therefore there will be no discharge to the environment during the remaining years of the operations phase.

### 12.4.2.3 Noise

To mitigate potential noise-related effects, Treasury will utilize new, low-noise-engineered machinery, will time major activities (e.g., blasting) to minimize adverse effects, and will minimize night-time activities where practical. With the application of these appropriate mitigation and monitoring strategies, the potential Noise-related residual effects of the Project should not be significant. Periodic noise monitoring at key receptor locations throughout the life of the Project is recommended to respond to any remaining public concern.

During all phases, the potential residual effect of noise resulting from traffic and construction was rated as Level I for Magnitude (within applicable guidelines), Level II for Geographic Extent (residual effect extends into the LSA), Level I for Duration (residual effect confined to a particular phase), Level II for Frequency (intermittent), and Level I for Reversible (fully reversible).

During all phases, the potential residual effect of noise-related disturbances on wildlife was rated as Level I for Magnitude (within applicable guidelines), Level II for Geographic Extent (residual effect extends into the LSA), Level I for Duration (residual effect confined to a particular phase), Level II for Frequency (intermittent), and Level I for Reversible (fully reversible).

### 12.4.2.4 Light

To mitigate potential light-related effects, Treasury will limit Project lighting to areas required for safe operations, orient Project lighting towards the interior of the Project area and, where possible, use down-shaded lighting on Project buildings and infrastructure. With the application of appropriate mitigation and monitoring strategies, the potential light-related residual effects of the Project should not be significant.

During all phases, the potential residual effect of light trespass was rated as Level I for Magnitude (within applicable guidelines), Level II for Geographic Extent (residual effect extends into the LSA), Level I for Duration (residual effect confined to a particular phase), Level III for Frequency (frequently or continuous), and Level I for Reversible (fully reversible).

During all phases, the potential residual effect of wildlife light attraction was rated as Level I for Magnitude (within applicable guidelines), Level II for Geographic Extent (residual effect extends into the LSA), Level I for Duration (residual effect confined to a particular phase), Level II for Frequency (intermittent), and Level I for Reversible (fully reversible).

Periodic light trespass monitoring at key receptor locations throughout the life of the Project is recommended to respond to lingering public concern. The implementation of the wildlife reporting system within the Project environmental management plan (EMP) will help quantify potential effects of light attraction on wildlife.

### 12.4.2.5 Air Quality

From construction through to closure there is expected to be limited to increases in the concentrations of products of combustion and fugitive particulate matter based contaminants of concern. Based on the criteria prescribed in the OAAQC, the potential effects of these contaminants are impaired visibility (TSP, PM10, PM2.5), soiling (dust fall), human health (CO, PM10, PM2.5, NOx, $SO_2$), and damage to vegetation (from $SO_2$). Ammonia was excluded from further consideration as emissions are expected to be very minor.

Mitigation measures that will minimize potential effects during construction, operation, and closure phases of the Project include:

- Surface drilling will be performed with drilling rigs equipped with dust suppression equipment, such as wet suppression or dry filtration systems;
- Blasting will be conducted in a phased manner that optimizes the amount of explosives needed for a given area to be blasted, and that minimizes the area being blasted;
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck (or equivalent bed height as material is loaded into the truck);
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order;
- Water and chemical suppressants will be used for dust control on the haul roads is used at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wetted road surface. This program would also be supplemented with applications of an approved dust suppressant as required to minimize fugitive dust emissions;
- The crusher will be located inside a structure that is equipped with a bag-house dust collector to minimize dust from processing; and
- A best management practices plan for dust will be implemented on the site to provide specific directions for operators.

Inventories of emission sources were prepared for each project phase based on the proposed project plan. Estimates of the expected emissions from these sources during each project phase were prepared based on published methodologies and emissions data from a number of sources.

The emission rate estimates and relevant emission source data were employed, along with the appropriate local terrain and meteorological data, to complete an advanced air dispersion modelling assessment. The O.Reg.419 approved, United States Environmental Protection Agency (U.S. EPA) AERMOD dispersion model was used to predict the local ground level concentrations of all contaminants of concern at the off-site receptor locations in the Project area.

The dispersion modelling assessment was prepared based on the worst case pperational phase of the Project. The total estimated annual emission rates from all phases of the Project are within the same order of magnitude, with the operational phase lasting significantly longer and therefore expected to have the longest term potential air quality impacts. Additionally, the expected increase in emissions from the haul road calculated for the construction and closure phases are due to truck traffic along the haul road from the waste rock pile to the open mine pit. As such the impact of these emissions is expected to be further from the receptors of interest those generated during operations. The results of the dispersion modelling assessment were then added to the existing baseline background concentrations for each air quality indicator to determine the cumulative impact.

Based on the results of the dispersion modelling assessment, the project is expected to result in a residual impact on local air quality (Magnitude Level I), with potential (but occasional – Frequency, Duration, and Likelihood of Occurrence Level I) exceedances of the Provincial (OAAQC) standards for TSP and PM10 beyond the Project footprint (Geographic Extent Level I). However, the direct effects of the Project at the nearest, regulated receptors (i.e., human residences) are expected to be consistently below federal and provincial standards. Application of the appropriate avoidance, minimization, and mitigation measure will help to minimize the effect on local air quality. As all air quality indicators are expected to remain in compliance with the applicable criteria at the relevant regulatory receptors, any potential residual effects are not significant. Based on these results, no follow-up monitoring will be conducted.

### 12.4.2.6 Climate

GHG emissions are anticipated to increase during the construction phase and peak during the development of the open pits (years 1 - 3) when surface activities are most extensive. GHG emissions are then anticipated to decline during the progressive reclamation of the surface works and development of the underground mine (years 4 – 12). Closure of surface developments such as the TSF will likely result in a short (one year) upswing in GHG emissions before GHG emissions cease all together. There are no compliance limits for GHG in Ontario; however, Project GHG emissions are expected to be less than projects of similar scale in isolated locations. This is because, unlike similar operations in isolated location, power for the Project will be provided by the existing power grid rather than diesel generation required at isolated locations. The residual effect of GHG emissions is projected to be not significant: Level I for magnitude (no measureable residual effect), Level III for Geographic Extent (residual effect extends into RSA), Level II for Duration in (residual effect will diminish at closure), Level III for Frequency (continuous during construction and operations), and Level I for Reversibility (reversible at closure). Therefore, the Project GHG emissions are low in comparison to similar projects, the Mining, Oil & Gas sector, and provincial and national overall reporting. Thus, the residual effect was determined to be not significant.

### 12.4.2.7 Surface Water Quality

During construction, sediment loading or accidental release of deleterious substances (e.g., spills) to receiving waters could result in exceedances of applicable federal and provincial regulations and guidelines. However, these exceedances are not expected to be measureable beyond the construction period and are expected to occur infrequently. Mitigation measures outlined in the EMP are designed to reduce the likelihood of occurrences of increased TSS or chemicals of concern in receiving waters. Environmental effects monitoring (EEM) studies will be conducted during construction to monitor potential changes in the water quality of receiving waters resulting from construction activities.

During operation, release of tailings storage facility effluent could result in exceedances of applicable federal and provincial regulations and guidelines; however, secondary water treatment (reverse osmosis) of effluent is expected to meet limits based on PWQOs. That is, the residual effects (magnitude, geographic extent, duration, frequency, reversibility, and likelihood of occurrence) are considered Level I and not expected to result in exceedances of federal or provincial regulations or guidelines beyond the mixing zone or beyond the construction period (3 years). Thus, the remaining potential effects to water quality during operation are considered not to be significant if appropriate mitigation measures are implemented. During operation, handling and/or equipment malfunctions could result in the release of chemicals and petroleum products due to spills; however, equipment refueling will be conducted at a refueling station positioned over a spill collection system. Additionally, spill prevention kits will be stationed throughout the mine as well as on vehicles. This will allow staff to rapidly address spills from equipment failure. Lastly, any transfer of chemicals will be conducted in dedicated and contained transfer areas. The residual effects resulting from handling and/or equipment malfunctions are considered Level I and not expected to result in exceedances of federal or provincial regulations or guidelines beyond the mixing zone or beyond the construction period (3 years). Thus, the remaining potential effects to water quality during operation are considered not to be significant if appropriate mitigation measures are implemented.

In the highly improbable event of a catastrophic failure of the TSF, the surface water quality of Blackwater Creek would be altered as the flood wave moves downstream. However, Wabigoon Lake would be affected for a very short period of time and the effect would be mostly localized to Kelpyn Bay. If the tailings solids dispersed on land and water bodies are not removed in a timely manner following a TSF dam breach, there could be a longer term risk of migration. Runoff could potentially mobilize tailings particles into Blackwater Creek and negatively affect its water quality (i.e., turbidity and chemical or mineral composition). It is less likely that remobilized particles would affect the quality of Wabigoon Lake since they would likely settle in low moving water such as beaver ponds along Blackwater Creek. However, high water levels and velocities, such as spring freshet, could remobilize the settled particles and affect the water quality of Wabigoon Lake.

During closure sediment loading or accidental release of deleterious substances to receiving waters could result in exceedances of applicable federal and provincial regulations and guidelines. However, these exceedances are not expected to be measureable beyond the closure period and are expected to occur infrequently. Mitigation measures outlined in the EMP (e.g., well-maintained equipment, spill response plan and kits, soil stabilization measures) are designed to reduce the likelihood of occurrences in increased in TSS or chemicals of concern in receiving waters during Project closure.

A screening level risk assessment (SLRA) to evaluate the potential for human health and ecological risk has been completed for the Project. The human health component of the SLRA focused on two contaminants of concern (COC; mercury and lead) and two human exposure pathways to contamination: direct soil contact (ingestion, dermal contact, and dust inhalation) and surface water (ingestion, dermal contact). The results of the human health component of the SLRA indicated that risk estimates did not exceed the acceptable threshold for both mercury and lead during the operations phase of the Project.

