3.0 PROJECT DESCRIPTION

This section provides a description of the proposed Goliath Gold Project (the Project) phases, components, and undertakings.

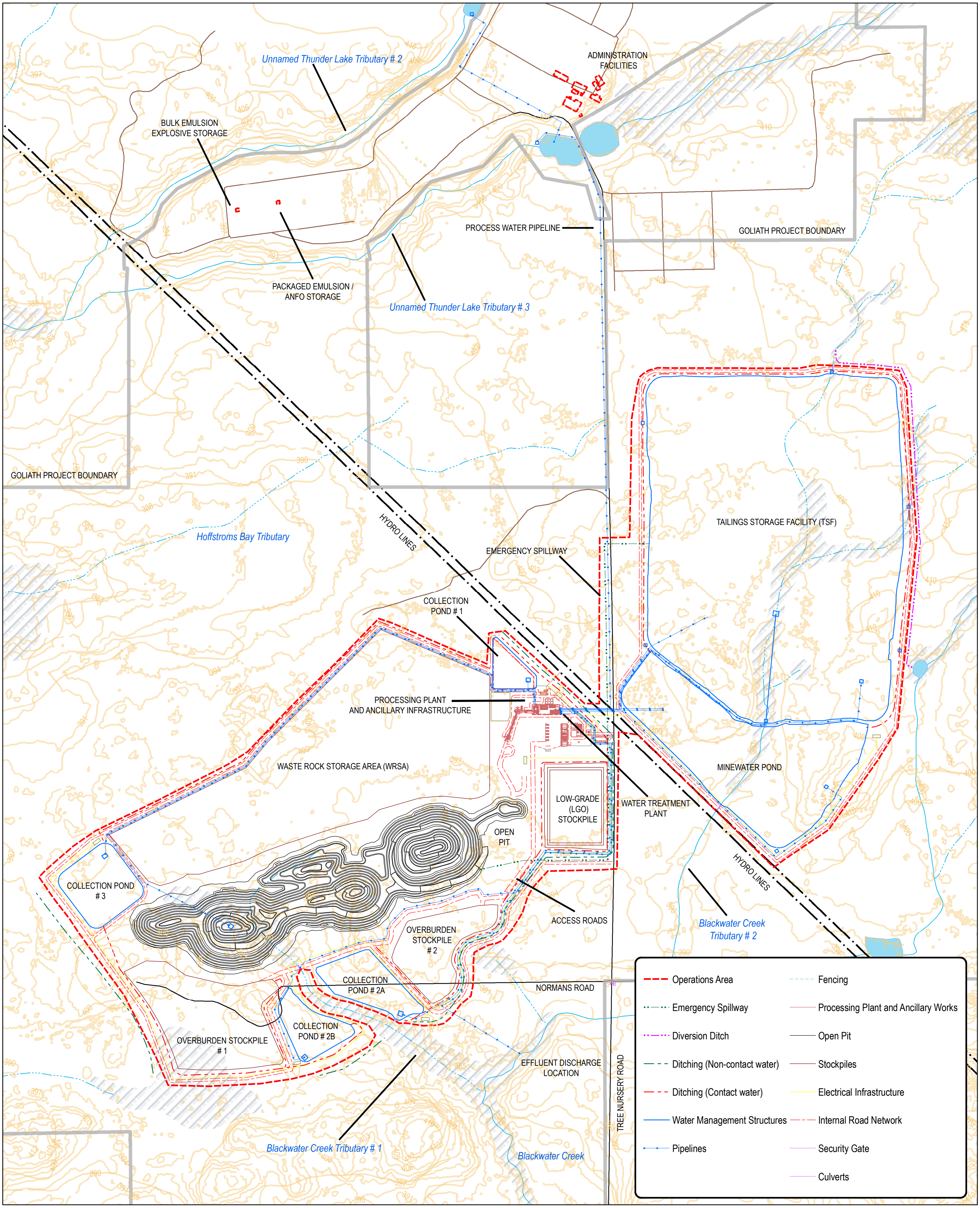
The mine layout places most mine-related facilities in close proximity to the proposed open pit, and to the extent possible, on private lands owned by Treasury Metals. The Operations Area (Figure 3.0-1A) will be surrounded by a perimeter ditch, which will prevent direct discharges to the environment as described in Sections 3.16.1 and 3.16.2. The overall Project footprint will cover approximately 188 ha during the maximum of extent of operations with the entire footprint on Treasury Metals lands that are either patented or leased (mining rights and surface rights). The site plan shown in Figure 3.0-1A shows the preferred alternatives for Project components, as described in Section 2. Figure 3.0-1B provides an illustration of the Plant site details, while the layout of the Administration Area is provided in Figure 3.0-1C. At closure, Treasury Metals will reclaim the site as described in Section 3.14. Two options are discussed in the EIS for closure, one using a dry cover for the closure of the tailings storage facility (TSF) (see Figure 3.0-1D), and one using a wet cover for the closure of the RSF (see Figure 3.0.1E).