### 12.4.2.8 Surface Water Quantity

Blackwater Creek water quantity can be expected to be reduced during mine operations as portions of the watershed such as the WRSA, low-grade ore stockpile, process plant, and TSF will be isolated and runoff/seepage collected and directed to the TSF. Treated water will initially be discharged into Blackwater Creek during the development of the open pits (years 1 to 3) which when combined with excess treated process water will be slightly higher than natural flows. Once open pit mining has been completed, the treated water effluent will be directed to the pit to accelerate filling which will result in a reduction in Blackwater Creek flow from years 4 to 12. After closure, natural drainage patterns will be restored. Reclaimed developed areas are expected to have a higher runoff coefficient which in turn will result in higher peak flows but no changes to low flows. The residual effects of flow alterations in Blackwater Creek have been categorized as Level I for Magnitude (no measurable effects outside of natural variation), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond operations), Level III for Frequency (will occur throughout the operations period), and Level I for Reversibility (readily reversible). The residual effects on flow rates in Blackwater Creek are predicted to be not significant; this prediction will be verified with surface hydrology monitoring throughout operations and closure.

In the highly improbable event of a catastrophic failure of the TSF, the resulting flood wave would likely cause some erosion along Blackwater Creek until the flood wave velocity is attenuated as it reaches bends and beaver ponds along the creek. This highly unlikely scenario would be of a relative short duration (several hours to few days) until the flow would return to seasonal normal.

The Hoffstrom's Bay tributary will provide 150 $m^3$/d of raw water to the process plant throughout the operational phase of the Project. Water will be drawn from the two impoundments which were constructed to provide irrigation water for the former tree nursery. Raw water requirements will be mitigated by the installation of a reverse osmosis secondary treatment plant. The secondary treatment plant will be able to recirculate 450 $m^3$/d of treated water back to the process plant reducing the raw water needs from 600 $m^3$/d to 150 $m^3$/d. It is anticipated that the impoundments on the Hoffstrom's Bay tributary will be able to provide the raw water needs for the process plant with limited effects to water quantity in the tributary. The residual effects of flow alterations in Blackwater Creek have been categorized as Level I for Magnitude (no measurable effects outside of natural variation), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond operations), Level III for Frequency (will occur throughout the operations period), and Level I for Reversibility (readily reversible). The residual effects on flow rates in Hoffman's Bay tributary are predicted to be not significant; this prediction will be verified with surface hydrology monitoring throughout operations and closure.

## 12.4.2.9 Groundwater Quality

The level of risk posed to the groundwater quality is considered to be variable throughout the life of the development, and is associated primarily with point sources and the leachate produced from waste rock and tailings. Increased risk of point source releases may be present during the construction phase where protective measures for the control and containment of any accidental releases may be limited. However, the severity of any release would also be limited and appropriate spill response and remediation procedures would be in place to address any potential impacts.

Over the course of the construction phase, the potential impact of these types of point source releases to the groundwater quality is not considered to be significant since, in accordance with environmental legislation and industry good practice, any releases would be subject to an environmental assessment and appropriate remediation at the time of occurrence. During operations, care and control measures are expected to be in place for any contaminant storage and handling areas. In the unlikely event that any accidental release should occur on site, the potential for subsurface contaminant migration would be limited by the operation of the groundwater dewatering system which would limit any impacts to the immediate vicinity of the source. Appropriate spill response and remediation measures would also be implemented to address these concerns prior to the off-site migration of any contaminants.

During operation of the mine site, there is the potential for between 200 $m^3$/d and 500 $m^3$/d of seepage through the base of the TSF. The majority of any seepage from the TSF to groundwater is predicted to be shallow horizontal flow that will be intercepted by perimeter drainage ditches. The remaining 10% to 30%, or about 70 $m^3$/d to 90 $m^3$/d, is predicted to bypass the ditches, migrating underneath them, and eventually discharging either into the flooded open pit, nearby creeks (Hoffstrom's Bay Tributary, Thunder Lake Tributary #3 and Blackwater Creek) or Thunder Lake/Thunder Creek.

Seepage out of the WRSA is estimated to be within the range of 100 $m^3$/d to 200 $m^3$/d. Under the base case scenario, about 80% of seepage coming out of the WRSA is expected to end up in the flooded open pit, while the remaining 20% is expected to be captured by the nearby creeks and Thunder Lake.

Based on the initial chemical analysis of the anticipated waste rock, this is not expected to develop into an acid generating waste for a period of a few tens of years to many tens of years. This suggests that any seepage would therefore have limited adverse impacts on groundwater quality conditions, which would then be further attenuated through natural dispersion within the groundwater system over this time frame.

As part of the overall closure plan, capping of the WRSA will begin soon after waste rock has been diverted from this area in order to backfill the exhausted open pits. The cap for the WRSA will therefore be completed well before the waste rock is predicted to go acid. At mine closure, the TSF will also be capped. Once capped, the WRSA and TSF are not expected to have any effect on groundwater quality since the cap will minimize infiltration of water and therefore further reduce the seepage from these areas.

The residual impact of spill-related events during all phases has been characterized as Level III for Magnitude (potential introduction of contaminants), Level I for Geographic Extent (restricted to release area), Level I for Duration (not measurable past phase of occurrence), Level I for Frequency (infrequent), and Level I for Reversibility (fully reversible). The residual impact of WRSA/TSF seepage during operation has been characterized as Level I for Magnitude (not measureable), Level I for Geographic Extent (restricted to Project), Level I for Duration (not measurable past phase of occurrence), Level I for Frequency (infrequent), and Level I for Reversibility (fully reversible). During closure, Reversibility is upgraded to Level I (partially reversible based on natural processes).

Throughout the site operations, a groundwater monitoring program will be maintained to monitor changes to water quality in the area. Water quality changes may be indicative of seepage and the potential for adverse impacts, which may require implementation of additional mitigation measures. This monitoring program will be continued following capping of the WRSA and TSF to confirm the effectiveness of the caps in minimizing future seepage.

### 12.4.2.10 Groundwater Quantity

During this initial phase of site construction, disturbance to site topography soil cover and drainage patterns will result in modifications to possible local ground recharge and/or discharge areas which will persist through operation and closure. However, these surficial disruptions are not expected to have any significant impact to groundwater quantity since the area of disturbance would be relatively small (less than 0.1%) compared to the overall groundwater basin.

The excavation of the open pit operations and subsequent operation of underground workings will include the implementation of a perimeter groundwater table depressions system, which, over the life of the mine operations, is expected to result in the gradual drawdown of the water table at the mine site to approximately 160 m below grade. This drawdown would extend out from the mine site in a radial manner with the drawdown impact decreasing with distance from the mine site.

In order to obtain an indication of the magnitude of this drawdown cone, a three-dimensional steady state numerical groundwater flow model of the proposed operations was created. This model was initially calibrated against observed groundwater conditions and then used to estimate the zone of influence/ drawdown created by the mine dewatering. This model is based on the assumption that the aquifer system is a relatively homogeneous porous media, which in the case of fractured rock is applicable only on a large scale since groundwater movement in fractured rock can be highly variable.

All the creeks close to the proposed open pit are runoff dominated creeks with watersheds that sit predominantly on clay. Blackwater Creek is predominantly on clay overburden and has limited base flow. The base flow loss for Blackwater Creek is expected to be negligible. Thunder Lake Tributary #2 and #3 and Hughes Creek are the water courses closest to the Project site with significant base flow from groundwater discharge, most of which would be from the outwash sand and gravel deposits along Thunder Lake. These creeks are predicted to have base flow reductions of around 5% and below 1% respectively. The residual effects on recharge patterns have been characterized as Level I for Magnitude (limited to no measurable effects), Level I for Geographic Extent (restricted to Project area), Level III for Duration (residual effect permanent), Level III for Frequency (residual effect permanent), and Level III for Reversibility (permanent). The residual effect will not be significant.

The residual operations-phase effects on groundwater contributions to surface flows (Table 6.4.2) have been characterized as Level I for Magnitude (no measurable residual effect), Level III for Geographic Extent (extends into RSA), Level III for Duration (effects will persist past operations and closure), Level III for Frequency (continuous during operations) and Level I for Reversible (readily reversible). The residual effect will not be significant.

Near the end of mine operations, the zone of influence within which the groundwater table is expected to be drawn down by more than 1 m below average annual static conditions is estimated to extend approximately 2.5 km to the west, 3.5 km to the south, 2 km to the north and 1.5 km to the east. There are 77 wells located within the zone of influence (ZOI) as defined by the predicted 1 m drawdown contour. A preliminary qualitative risk assessment has been undertaken for these 77 wells:

- Twelve wells within the 5 m Base Case drawdown contour located on the Thunder Lake shore to the east of Thunder Lake have moderate to high risk of dewatering. These are relatively shallow wells (< 25 m deep) that likely source most of their water from the basal sand and shallow bedrock;
- Five wells within the 5 m Base Case drawdown contour also located on Thunder Lake shore have low risk of dewatering. These are deeper wells (> 30 m) that likely source the majority of their water from deeper bedrock;
- 55 wells outside of the 5 m Base Case drawdown contour are assessed to have low risk of dewatering due to their proximity and likely good hydraulic connection with a recharge boundary and/or recharge source;
- The five remaining wells within the 1 m ZOI are within the Project property boundaries.

The residual effect of the Project on private well performance during operations has been characterized Level III for Magnitude (residual effect exceeds natural variation), Level III for Geographic Extent (extends into RSA), Level III for Duration (residual effect will persist beyond closure), Level III for Frequency (continuous), and Level II for Reversibility (partially reversible). The residual effect of the Project on private well performance during closure (Table 6.4.3) has been characterized Level II for Magnitude (residual effect exceeds natural variation but less so than during operations), Level II for Geographic Extent (extends into LSA), Level III for Duration (residual effect will persist beyond closure), Level II for Frequency (effect gradually decreasing over time), and Level I for Reversibility (reversible).