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.

3.1 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 Metals 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 Ontario Ministry of Natural Resources and Forestry (MNRF) established a tree nursery facility, located north of the mineral deposit, which was sold to Treasury Metals in 2011 and houses the Project office (Figure 3.1-1).



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

General Arrangement
Operations Phase

Figure 3.0-1A REV.01

TREASURY METALS Inc.

DESIGN:	MP	03/27/2017
GIS:	MP	03/27/2017
CHECK:	MW	03/27/2017
REVIEW:	DB	03/27/2017

Hydro Line
Natural Gas Pipeline
Railway
Provincial Parks
Expressway / Highway
Local Road
Resource / Recreation Road
Contours (3 meters)
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:16,000

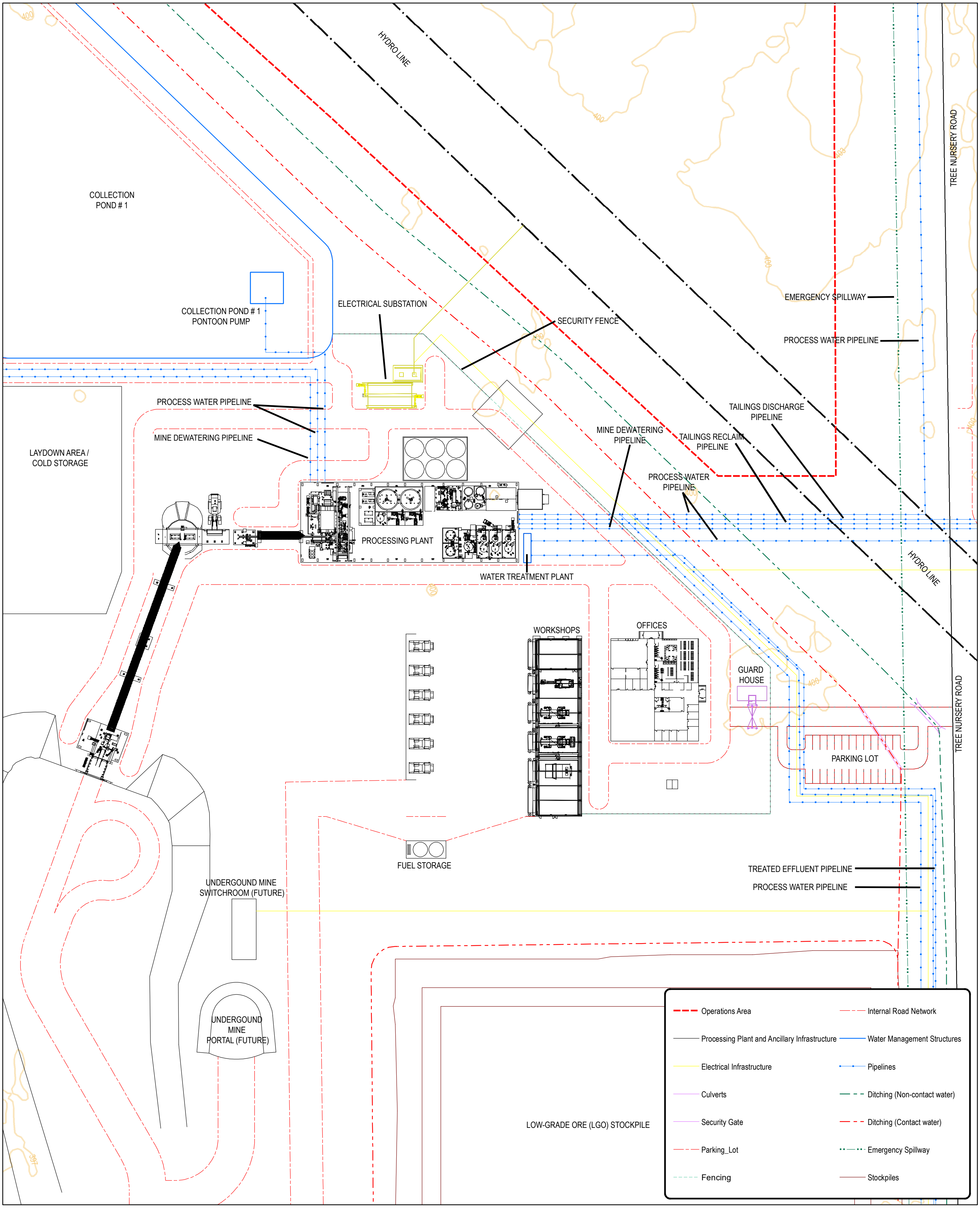
NAD 83, UTM Zone 15

N

0 750
Meters

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
Harvest will be contained within operations area.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	
General Arrangement Operations Phase (Plant Site Details)	DESIGN: MP 03/27/2017 GIS: MP 03/27/2017 CHECK: MW 03/27/2017 REVIEW: MW 03/27/2017	
Figure 3.0-1B	REV.01	

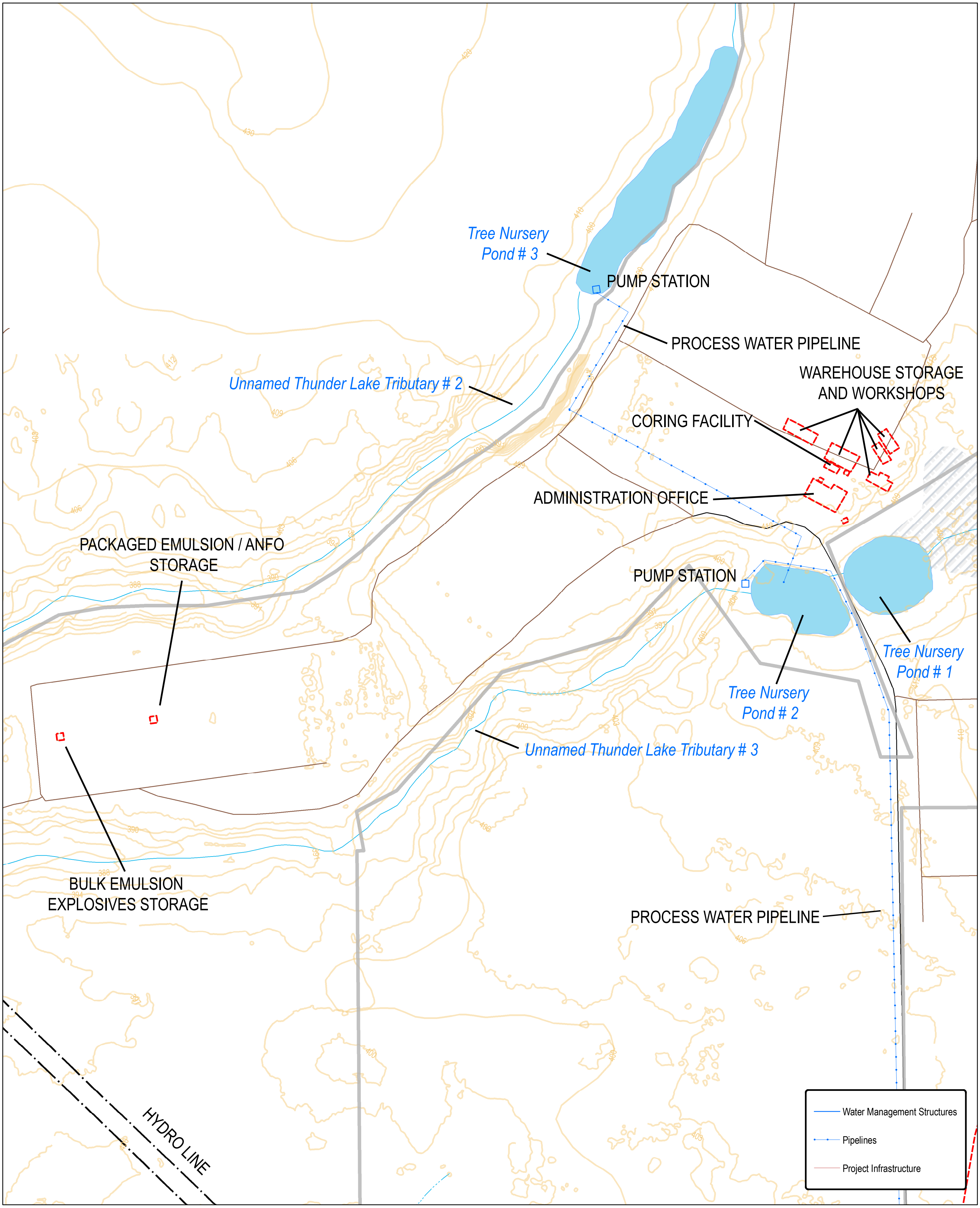
Hydro Line — Natural Gas Pipeline — Railway — Provincial Parks — Expressway / Highway — Local Road — Resource / Recreation Road — Contours (3 meters) — Waterbody — Intermittent Streams — Permanent Streams — Wetland

SCALE 1:2,000 — NAD 83, UTM Zone 15 — N

0 — 100 Meters

Base Data: Treasury Metals Inc., LIO Database, KBM Resources Group

Notes: Harvest will be contained within operations area.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

General Arrangement
Operations Phase (Administration Area)

Figure 3.0-1C | REV.01

DESIGN: MP 03/27/2017
GIS: MP 03/27/2017
CHECK: MW 03/27/2017
REVIEW: MW 03/27/2017

Hydro Line
Natural Gas Pipeline
Railway
Provincial Parks
Expressway / Highway
Local Road
Resource / Recreation Road
Contours (3 meters)
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:7,000

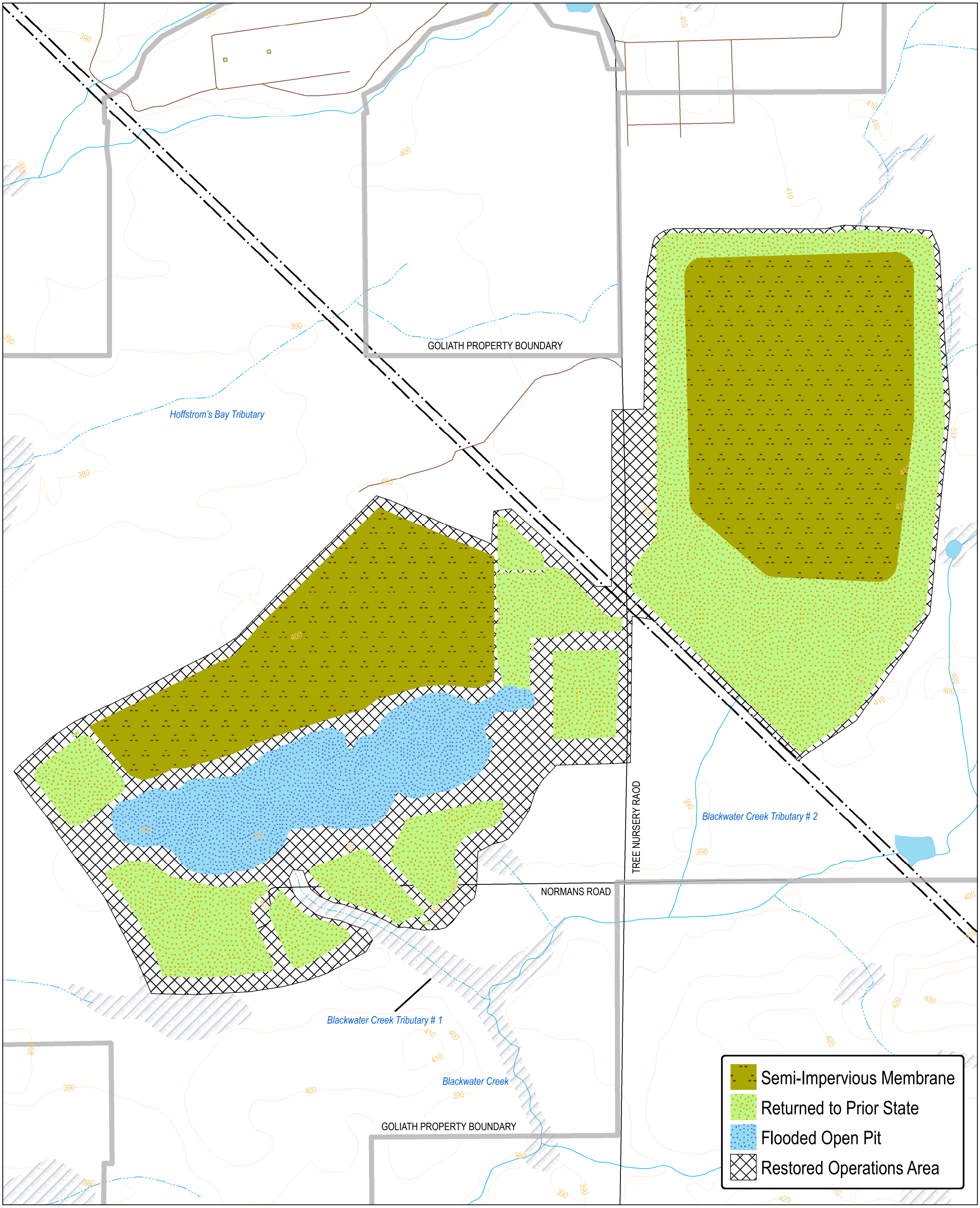
NAD 83, UTM Zone 15

N

0 300
Meters

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
Harvest will be contained within operations area.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Project Configuration
Post-Closure (Dry TSF Cover)

Figure 3.0-1D REV.01

DESIGN:	MP	03/27/2017
GIS:	MP	03/27/2017
CHECK:	MW	03/27/2017
REVIEW:	MW	03/27/2017

Hydro Line
Natural Gas Pipeline
Railway
Expressway / Highway
Local Road
Resource / Recreation Road
Provincial Parks
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:15,000