In order to address the potential for impact to private water wells, an ongoing hydrogeological monitoring program will be implemented. This program will involve the regular monitoring of water level fluctuations in areas between the mine site and the private well developments to determine if the rate and extent of drawdown is progressing as anticipated. The numerical model will be regularly revised to incorporate additional geological and hydrogeological findings to better represent the effects to date and therefore the reliability of future predictions. In the event that this monitoring program does confirm the likelihood of adverse groundwater table drawdown impacts on local private wells, mitigations measures will be implemented. These mitigation measures may include deepening of existing wells, relocation of existing wells, or installation of an alternative water supply, as conditions may require. With the implementation of appropriate mitigation, the residual effects are predicted to be not significant.

At closure, when the mine is allowed to flood, the groundwater elevations are expected to gradually return to the pre-development elevations. The groundwater monitoring program will be continued through the early closure phase to confirm the rate of groundwater recovery. It is anticipated that the drawdown effects will be fully reversed in 20 to 30 years.

## 12.4.2.11 Wildlife and Wildlife Habitat

**Wildlife Species at Risk**

Two terrestrial mammalian SAR were observed within the LSA during field survey efforts: Little Brown Myotis (2011 and 2012) and Northern Myotis (2012). Seven bird SAR were observed within the LSA during the field survey efforts: Bald Eagle, Peregrine Falcon, Black Tern, Common Nighthawk, Barn Swallow, Canada Warbler, Olive-sided Flycatcher. Based on range overlap and habitat availability, seven additional bird SAR are potentially present (at least in some years) but have not yet been reported from the LSA: American White Pelican, Bobolink, Eastern Whip-poor-will, Golden Eagle, Least Bittern, Short-eared Owl, and Yellow Rail.

Construction - The primary potential Project effect on wildlife SAR during construction is the potential change in population abundance and distribution due to habitat removal. Project construction will eliminate approximately 202.5 ha of terrestrial habitat and 39.5 ha of wetland habitat that could and does serve as habitat for wildlife SAR. Treasury has minimized the amount of habitat clearing required for the Project by optimizing pit design and siting Project infrastructure in previously disturbed areas (e.g., use of existing access roads). In addition, Treasury's EMP (Section 12) will limit activity of Project personnel outside of Project boundaries. The residual effects of habitat removal have been categorized as Level II for Magnitude (has the potential to measurably affect population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level III for Frequency (will occur throughout the construction period), and Level II for Reversibility (partially reversible upon closure). However, habitats slated for removal are not limiting within the LSA (removed habitat constitutes approximately 7.5% of available habitat in the LSA) and, as a result, their removal should not have a significant effect on SAR abundance in the region.

Additional potential effects during construction include direct mortality as a result of human activity: mortality of roosting bats or nesting birds during habitat clearing activities, and vehicular collisions. To minimize the potential for effects on roosting bats and nesting birds, Treasury will conduct all habitat clearing activity outside of bat and bird migration and breeding periods. To limit the potential for vehicular collision and negative human-wildlife interaction, Treasury will establish and enforce speed limits on all Project roads and will implement a comprehensive EMP that includes measure to minimize the attraction of wildlife to the Project (e.g., waste management). The residual effects of direct mortality have been categorized as Level I for Magnitude (no measurable effect on population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (will occur infrequently), and Level III for Reversibility (not reversible). The residual effect is predicted to be non-significant based on the predicted low frequency and low likelihood of a mortality event during construction and, therefore, the low total mortality over the construction phase. Treasury will implement a Wildlife Incident Response and Reporting System as part of its EMP to quantify interactions between Project personnel and wildlife.

Operations and Closure - Potential Project effects on wildlife SAR during operations and closure will be limited to direct mortality as a result of human activity (e.g., vehicle collisions). To limit the potential for vehicular collision and negative human-wildlife interaction, Treasury will establish and enforce speed limits on all Project roads and will implement a comprehensive EMP that includes measure to minimize the attraction of wildlife to the Project (e.g., waste management). The residual effects of direct mortality have been categorized as Level I for Magnitude (no measurable effect on population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (will occur infrequently), and Level III for Reversibility (not reversible). The residual effect is predicted to be non-significant based on the predicted low frequency and low likelihood of a mortality event during construction and, therefore, the low total mortality over the construction phase. Treasury will implement a Wildlife Incident Response and Reporting System as part of its EMP to quantify interactions between Project personnel and wildlife.

**Ungulates and Furbearers**

Construction – The primary potential Project effect on ungulates and furbearers during construction is the potential change in population abundance and distribution due to habitat removal. Project construction will eliminate approximately 202.5 ha of terrestrial habitat and 39.5 ha of wetland habitat that could and does serve as habitat for ungulates. Treasury has minimized the amount of habitat clearing required for the Project by optimizing pit design and siting Project infrastructure in previously disturbed areas (e.g., use of existing access roads). In addition, Treasury's EMP (Section 12) will limit activity of Project personnel outside of Project boundaries. The residual effects of habitat removal have been categorized as Level II for Magnitude (has the potential to measurably affect population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level III for Frequency (will occur throughout the construction period), and Level II for Reversibility (partially reversible upon closure). However, habitats slated for removal are not limiting within the LSA (removed habitat constitutes approximately 7.5% of available habitat in the LSA) and, as a result, their removal should not have a significant effect on ungulate and furbearer abundance in the region.

Additional potential effects during construction include direct mortality as a result of human activity (e.g., vehicular collisions). To limit the potential for vehicular collision and negative human-wildlife interaction, Treasury will establish and enforce speed limits on all Project roads and will implement a comprehensive EMP that includes measure to minimize the attraction of wildlife to the Project (e.g., waste management). The residual effects of direct mortality have been categorized as Level I for Magnitude (no measurable effect on population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (will occur infrequently), and Level III for Reversibility (not reversible). The residual effect is predicted to be non-significant based on the predicted low frequency and low likelihood of a mortality event during construction and, therefore, the low total mortality over the construction phase. Treasury will implement a Wildlife Incident Response and Reporting System as part of its EMP to quantify interactions between Project personnel and wildlife.

Operations and Closure - Potential Project effects on ungulates and furbearers during operations and closure will be limited to direct mortality as a result of human activity (e.g., vehicle collisions). To limit the potential for vehicular collision and negative human-wildlife interaction, Treasury will establish and enforce speed limits on all Project roads and will implement a comprehensive EMP that includes measure to minimize the attraction of wildlife to the Project (e.g., waste management). The residual effects of direct mortality have been categorized as Level I for Magnitude (no measurable effect on population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (will occur infrequently), and Level III for Reversibility (not reversible). The residual effect is predicted to be non-significant based on the predicted low frequency and low likelihood of a mortality event during construction and, therefore, the low total mortality over the construction phase. Treasury will implement a Wildlife Incident Response and Reporting System as part of its EMP to quantify interactions between Project personnel and wildlife.

**Upland and Wetland Birds**

Construction – The primary potential Project effect on upland and wetland birds during construction is the potential change in population abundance and distribution due to habitat removal. Project construction will eliminate approximately 202.5 ha of terrestrial habitat that could and does serve as habitat for upland birds and 39.5 ha of wetland habitat that could and does serve as habitat for wetland birds. Treasury has minimized the amount of upland habitat clearing required for the Project by optimizing pit design and siting Project infrastructure in previously disturbed areas (e.g., use of existing access roads). In addition, Treasury's EMP will limit activity of Project personnel outside of Project boundaries. The residual effects of habitat removal have been categorized as Level II for Magnitude (has the potential to measurably affect population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level III for Frequency (will occur throughout the construction period), and Level II for Reversibility (partially reversible upon closure). However, habitats slated for removal are not limiting within the LSA (removed habitat constitutes approximately 7.5% of available habitat in the LSA) and, as a result, their removal should not have a significant effect on bird abundance in the region.

Additional potential effects during construction include direct mortality as a result of human activity: mortality of nesting birds during habitat clearing activities, and vehicular collisions. To minimize the potential for effects on nesting birds, Treasury will conduct all habitat clearing activity outside of bird migration and breeding periods. To limit the potential for vehicular collision and negative human-wildlife interaction, Treasury will establish and enforce speed limits on all Project roads and will implement a comprehensive EMP that includes measure to minimize the attraction of wildlife to the Project (e.g., waste management). The residual effects of direct mortality have been categorized as Level I for Magnitude (no measurable effect on population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (will occur infrequently), and Level III for Reversibility (not reversible). The residual effect is predicted to be non-significant based on the predicted low frequency and low likelihood of a mortality event during construction and, therefore, the low total mortality over the construction phase. Treasury will implement a Wildlife Incident Response and Reporting System as part of its EMP to quantify interactions between Project personnel and wildlife.

Operations and Closure - Potential Project effects on upland and wetland birds during operations and closure will be limited to direct mortality as a result of human activity (e.g., vehicle collisions). To limit the potential for vehicular collision and negative human-wildlife interaction, Treasury will establish and enforce speed limits on all Project roads and will implement a comprehensive EMP that includes measure to minimize the attraction of wildlife to the Project (e.g., waste management). The residual effects of direct mortality have been categorized as Level I for Magnitude (no measurable effect on population size), Level II for Geographic Extent (extends into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (will occur infrequently), and Level III for Reversibility (not reversible). The residual effect is predicted to be non-significant based on the predicted low frequency and low likelihood of a mortality event during construction and, therefore, the low total mortality over the construction phase. Treasury will implement a Wildlife Incident Response and Reporting System as part of its EMP to quantify interactions between Project personnel and wildlife.

### 12.4.2.12 Fish and Fish Habitat

There will be a direct Project effect on fish and fish habitat and there exists the potential for both direct and indirect effects on fish and fish habitat associated with the Project. The single largest and unavoidable direct effect is due to the physical disturbance to a watercourse associated with the Project footprint, namely the loss of habitat within the tributary that will be sacrificed to accommodate the placement of the tailings impoundment. Another potential direct effect is mortality of fish due to physical disturbances or the release of a deleterious substance. On-site water management has the potential to directly affect fish and fish habitat by altering flow in Blackwater Creek particularly during low-flow periods of the year. Indirect effects include the potential to change habitat beyond the Project footprint resulting from changes in water quality and/or water quantity and resultant effects on fish species population abundance and/or distribution due to changes in habitat quality or availability. With the exception of the unavoidable loss of habitat associated with the tailings facility, the application of appropriate avoidance, minimization, and mitigation measure should result in non-significant residual effects associated with the remaining identified potential effects.

Section 35 of the Federal *Fisheries Act 2012* includes prohibitions against causing serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Serious harm to fish is defined as “the death of fish or any permanent alteration to, or destruction of, fish habitat” and includes habitat loss/degradation, flow alteration and pollution, among other things. The Project will result in approximately 6 ha of fish habitat loss due to the unavoidable elimination of the tributary watercourse associated with the tailings storage facility, mostly in the vicinity of the pit excavation and tailing storage facilities. Therefore, under Subsection 35(2) of the *Fisheries Act,* an Authorization, which typically includes habitat compensation, will likely be required for the Project. Section 27.1 of the MMER also requires habitat compensation to offset losses of fish habitat associated the deposit of a deleterious substances to a watercourse. Waterbodies identified as potential candidate sites for the implementation of habitat compensation prescriptions are Thunder Lake, Wabigoon Lake and Thunder Creek.

**Fish**

Construction – Four potential effects to fish during the construction phase of the Project have been identified as follows:

- Fish mortality resulting from changes in water quality due to increased sediment from runoff and/or release of deleterious substances (e.g., chemical/fuel spills). Mitigation will involve implementation of an EMP, which will include measures to minimize potential for release of deleterious substances and a Spill Response plan. Equipment used will be well-maintained and will carry appropriately stocked spill kits. Operators will be trained in their use and have a spill response plan in place. Disturbed soils will be stabilized where possible to limit potential for erosion and sediment mobilization. Residual effects are characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fisheries); Level ll for Geographic Extent (extends into the LSA); Level l for Duration (not measurable beyond the construction period); Level l for Frequency (expected to occur infrequently); and Level lll for Reversibility (not reversible). Although this residual effect could reasonably be expected to occur, the effect on fish mortality from changes in water quality is predicted to be not significant following the implementation of mitigation measures since the effect will be temporary (restricted to the construction period) and will occur infrequently. As such, mortalities, if they occur, will be limited spatially and temporally. Treasury will develop and implement a water quality monitoring program to comply with the *Fisheries Act* and the MMER.
- Direct mortality of individuals due to physical activities that occur within or adjacent to a watercourse (e.g., access roads, tailing area dam construction, pit excavation). Mitigation will involve minimizing work within watercourses, scheduling works to occur during reduced risk periods (i.e., outside of sensitive spawning, hatching, and nursery periods), and conducting fish salvage prior to construction where possible. Residual effects are characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fisheries); Level ll for Geographic Extent (extends into the LSA); Level l for Duration (not measurable beyond the construction period); Level l for Frequency (expected to occur infrequently); and Level lll for Reversibility (not reversible). Although this effect could reasonably be expected to occur, the effect on fish mortality due to physical activities is predicted to be not significant since the effect will have a relatively low magnitude, will be temporary (restricted to the construction period), and will occur infrequently due to the implementation of mitigation.
- Potential degradation of habitat availability and quality that result in changes to population abundance and distribution of fish species. Mitigation will involve minimization of site preparation activities in the vicinity of watercourses and implementation of comprehensive EMP measures (including erosion and sediment control measures) that minimize the potential for habitat disturbance. With these mitigation measures applied, it is predicted that the residual effects can be characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fisheries); Level ll for Geographic Extent (extends into the LSA); Level l for Duration (not measurable beyond the construction period); Level lll for frequency (occurs frequently or continuously); and Level ll for Reversibility (partially reversible). However, since the likelihood of occurrence is Level l (unlikely to occur), it is predicted that the effect on potential changes to fish population abundance and distribution will be not significant. Treasury will conduct monitoring during construction to detect ongoing or potential adverse effects to adaptively manage such issues and will implement follow up fish surveys to assess fish distribution and species composition.
- Habitat avoidance and disruption of fish spawning potential from noise and vibration disturbances resulting from heavy equipment operation. Specific mitigation measures will be detailed in the EMP, which will include measures to reduce potential impacts of noise and vibration, such as utilizing well-maintained equipment operated at optimum loads. Residual effects are characterized as Level l for Magnitude (no measurable residual effect to fish as fish will typically exhibit avoidance behavior); Level l

for Geographic Extent (restricted to the Project footprint); Level I for Duration (not measurable beyond the construction period); Level II for Frequency (expected to occur intermittently); and Level I for Reversibility (reversible). Although this effect will occur due to the unavoidability of noise and vibration from construction machinery, it is predicted to be not significant since it will be temporary, will have a low magnitude, and will occur intermittently.

Operations - It is expected that the four potential effects to fish during the construction phase will also occur during the operations phase of the Project:

- Direct mortality of individuals due to physical activities that occur within or adjacent to a watercourse (e.g., access roads, tailing area dam construction, pit excavation). Mitigation will involve minimizing work within watercourses, scheduling works to occur during reduced risk periods (i.e. outside of sensitive spawning, hatching, and nursery periods), and conducting fish salvage where possible. Residual effects are characterized as: Level II for Magnitude (activity has the potential to measurably affect productive capacity of local fisheries); Level I for Geographic Extent (restricted to the Project footprint); Level III for Duration (may extend beyond 10 years after operation initiation); Level I for Frequency (expected to occur infrequently); and Level III for Reversibility (not reversible). Although this effect could reasonably be expected to occur, the effect on fish mortality due to physical activities is predicted to be not significant since the effect will have a relatively low magnitude, will be geographically restricted, and will occur infrequently due to the implementation of mitigation.
- Fish mortality resulting from changes in water quality due to increased sediment from runoff and/or release of deleterious substances (e.g., chemical/fuel spills). Mitigation will involve implementation of an EMP, which will include measures to minimize potential for release of deleterious substances and a Spill Response plan. Equipment used will be well-maintained and will carry appropriately stocked spill kits. Operators will be trained in their use and have a spill response plan in place. Disturbed soils will be stabilized where possible to limit potential for erosion and sediment mobilization. Residual effects are characterized as: Level II for Magnitude (activity has the potential to measurably affect productive capacity of local fisheries); Level II for Geographic Extent (extends into the LSA); Level III for Duration (may extend beyond 10 years after operation initiation); Level I for Frequency (expected to occur infrequently); and Level III for Reversibility (not reversible). The residual effect on fish mortality from changes in water quality is predicted to be significant. As such, Treasury will develop and implement a water quality monitoring program to comply with the *Fisheries Act* and the MMER. In the highly improbable event of a catastrophic failure of the TSF, the resulting flood wave would increase the potential for fish mortality within Blackwater Creek as a result of its high kinetic energy until the flood wave velocity is attenuated as it reaches bends and beaver ponds along the creek. This highly unlikely scenario would be of a relative short duration (several hours to few days) until the flow would return to seasonal normal.
- Potential degradation of habitat availability and quality that result in changes to population abundance and distribution of fish species. Mitigation will involve minimization of site preparation activities in the vicinity of watercourses and implementation of comprehensive EMP measures (including erosion and sediment control measures) that minimize the potential for habitat disturbance. With these mitigation measures applied, it is predicted that the residual effects can be characterized as: Level II for Magnitude (activity has the potential to measurably affect productive capacity of local fisheries); Level III for Geographic Extent (extends into the LSA); Level III for Duration (may extend beyond 10 years after operation initiation); Level III for frequency (occurs frequently or continuously); and Level II for Reversibility (partially reversible). The residual effect on fish mortality from changes in habitat quality is predicted to be significant. Treasury will conduct monitoring during the operations phase to detect ongoing or potential adverse effects to adaptively manage such issues and will implement follow up fish surveys to assess fish distribution and species composition.

- Habitat avoidance and disruption of fish spawning potential from noise and vibration disturbances resulting from heavy equipment operation. Specific mitigation measures will be detailed in the EMP, which will include measures to reduce potential impacts of noise and vibration, such as utilizing well-maintained equipment operated at optimum loads. Residual effects are characterized as Level I for Magnitude (no measurable residual effect to fish as fish will typically exhibit avoidance behavior); Level I for Geographic Extent (restricted to the Project footprint); Level III for Duration (may extend beyond 10 years after operation initiation); Level II for Frequency (expected to occur intermittently); and Level I for Reversibility (reversible). Although this effect will occur due to the unavoidability of noise and vibration from construction machinery, it is predicted to be not significant since it will be temporary, will have a low magnitude, and will occur intermittently.