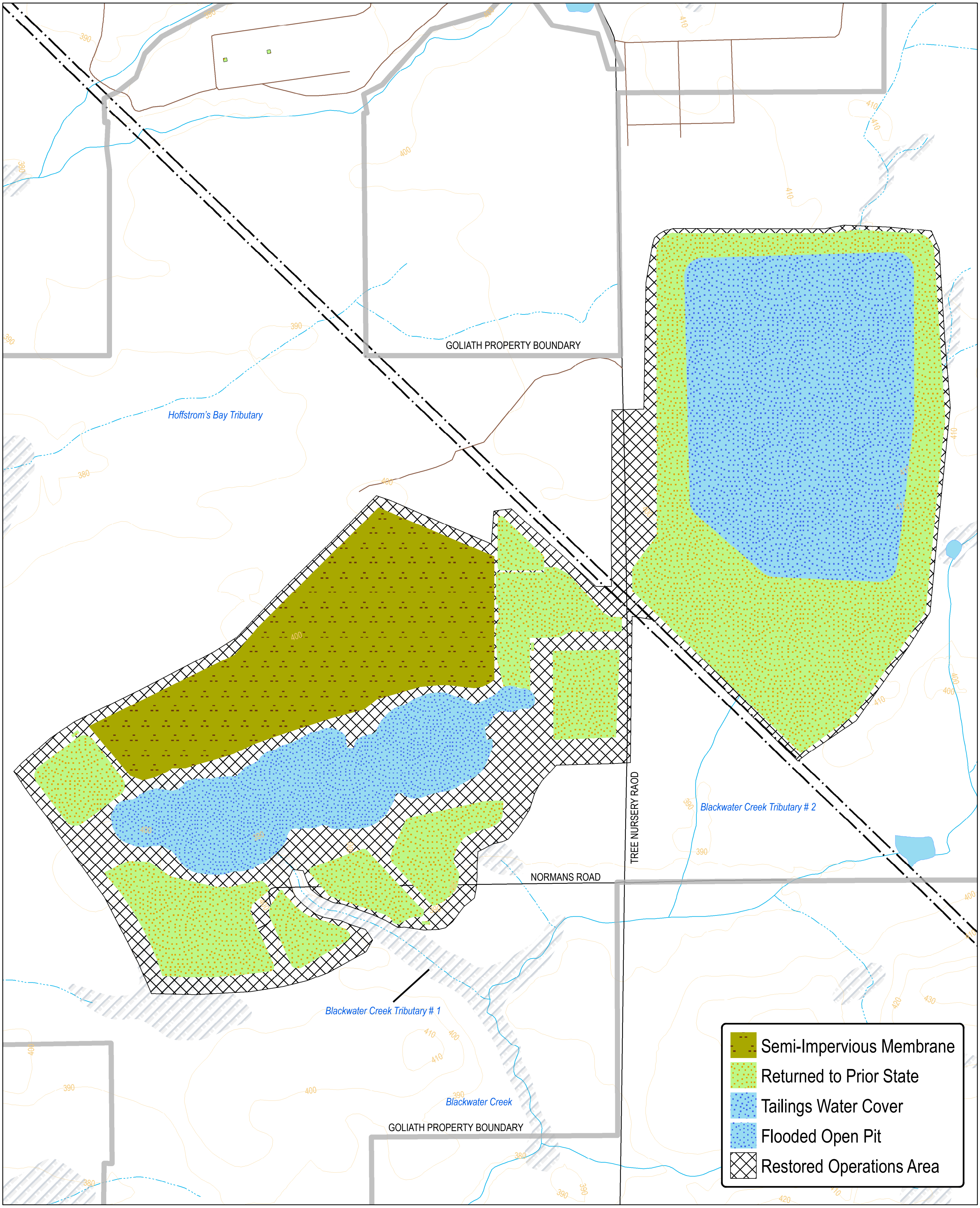
NAD 83, UTM Zone 15

N

0 750
Meters

Base Data:
Treasury Metals Inc., LIO Database,
KBM Resources Group

Notes:
Harvest will be contained within
operations area.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Project Configuration
Post-Closure (Wet TSF Cover)

Figure 3.0-1E | REV.01

DESIGN: MP 03/27/2017
GIS: MP 03/27/2017
CHECK: MW 03/27/2017
REVIEW: MW 03/27/2017

Hydro Line
Natural Gas Pipeline
Railway
Expressway / Highway
Local Road
Resource / Recreation Road
Provincial Parks
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:15,000

NAD 83, UTM Zone 15

N

0 750
Meters

Base Data:
Treasury Metals Inc., LIO Database,
KBM Resources Group

Notes:
Harvest will be contained within
operations area.