<u>Closure</u> - The closure phase of the Project is anticipated to result in effects on fish that are similar to those in the construction and operations phases:

- Direct mortality of individuals due to physical activities that occur within or adjacent to a watercourse (e.g., physical alteration of the landscape for reclamation, infrastructure removal). Mitigation will involve minimizing work within watercourses, scheduling works to occur during reduced risk periods (i.e. outside of sensitive spawning, hatching, and nursery periods), and conducting fish salvage where possible. Residual effects are characterized as: Level II for Magnitude (activity has the potential to measurably affect productive capacity of local fisheries); Level I for Geographic Extent (restricted to Project footprint); Level I for Duration (not measurable beyond the reclamation period); Level I for Frequency (expected to occur infrequently); and Level III for Reversibility (not reversible). Although this effect could reasonably be expected to occur, the effect on fish mortality due to physical activities is predicted to be not significant following the implementation of mitigation since the effect will have a relatively low magnitude, will be temporary (restricted to the reclamation period), and will occur infrequently.
- Fish mortality resulting from changes in water quality due to increased sediment from runoff and/or release of deleterious substances (e.g., chemical/fuel spills). Mitigation will involve implementation of an EMP, which will include measures to minimize potential for release of deleterious substances and a Spill Response plan. Equipment used will be well-maintained and will carry appropriately stocked spill kits. Operators will be trained in their use and have a spill response plan in place. Disturbed soils will be stabilized where possible to limit potential for erosion and sediment mobilization. Residual effects are characterized as: Level II for Magnitude (activity has the potential to measurably affect productive capacity of local fisheries); Level II for Geographic Extent (extends into the LSA); Level I for Duration (not measurable beyond the closure period); Level I for Frequency (expected to occur infrequently); and Level III for Reversibility (not reversible). Based on these assessments, the effect on fish mortality from changes in water quality is unlikely to occur and will be not significant following the implementation of mitigation measures. However, Treasury will develop and implement a water quality monitoring program to ensure compliance with the *Fisheries Act* and the MMER.
- Potential degradation of habitat availability and quality that result in changes to population abundance and distribution of fish species. Mitigation will involve minimization of reclamation related disturbances in the vicinity of watercourses, implementation of comprehensive EMP measures (including erosion and sediment control measures) that minimize the potential for habitat disturbance, and the implementation of measures to return watercourses to pre-disturbance conditions as much as is possible. With these mitigation measures applied, it is predicted that the residual effects can be characterized as: Level II for Magnitude (activity has the potential to measurably affect productive capacity of local fisheries); Level III for Geographic Extent (extends into the LSA); Level II for Duration (may extend up to 10 years after project initiation); Level III for frequency (occurs frequently or continuously); and Level II for Reversibility (partially reversible). Although the likelihood of occurrence is Level I (unlikely to occur), it is predicted that the potential effects on changes to fish population abundance and distribution, if they were to occur, would be significant. Treasury will conduct monitoring during the closure period to detect ongoing or

potential adverse effects to adaptively manage such issues and will implement follow up fish surveys to assess fish distribution and species composition.

- Habitat avoidance and disruption of fish spawning potential from noise and vibration disturbances resulting from heavy equipment operation. Specific mitigation measures will be detailed in the Closure Plan, which will include measures to reduce potential impacts of noise and vibration, such as utilizing well-maintained equipment operated at optimum loads. Residual effects are characterized as Level I for Magnitude (no measurable residual effect to fish as fish will typically exhibit avoidance behavior); Level I for Geographic Extent (restricted to the Project footprint); Level I for Duration (effect is not measurable beyond the closure period); Level II for Frequency (effect is expected to occur intermittently); and Level I for Reversibility (effect is reversible). Although this effect will occur due to the unavoidability of noise and vibration from construction machinery, it is predicted to be not significant since it will be temporary, will have a low magnitude, and will occur intermittently.

**Fish Habitat**

Construction – Three potential effects to fish during the construction phase of the Project have been identified:

- Decreased habitat quality due to changes in water quality from increased sediment loads (increased turbidity/suspended solids) and/or release of deleterious substances (chemical/fuel spills). An EMP for the Project will include mitigation measures to minimize the potential for release of deleterious substances and include a Spill Response plan. Equipment used should be well-maintained and carry appropriately stocked spill kits. Operators will be trained in their use and have a spill response plan in place. Disturbed soils should be stabilized where possible to limit potential for erosion and sediment mobilization. Habitat compensation, as per the Fisheries Act, will be provided. With these mitigation measures applied, it is predicted that the residual effects can be characterized as: Level II for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level II for Geographic Extent (extends into the LSA); Level II for Duration (may extend up to 10 years after project initiation); Level I for Frequency (expected to occur infrequently); Level II for Reversibility (partially reversible). Although this effect could reasonably be expected to occur, it is predicted to be not significant.
- Physical disturbance to or loss of aquatic habitat by equipment working in or adjacent to a waterbody. Construction of mine infrastructure (e.g., ponds, pits, WSRA, roads) will result in a direct impact to 5.991 ha of aquatic habitat, primarily within Blackwater Creek and several tributaries. Mitigation of these effects will involve minimizing work within watercourses; scheduling works to occur during reduced risk periods (i.e., outside of spawning, hatching etc.); conducting fish salvage where possible. Appropriately sizing and embedding culverts or constructing bridges where appropriate. Habitat compensation, as per the *Fisheries Act* will be provided. Based on these mitigation measures, it is predicted that the residual effects can be characterized as: Level II for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level I for Geographic Extent (restricted to the Project footprint); Level III for Duration (may persist beyond 10 years after project initiation); Level III for Frequency (expected to occur frequently of continuously); Level II for Reversibility (partially reversible). Although this effect is likely to occur, it is predicted to be not significant, particularly due to its moderate magnitude and restricted geographic extent. Treasury will develop and implement fish habitat compensation, if necessary, as per *Fisheries Act* requirements.
- Potential decrease in habitat quality due to changes in water quality (e.g., increased turbidity/suspended solids, release of deleterious substances). The Project will include an EMP with mitigation measures to minimize potential for release of deleterious substances and include a Spill Response plan. Equipment used will be well-maintained and carry appropriately stocked spill kits. Operators will be trained in their use and will have a spill response plan in place. Disturbed soils will be stabilized where possible to limit potential for erosion and sediment mobilization. With these mitigation measures applied, it is predicted that the residual effects can be characterized as: Level II for Magnitude (has the potential to measurably

affect productive capacity of local fish habitat); Level ll for Geographic Extent (extends into the LSA); Level ll for Duration (may extend up to 10 years after project initiation); Level l for Frequency (expected to occur infrequently); Level ll for Reversibility (partially reversible). Although this effect could reasonably be expected to occur, it is predicted to be not significant. A Water Quality Monitoring program will be developed and implemented to comply with *Fisheries Act* and MMER.

Operations - Four potential effects to fish habitat during the operations phase of the Project have been identified:

- Physical disturbance to, or loss of, aquatic habitat by equipment working in or adjacent to a waterbody. Mine infrastructure (e.g., ponds, pits, WSRA, roads) will result in a loss of 5.991 ha of aquatic habitat. Most of the footprint will be cleared during construction but the total footprint will expand during operations. Mitigation will include: minimizing work within watercourses; scheduling works to occur during reduced risk periods (i.e., outside of spawning, hatching); and conducting fish salvage where possible. Habitat compensation, as per the *Fisheries Act* will be provided, as required. Based on implementation of these mitigation measures, the residual effects can be characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level l for Geographic Extent (restricted to the Project footprint); Level lll for Duration (may persist beyond 10 years after project initiation); Level lll for Frequency (expected to occur frequently of continuously; Level ll for Reversibility (partially reversible). Although this effect is likely to occur, it is predicted to be not significant, particularly since residual effects will be limited in geographic scale and will be partially reversible. Follow-up monitoring will include implementing fish habitat compensation as required by the *Fisheries Act.* The focus on the habitat compensation plan will be to avoid, minimize, and mitigate any residual serious harm to fish or fish habitat.
- Changes to water quality due to release of deleterious substances into a watercourse (e.g., sediment runoff, chemical/fuel spills). This effect could be within and beyond the Project footprint. The Project will include an EMP with mitigation measures to minimize the potential for release of deleterious substances and include a Spill Response plan. Equipment used will be well-maintained and carry appropriately stocked spill kits. Operators are to be trained in their use and will have a spill response plan in place. Disturbed soils will be stabilized where possible to limit potential for erosion and sediment mobilization. Habitat compensation, as per the *Fisheries Act* will be provided. Based on implementation of these mitigation measures, the residual effects can be characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level ll for Geographic Extent (extends into the LSA); Level lll for Duration (may extend beyond 10 years after project initiation); Level l for Frequency (expected to occur infrequently); Level ll for Reversibility (partially reversible). Although this effect is reasonably likely to occur, it is predicted to be not significant, particularly since residual effects will be limited in geographic scale, will occur infrequently and will be partially reversible. Follow-up monitoring will include development and implementation of a Water Quality Monitoring program to comply with the *Fisheries Act* and MMER*.* In the highly improbable event of a catastrophic failure of the TSF, the surface water quality of Blackwater Creek would be altered as the flood wave moves downstream. However, Wabigoon Lake would be affected for a very short period of time and the effect would be mostly localized to Kelpyn Bay. The initial emergency response would focus on preventing further movements of tailings solids to Blackwater Creek and intercepting the particles in suspension (silt fences). Additional mitigative measures would concentrate on removing the tailings solids dispersed on land to prevent potential future migration to water bodies as runoff.
- Changes to water quantity and subsequent habitat availability/quality downstream of the project footprint due to assumed altered surface water hydrology, particularly during natural low-flow periods. Mitigation will involve planning for on-site water management to maintain downstream water balance or to ensure the release of minimum flows to maintain a sufficient quality and quantity of fish habitat within affected channels. Following implementation of mitigation, the residual effects can be characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level ll for

Geographic Extent (extends into the LSA); Level lll for Duration (may extend beyond 10 years after project initiation); Level ll for Frequency (expected to occur intermittently); Level l for Reversibility (reversible). Although this effect is reasonably likely to occur, it is predicted to be not significant.