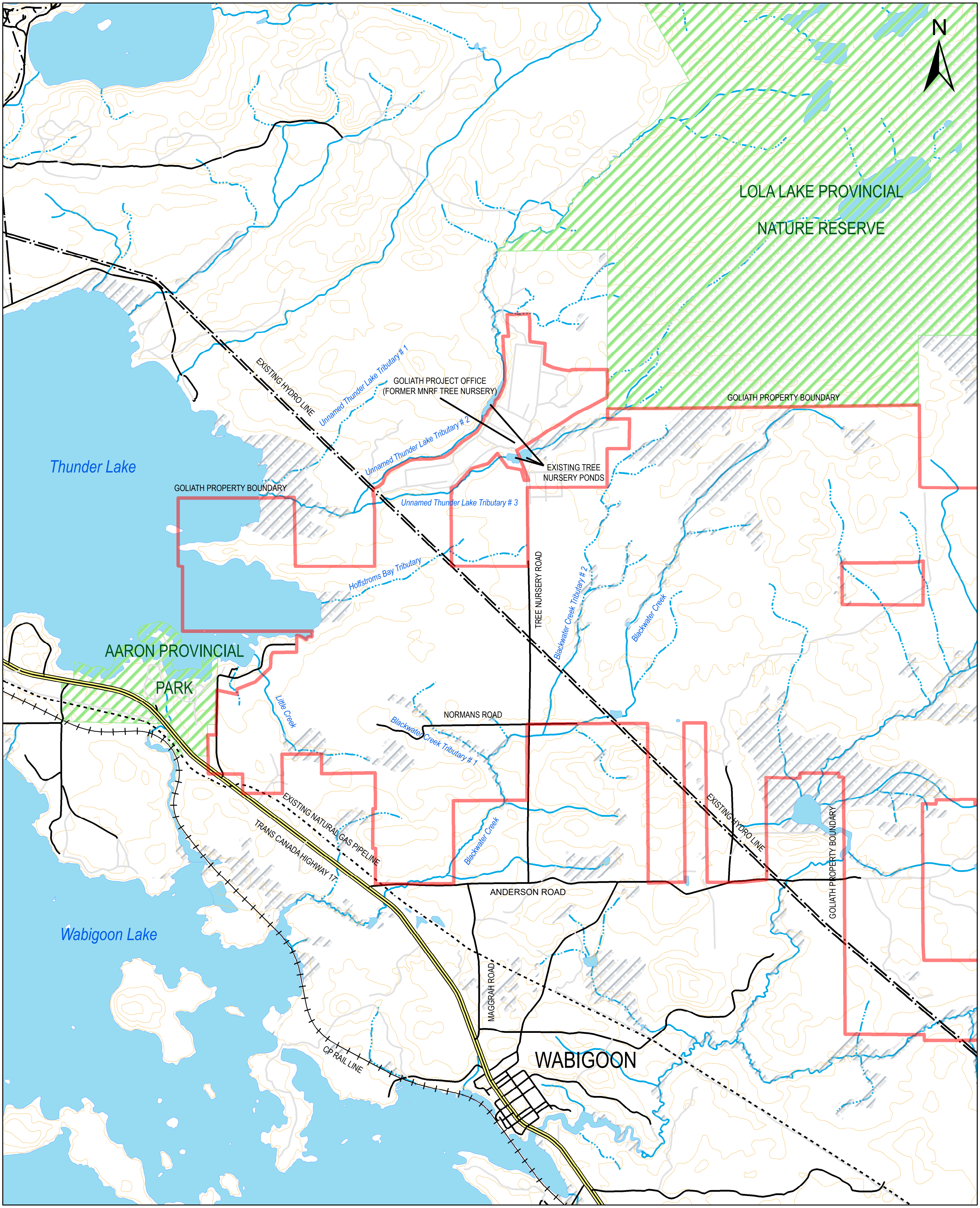
Figure 3.1-1: Project Office

3.1.1 Roads

The Project site is accessed from Highway 17 via Anderson Road and Tree Nursery Road (Figure 3.1.1-1). Highway 17 is part of the Trans-Canada Highway network and is operated by the MTO. Anderson Road and Tree Nursery Road are unpaved and maintained by the municipality. The intersection of Anderson Road and Highway 17 is an un-signalized 'T' intersection with stop sign control on Anderson Road. There are no signalized entrances located on Highway 17 in the area of the Project. 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 Metals for access to drill targets and environmental sampling locations.

3.1.2 Power

The existing power infrastructure includes the 115 kV and 230 Hydro One M2D line that cuts diagonally across the Project property. Currently electrical power is supplied by a separate, low voltage power line that runs parallel to the Tree Nursery Road (see Figure 3.1.1-1). Treasury Metals has been informed by Hydro One that the low voltage line does not have the capacity to service the Project, electrical power is preferred to be supplied by the aforementioned M2D line.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Existing Infrastructure

DESIGN: MP 01/08/2017
GIS: MP 01/08/2017
CHECK: MW 01/08/2017
REVIEW: MW 01/08/2017

Figure 3.1-1 REV.01

Hydro Line
Natural Gas Pipeline
Provincial Parks
Railway
Expressway / Highway
Local Road
Resource / Recreation
Contours (10 meters)
Intermittent Watercourses
Permanent Watercourses
Waterbody
Wetland

SCALE 1:50,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 500 1,000 1,500 2,000
Meters

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.

3.1.3 Railway