Closure - During the Closure Phase, two potential main effects on fish habitat are predicted:

- Physical disturbance to or loss of aquatic habitat by equipment working in or adjacent to a waterbody; reclamation works may include disturbance or alteration of aquatic features. Mitigation of these physical effects to habitat will involve development of a closure plan that provides measures to minimize disturbances to existing natural features and aims to restore watercourse and riparian areas to pre-mine conditions, where possible. The residual effect of physical disturbances following mitigation can be characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level l for Geographic Extent (restricted to the Project footprint); Level lll for Duration (may extend beyond 10 years after project initiation); Level l for Frequency (expected to occur infrequently); Level ll for Reversibility (partially reversible). It is expected that physical effects during closure will occur, but that they are predicted to be not significant. A closure plan will be approved by regulatory bodies. All follow-up and monitoring requirements will be met.
- Physical alteration of the landscape during reclamation could result in changes to water quality due to the release of deleterious substances into a watercourse (e.g., sediment runoff, chemical/fuel spills, and release of effluent). To mitigate effects on habitat due to deterioration in water quality, an EMP will be produced, which will contain measures to minimize the potential for the release of deleterious substances and which will include a Spill Response plan and an Erosion and Sediment Control Plan. Equipment used must be well-maintained and carry appropriately stocked spill kits. Operators will be trained in their use and have a spill response plan in place. Disturbed soils will be stabilized where possible to limit potential for erosion and sediment mobilization. Habitat compensation, as per the *Fisheries Act* will be provided, as required. The residual effect of physical disturbances following mitigation can be characterized as: Level ll for Magnitude (has the potential to measurably affect productive capacity of local fish habitat); Level ll for Geographic Extent (extends into the LSA); Level ll for Duration (may extend up to 10 years after project initiation); Level l for Frequency (expected to occur infrequently); Level ll for Reversibility (partially reversible). It is expected that physical effects during closure are reasonably likely to occur, but are predicted to be not significant. A closure plan will be approved by regulatory bodies and all follow-up and monitoring requirements will be met. In addition, Treasury will develop and implement a Water Quality Monitoring program to comply with the *Fisheries Act* and MMER.

## 12.4.2.13 Wetlands and Vegetation

**Wetlands**

Construction – Potential direct effects to wetlands during construction include loss of functions including filtration, water retention, and habitat for rare plants, reptiles/amphibians, furbearers, waterfowl, and ungulates such as moose that graze in wetland areas. Treasury has minimized the amount of wetland disturbance required for the Project by optimizing pit design and siting Project infrastructure in previously disturbed areas (e.g., use of existing access roads). The residual effect of loss of wetland functionality during construction have been categorized as Level I for Magnitude (localized loss of a non-limiting resource), Level I for Extent (restricted to Project footprint), Level III for Duration (effect is permanent), Level 1 for Frequency (infrequent occurrence), and Level III for Reversibility (permanent). Permanent loss of up to 39.5 ha of wetlands would occur as a result of Project development. However, as wetlands comprise a dominant land cover type in this region (removed habitat constitutes approximately 7.4% of available habitat in the LSA) and are not limiting in terms of water quality or habitat, these losses are not expected to be locally or regionally significant. Furthermore, the wetlands are not located in an area that is bound to be highly developed for other projects, so these losses are not expected to contribute to a cumulatively significant loss.

Operations and Closure – As a result of being found in topographical depressions, wetlands may become the endpoint for contaminated runoff from mine operations. As waterfowl and wildlife (e.g., reptiles/amphibians) are attracted to wetlands for foraging and breeding, concentrations of contaminants could constitute an attractive nuisance to such species. This effect will be offset by diverting runoff to a tailings pool, with a fenced perimeter and possibly a screen over the top to prevent entry by migrating waterfowl. If contaminated runoff cannot be diverted to a tailings pool, wetlands receiving contaminated runoff would be monitored and isolated if contaminant levels exceed regional thresholds. The residual effect on wetlands during operations has been categorized as Level I for Magnitude (not expected to be measurable), Level I for Extent (restricted to Project footprint), Level II for Duration (may extend up to 10 years after initiation of operations), Level II for Frequency (could occur during rain or snowfall events), and Level I for Reversibility (readily reversible). The residual effect is expected to be not significant. Follow-up activities will include EEM monitoring.

The residual effect on wetland during closure has been categorized as Level II for Magnitude (has potential to affect hydrological function and wildlife/fish habitat), Level II for Extent (extends into the LSA), Level II for Duration (may extend up to 10 years after initiation of operations), Level I for Frequency (infrequent), and Level II for Reversibility (partially reversible). The residual effects is expected to be not significant. Follow-up activities will include EEM monitoring.

**Vegetation Species at Risk, Species of Special Concern and Provincially Rare Species**

Potential direct effects to floating marsh marigold include habitat loss due to habitat destruction (e.g., wetlands). Indirect effects include the potential change in the abundance and health of any populations that are downstream from the Project resulting from changes to outflow water quality. Mitigation measures outlined in the EMP are designed to reduce the likelihood of occurrences in increased in TSS or chemicals of concern in receiving waters. EEM studies will be conducted during construction to monitor potential changes in the water quality of receiving waters resulting from construction activities. During operation, release of tailings storage facility effluent could result in exceedances of applicable federal and provincial regulations and guidelines; however, secondary water treatment (reverse osmosis) of effluent is expected to meet limits based on PWQOs.

During construction and operations, the potential residual effects have been characterized as Level I for Magnitude (no measureable effect on populations), Level II for Extent (extends into LSA), Level II for Duration (may extend up to 10 years after initiation of operations), Level I for Frequency (infrequent), and Level II for Reversibility (partially reversible). During closure, the potential residual effects have been characterized as Level I for Magnitude (no measureable effect on populations), Level II for Extent (extends into LSA), Level II for Duration (not measurable beyond closure period), Level I for Frequency (infrequent), and Level II for Reversibility (partially reversible). Application of appropriate avoidance, minimization, and mitigation measures should result in non-significant residual effect.

## 12.4.3 Potential Residual Effects to Socio-economic Valued Components

### 12.4.3.1 Land Use

**Land and Resource Use**

The primary potential Project residual effect on the land and resource use during all phases of the Project is the loss of land area to the mine footprint. Treasury has minimized the Project footprint by optimizing pit design and siting Project infrastructure in previously disturbed areas (e.g., use of existing access roads). The residual effects of the obstruction and loss of land has been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level I for Geographic Extent (confined to the Project footprint), Level III for Duration (likely to persist beyond closure), Level III for Frequency (expected to occur regularly or continuously), and Level III for Reversibility (not reversible). The loss and obstruction of area will be reversed following closure to the extent possible (directly related to the successful reclamation); as a result, it should not have a significant residual effect.

Additional potential residual effects during all phases of the project include change in local ambience due to noise, vibration and decreased aesthetics at the mine site, as well as increased traffic. To minimize the potential for effects in local ambience, Treasury will establish and implement Noise Management Plans, Emergency and Spill Response Plans and will ensure ongoing communication with local stakeholders to minimize the changes in the landscape and environment. The residual effects in local ambience have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level II for Geographic Extent (confined to the LSA), Level II for Duration (residual effect throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term). The residual effect is predicted to be not significant with an expected decrease once closure commences. Regarding increased project traffic and improved access, Treasury will establish and implement a Transportation and Access Management Plan. The residual effects associated with Project traffic and improved access have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to RSA), Level II for Duration (residual effect throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long term). The residual effect is predicted to be not significant based on the improved access and reduced travelling time to and from the site.

**Transportation**

<u>Construction</u> – The primary potential Project residual effect on transportation during construction is the increased traffic volume to delivery equipment and materials needed for the mine site development. Treasury will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). The increased traffic will be reflected in average daily increases during construction that with appropriate mitigation and monitoring strategies should not have a significant effect.

<u>Operations and Closure</u> – Potential Project residual effects on the transportation will be observed as increased traffic volumes during operations and a decline over the closure phase. The additional wear and tear of road surfaces will be minimized with ongoing monitoring and enhanced maintenance (e.g., grading, dust suppression, snow removal). The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term). The residual effect is predicted to be not significant based on the implementation of management and mitigation measures identified.

## 12.4.3.2 Social Factors

**Population Demographics**

<u>Construction</u> – Potential Project residual effects on population demographics during the construction phase is the immigration of job seekers and their dependents. The changes related to the characteristics of that population (e.g., ethnicity, age, gender) are directly dependent on the magnitude of the population change. Treasury will develop training programs for unemployed and under employed resident and non-resident workers. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through

the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). The residual effect is predicted to be not significant based on the direct and indirect employment positions filled by a combination of non-residents and existing residents.

Operations – Potential Project residual effects on population demographics during the operations phase will continue to be the immigration of job seekers and their dependents. The long-term employment opportunities could promote the relocation of population closer to the Project. Although mitigation measures will look to employ the local population, it is recognized that skilled workers might need to be recruited from outside of the LSA/RSA. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term). The residual effect is predicted to be not significant based on the direct and indirect employment positions filled by a combination of non-residents and existing residents.

Closure – The primary potential Project residual effects on population demographics during the closure phase is the out-migration of job seekers and their dependents. As operations wind down, the workforce will start to decrease in the LSA/RSA. The changes in demographics will be dependent on the availability of other work opportunities available at the time in the region. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level III for Reversibility (not reversible). The residual effect is predicted to be not significant based on project labour demand and mitigation measures aimed at ensuring that an adequate workforce is available to meet proposed Project requirements without affecting the regional population.

**Education**

Construction – The primary potential Project residual effect on education during construction is largely related to changes in population and, thus, in demands for local and regional education services. Although governments are responsible for planning and implementing social programs and delivering public services that address social effects, Treasury will continuously communicate the appropriate information (e.g., the timing and the communities in which new residents may locate) to the school district(s) to assist with their resource planning process. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). The increase in student enrolment due to changes in in-and-out-migration should not have a significant effect.

Operations and Closure – Potential Project residual effects on education will be represented by demand increase during operations and a decline on enrolment over the closure phase. Treasury will continue to communicate the appropriate information to the school district(s) to assist with their resource planning process and make clear the education requirements needed for employment on the site to discourage dropouts. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term) (Tables 6.4.7 and 6.4.8). The residual effect is predicted to be not significant based on the offset of in-migration during the operations phase to any potential out-migration after construction is completed, and the small decline during closure as the result of workforce relocation.

**Regional infrastructure and services**

Construction – Potential residual effects on regional infrastructure and services during construction will be largely attributable to changes in population, and the demands for local and regional public services. In turn, demand for regional services is linked to the expected increases in population. Whether it is new home construction, rental activity, or securing temporary accommodations in hotels, motels or RV/camp sites, these new residents will require utilities, housing, communication services, and recreation facilities. Treasury will aim their mitigation measures at closely and frequently communicating with government agencies to ensure that the appropriate information (e.g. proposed transportation volumes, potential variation to the local population) are considered in the planning of future services and response capabilities. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). The increase in traffic volumes, population and the reflection of these on the demand for services are not expected to have a significant effect based on the construction period and other VC mitigation efforts to utilize local workforce.

Operations and Closure – Potential Project residual effects on the regional infrastructure and services will be observed in the demand changes during operations and closure phase. Treasury will continue to communicate with the various service providers to ensure that the appropriate information (e.g., transportation volumes, site operations, and the variation to the local population during operation and closure) are considered and managed. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term). The residual effect is predicted to be not significant based on the low population increase during operations and slight reduction during closure.

**Housing**

Construction – Potential residual effects on housing during construction will be largely attributable to changes in population due to non-residents who relocate. Treasury will work with local and regional governments to minimize the in-migration workforce where possible. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period) (Table 6.4.6). The increase of housing demand is not expected to have a significant effect based on residents working on the proposed Project assumed to already have housing.

Operations and Closure – Potential Project residual effects on housing will reflect population changes during the operations and closure phase. Treasury will continue to work with local and regional government to minimize in-and-out-migration of the workforce where possible. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term). The residual effect is predicted to be not significant based on the expected slight incremental demand (over a long period of time) during the operations phase and the return of demand to base conditions after Project closure. The expected fluctuation is expected to be normal, product of resource development trends.

**Crime**

Construction – Potential Project residual effects on crime during construction is the increase in demand for public safety services due to traffic volumes. Treasury will work with public safety services to develop safety and work policy guidelines for mine workers. Mitigation measures at the Project site can include contracted security services, which would help ensure a secure and safe worksite environment; a policy of no alcohol or drugs on-site; policies and guidelines for ensuring a respectful workplace. These measures would assist in mitigating the requirement of local policing resources to enforce criminal code offences that may occur. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). With the application of appropriate mitigation and monitoring strategies, the crime (demand for public safety services) residual effects of the Project should not be significant.

Additional potential residual effects during project construction include effects related to behavior of a non-local labour force and income/spending levels. To minimize the potential for effects, Treasury will work with local agencies to assist in monitoring community wellbeing and take corrective actions where appropriate. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). The residual effect is predicted to be not significant and could have positive effects with the application of appropriate mitigation and monitoring strategies.

Operations and Closure – Potential Project residual effects on crime during operations and closure would be reflected in the changes in demand for public safety services. Treasury will continue to work with public safety services to develop safety and work policy guidelines for mine workers during operations, and in the incorporation of employment and wages decrease variables in management initiatives. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term). With the application of appropriate mitigation and monitoring strategies residual effects of the Project should not be significant.

To minimize the potential for effects related to behavior of a non-local labour force and income/spending levels during operations and closure, Treasury will work with local agencies to assist in monitoring community wellbeing and take corrective actions where appropriate as well as develop a mine closure plan that identifies strategies and actions to aid residents. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term) (Tables 6.4.7 and 6.4.8). The residual effect is predicted to be not significant based on the overall economic and social wellbeing achieved during operations and the implementation of an effective closure plan.

### 12.4.3.3 Economic Factors

**Employment**

Construction – Potential residual effects on employment during construction will be largely attributable to Project spending generating the need for services and workers. The Project will provide direct construction employment and will create employment for workers in industries that will supply goods and services needed for the mine construction. These direct employment opportunities are expected to occur in the local and regional context based on the existing workforce, and regional businesses goods and services with experience in the construction and mining industries. Treasury will develop and implement employment practices that give preference to local and regional labour where possible. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). The potential residual effects of Project employment would vary among the various communities in the region. Generally, for construction, effects of the proposed Project on employment are characterized as significant in magnitude and positive and reasonably likely to occur.

<u>Operations and Closure</u> – Potential Project residual effects on employment will be observed in the decrease of unemployed population during the operations phase and an increase during the closure phase. Treasury will look to hire and train the vast majority of its operational and maintenance workforce from the local population around Wabigoon, Dryden, and neighbouring First Nation communities. Training would be done through in-house programs and in conjunction with local and regional educational institutes. Closure mitigation measures will focus on working with the affected communities and government agencies to develop a mine closure plan that includes a strategy for buffering the effects of eventually losing direct mine-related jobs and assist in the placement of potentially affected employees. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the RSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term).

**Income**

<u>Construction</u> – Potential Project residual effects on income during the construction phase will be reflected in the generation of income for employees and supply industries due to project spending. However, there will be considerable variation in income depending on the type of job. The extent of the effects of the Project will be influenced by Treasury's approach to local and regional hiring and procurement. Generally, pay scales for jobs in the mining sector in Ontario are significantly higher than all other manufacturing jobs. The effects of the proposed Project will be positive and significant to local and regional areas as Treasury has stated local hiring and purchasing policies and a demonstrated track record in these areas. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level II for Geographic Extent (confined to the LSA), Level I for Duration (extends through the construction phase), Level III for Frequency (expected to occur regularly or continuously), and Level I for Reversibility (reversible over a relatively short period). No adverse effect is expected.

<u>Operations</u> – Potential Project residual effects on income during the operations phase will continue to be the generation of income for employees and supply industries due to project spending with variations depending on the type of job and services required. The effects are positive so no mitigation is necessary. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level II for Geographic Extent (confined to the LSA), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long-term).

<u>Closure</u> – Potential Project residual effects on income during the closure phase is the lower direct, indirect and induced income products of the cessation of mining operations. Nearly all of the employment opportunities for residents of the LSA and RSA will cease during closure affecting income. Mitigation measures will focus on working with the affected communities and government agencies to develop a mine closure plan that will assist in buffering the effects of an eventual mine closure on income. The residual effects have been categorized as Level I for Magnitude (might or might not be detectable, but is within the normal range of variability), Level III for Geographic Extent (extends to the Province), Level II for Duration (throughout operations and closure), Level III for Frequency (expected to occur regularly or continuously), and Level II for Reversibility (reversible in the long term). The significance of potential residual effects of Project employment would vary among the various communities in the study area in terms of spatial extent, magnitude, and significance. With the application of appropriate mitigation and monitoring strategies, the residual effects of the Project should not be significant and reasonably expected to occur.

**Economic Development**

<u>Construction</u> – Potential residual effects on economic development during construction will be largely attributable to increases in the Gross Domestic Product, employment and government revenues. The proposed Project would involve directly purchasing labour, goods, and services and, in turn, tax revenues distributed between the federal,

provincial and local (municipal and regional) governments. The overall effects of construction of the proposed Project are all positive and require no mitigation.

Operations and Closure – Potential residual effects on economic development during the site operation and closure will be largely attributable to changes in the Gross Domestic Product, employment and government revenues. The overall effects of operation of the proposed Project are all positive and require no mitigation although mine closure will result in the net loss of operating jobs and income.

## 12.4.3.4 Heritage Resources

**Archeological sites**

Potential direct residual effects results from land altering activities impacting undocumented archaeological sites. The indirect Project residual effect results from increased activity in the LSA from the increase in people and related activities and their effect on undocumented archaeological sites. Construction would have the greatest direct impact; however, any land-altering activity during operations and closure phases could impact archaeological sites.

An archaeological assessment of the project site has not identified any sights of archaeological significance or interest. Nor has consultation with aboriginal communities resulted in any sites of interest or importance being identified. Consequently, no documented archaeological sites would be affected by the proposed Project. With the application of appropriate mitigation and monitoring strategies, the residual effects of the Project should not be significant. Treasury will develop and implement the appropriate management and mitigation measures (i.e., Archaeological and Cultural Heritage Resource Management Plan).

**Historic heritage sites**

The direct Project residual effect results from land altering activities impacting historic heritage sites. The indirect Project residual effect results from increased activity from the increase in people and related activities and their effect on historic heritage sites. Construction would have the greatest direct impact; however, any land-altering activity during operations and closure phases could impact historic heritage sites.

No historic heritage sites are identified within the proposed Project. No documented historic heritage sites would be affected by the proposed Project. With the application of appropriate mitigation and monitoring strategies, the residual effects of the Project should not be significant. Treasury will develop and implement the appropriate management and mitigation measures (i.e., Archaeological and Cultural Heritage Resource Management Plan).

## 12.4.3.5 Aboriginal Peoples

Health Effects

Aboriginal communities have identified the potential impacts of the Project on water as a concern. This concern is applicable to both drinking water sources as well as the potential impacts that alteration to water quality could have on fish and fish habitat. The possibility of mercury contamination of waterways downstream from the Project area was raised as a particular concern.

During construction, sediment loading or accidental release of deleterious substances (e.g., spills) to receiving waters could result in exceedances of applicable federal and provincial regulations and guidelines. These exceedances, however, are not expected to be measureable beyond the construction period and are expected to occur infrequently. Mitigation measures outlined in the EMP are designed to reduce the likelihood of occurrences in increased in TSS or chemicals of concern in receiving waters. EEM studies will be conducted during construction to monitor potential changes in the water quality of receiving waters resulting from construction activities. The potential residual effect has been characterized as Level II for Magnitude (residual effect in receiving waters could exceed regulations), Level II for Extent (could extend into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (infrequent), and Level I for Reversibility (readily reversible). The residual effect is predicted to be not significant.

During operation, release of TSF effluent could result in exceedances of applicable federal and provincial regulations and guidelines; however, secondary water treatment (reverse osmosis) of effluent is expected to meet limits based on PWQOs. The potential residual effects have been characterized as Level I for Magnitude (no exceedances), Level I for Extent (limited to Project footprint), Level I for Duration (not measurable beyond construction), Level I for Frequency (infrequent), and Level I for Reversibility (readily reversible). Thus, the remaining potential effects to water quality during operation are considered not to be significant if appropriate mitigation measures are implemented.

Similar to construction, during closure sediment loading or accidental release of deleterious substances to receiving waters could result in exceedances of applicable federal and provincial regulations and guidelines. These exceedances, however, are not expected to be measureable beyond the construction period and are expected to occur infrequently. Mitigation measures outlined in the EMP are designed to reduce the likelihood of occurrences in increased in TSS or chemicals of concern in receiving waters during Project closure. The potential residual effect has been characterized as Level II for Magnitude (residual effect in receiving waters could exceed regulations), Level II for Extent (could extend into the LSA), Level I for Duration (not measurable beyond construction), Level I for Frequency (infrequent), and Level I for Reversibility (readily reversible). The residual effect is predicted to be not significant.

A screening level risk assessment (SLRA) to evaluate the potential for human health and ecological risk has been completed for the Project. The human health component of the SLRA focused on two contaminants of concern (COC; mercury and lead) and two human exposure pathways to contamination: direct soil contact (ingestion, dermal contact, and dust inhalation) and surface water (ingestion, dermal contact). As detailed within the Screening Level Risk Assessment, exposure pathways were defined for wildlife that is seen as valued components (moose, deer, hare, and ruffed grouse). These exposure pathways included direct soil/tailings contact, ingestion of soil/tailings (while foraging), ingestion of surface water, and the ingestion of food (i.e., plants, soil invertebrates). Hazard quotients (HQ) were calculated for the selected wildlife receptors based on the ratio of the estimated exposure to the toxicity reference value (TRV) to evaluate potential risk from exposure to mine-related containments of concerns.

Based on the calculated HQs, estimated risks for wildlife were below risk thresholds (1.0) for hare, moose, and deer exposed to mercury and lead for the Operational Phase. For grouse, the HQ for mercury was below risk thresholds for the Operational Phase. However, the HQ for lead was just above the risk threshold (HQ = 1.2) for grouse exposed to lead from the ingestion of tailings and food (plants and soil invertebrates) from the tailings during the Operational Phase. The HQ falls below the risk threshold when the assumption is made that grouse obtain one third rather than one half of their food from plants and soil invertebrates living on the tailings. These HQ were derived using a very small set of COC concentrations in tailings, and modelled surface water concentrations. In summary, the results of the human health component of the SLRA indicated that risk estimates did not exceed the acceptable threshold for both mercury and lead during the operations phase of the Project.

Gathering of Country Foods and Traditional Plant Materials

Aboriginal communities have expressed concern that the Project could adversely impact their ability to gather plants and berries. Specific types or plants and berries that are of interest have not been specified, nor have any specific locations from which plants and berries been traditionally gathered been identified.

Blueberry patches within the RSA that are known to Treasury have been identified. As locations have not been identified within the Project site, Treasury has identified additional areas of the property that provide the natural conditions for blueberry occurrence. This has been determined via Forest Resource Inventory (FRI) compiled by the OMNRF, and quantifying area via suitable ecosite area as defined by the OMNRF. In addition to this, Treasury has identified known sources of blueberries within the RSA. These sites has been documented though observations on site, and communications with public stakeholders. Potential effects to blueberry sites are minimal within the context of the RSA. FRI inventory data indicates a large amount of land that supports potential blueberry habitat and that Project construction will only result in the loss of 0.8% of potential blueberry habitat. In addition to this the Dryden Forest Management Plan has harvested a number of sites in proximity to the Project site within 2012 to 2013. It is expected that blueberries will continue to be available on these harvested areas for the next few years, until crown closure of the regenerating forest occurs. Future logging in this area will result in ongoing picking opportunity.

Existing chanterelle picking areas will not be directly affected though Project development, although they will not be available to the public due to safety concerns. Upon closure of the Project this site will be available to the public and First Nation communities. Known sites within RSA and LSA have been documented though observations on site and communications with public stakeholders.

Some of the documented wild rice locations fall within the discharge area of the Project. However, the Project has been designed to discharge all effluent at PWQO guidelines. These guidelines are designed to protect aquatic life at all exposure levels. Therefore, it will not adversely impact the gathering of wild rice within the local and regional area.

The residual effects on the gathering of country foods has been characterized as Level 1 for Magnitude (no measurable effect on country food abundance and distribution), Level I for Extent (restricted to Project footprint), Level III for Duration (could extend beyond closure period), Level III for Frequency (regular or continuous), and Level II for Reversibility (partially reversible). The residual effect is predicted to be not significant. No follow-up activities are required.

Hunting, Trapping, and Fishing

Potential impacts to hunting, trapping and fishing that could result from the Project have been identified by Aboriginal communities as a concern.

The Project is located within the Hartman and Zealand Townships in the Kenora Mining Division. The property has a total area of 4,976 ha and is comprised of 137 unpatented mining claims on 4,064 hectares and 20 patented mining claims on 912 ha. Crown land accounts for 43.4 ha, or 1.11% of the total mine site area. Crown land to the east of the Project accessed via Dump Road or the Trans-Canada highway will not be disturbed by the Project will remain available for hunting. The immediate mine site area will be closed to the public due to safety concerns.

The residual effects on hunting and trapping have been characterized as Level I for Magnitude (no measurable effect on hunting and trapping opportunities), Level I for Extent (restricted to Project footprint), Level III for Duration (residual effect could extend beyond closure period), Level III for Frequency (regular or continuous), and Level II for Reversibility (partially reversible). Therefore, based on the private land holdings and the SLRA it has been determined that the Project will have no significant effect to hunting and trapping activities within the LSA. Regionally hunting and trapping can continue as per the limits imposed by the OMNRF.

The Project has been designed to discharge all effluent at PWQO guidelines. PWQO's are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure. In addition to discharging all effluent at the appropriate standards, Treasury will initiate EEM as per the MMER. The EEM studies will consist of:

- Effluent and water quality monitoring studies comprising effluent characterization, sub-lethal toxicity testing and water quality monitoring (MMER, Schedule 5, Part 1); and
- Biological monitoring studies in the aquatic receiving environment to determine if mine effluent is having an effect on fish, fish habitat or the use of fisheries resources (MMER, Schedule 5, Part 2)

The level of Wabigoon Lake is controlled by a dam located at the Domtar pulp mill site in Dryden and operated by Domtar. Similarly, the level of Thunder Lake is controlled by a dam located within the boundary of Aaron Provincial Park and operated by the OMNRF. Based on anticipated discharge levels as detailed with the Water Management Plant completed by Lycopodium, it is anticipated that the Project will not impact the lake level of Wabigoon Lake or Thunder Lake.

The residual effects on fishing have been characterized as Level I for Magnitude (no measurable effect on fishing opportunities), Level I for Extent (restricted to Project footprint), Level III for Duration (could extend beyond closure period), Level III for Frequency (regular or continuous), and Level II for Reversibility (partially reversible). Thus, the Project will not cause any significant effects to the valued aquatic components identified by Aboriginal stakeholders.

# 13.0 CUMULATIVE EFFECTS

In accordance with CEAA 2012, Treasury evaluated the potential for cumulative effects on VCs defined for the Project in the following categories: mining and exploration, forestry, transportation, electricity, and municipalities. The cumulative effects assessment was conducted at three spatial scales: LSA, RSA, and a 40-km radius surrounding the Project. There are very few projects (existing, planned, or proposed) identified within the cumulative effects study areas of a scale that, if executed in accordance within current regulatory frameworks, would be expected to contribute to a cumulative negative effect on the VCs defined for the Project. Those few cumulative effects that have been identified are positive or neutral (i.e., not significant).

# 14.0 MONITORING AND ENVIRONMENTAL MANAGEMENT PLANS

The Federal EIS guidelines require the development of an environmental monitoring framework for compliance and effects monitoring, considerations in this plan include comments provided by government agencies, Aboriginal groups, and other stakeholders. Detailed EMPs will occur through consultation with Federal and Provincial government agencies, Aboriginal groups, the public and other stakeholders. The EMP will be consistent with the information presented in the EIS, all EMP and monitoring plans will follow all applicable legislation, regulations, industry standards, documents and legislative guides will be used in the development of the monitoring program.

In accordance with the Canadian Environmental Assessment Act, 2012 the purpose of the EMP is to:

- Verify the accuracy of the EA of a designated project; and
- Determine the effectiveness of any mitigation measure.

In addition, the EMP is expected to:

- Provide for adaptive management
- Communicate the EMP results to shareholders of Treasury; and
- The EMP applies to the construction, operation, closure, and post-closure phases of the Project.

The EA Report provides a framework for components to be included in the EMP. These include:

- Verifying predictions of environmental effects, as well as residual impacts;
- Determining the effectiveness of mitigation measures as they relate to environmental effects in order to modify or implement new measures where required;
- Supporting the implementation of adaptive management measures to address previously unanticipated adverse environmental effects; and
- Verifying measures identified to prevent and mitigate potential adverse effects of the Project.

Treasury expects that it will hold responsibility in conducting all EMP activities, that the involved Federal and Provincial agencies and authorities will be responsible for ensuring implementation of the EMP, with input from involved Aboriginal groups and respective stakeholders.

Each aspect of the detailed EMP will provide: monitoring context and objectives, methods for measuring effects, adaptive management measures, and reporting of results. The EA Report provides a framework for the development of environmental management plans. It is anticipated the environmental management system that will be finalized though the EA process will consider a number of areas as significant environmental aspects of the Project including:

- Recycling and waste reduction;
- General waste management;
- Mine Rock Management;
- Water Management;
- Hazardous materials management;
- Fuel handling and storage;
- Fugitive dust management;
- Sound management;
- Wildlife management;
- Traffic management;
- Cultural awareness;
- Heritage management;
- Emergency response; and
- Response to accidents and malfunctions.

Aspects that have increased or have the potential to cause significant adverse environmental effect will have additional operational and management controls. The details of these EMP will be developed in consultation with Federal and Provincial governments, Aboriginal communities, and public stakeholders.