The Canadian Pacific Railway main line runs south of the Project site, along the northern shore of Wabigoon Lake (see Figure 3.1.1-1). 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.

3.1.4 Warehousing and Office Facilities

The former MNRF tree nursery facility is owned by Treasury Metals and operates as the Project office and as a warehousing facility (see Figure 3.1.1-1).

3.1.5 Dams and Impoundments

The unnamed tributaries passing through the former tree nursery were historically impounded by MNRF to provide water for the tree nursery (see Figure 3.1.1-1). The structures and impoundments remain in place and functional.

3.1.6 Natural Gas Pipeline

TransCanada Corp. owns and operates the Canadian Mainline pipeline that transports natural gas from Alberta and Saskatchewan to Ontario and beyond. This pipeline runs approximately parallel to the TransCanada Highway in the section adjacent to the Goliath Project. Specifically the pipeline crosses the south-western boundary of the Goliath Project property line and lies to the north of the highway as it crosses Anderson Road. The pipeline comes to within approximately 2.5 km from the proposed plant site at its closest point.

3.2 Project Phases and Schedule

The total lifespan of the Project is approximately 18 to 20 years beginning with site preparation and ending with the completion of care and maintenance during post-closure (Figure 3.2-1; Table 3.2-1). The estimated duration of each key Project phase is:

- Site Preparation and Construction : 2 years
- Operations Phase: 12 years
- Closure Phase: 3 years
- Post-closure (care and maintenance): 10+ years (anticipated)

Ongoing exploration at the Project may identify additional resources and extend the duration of the Operations phase.

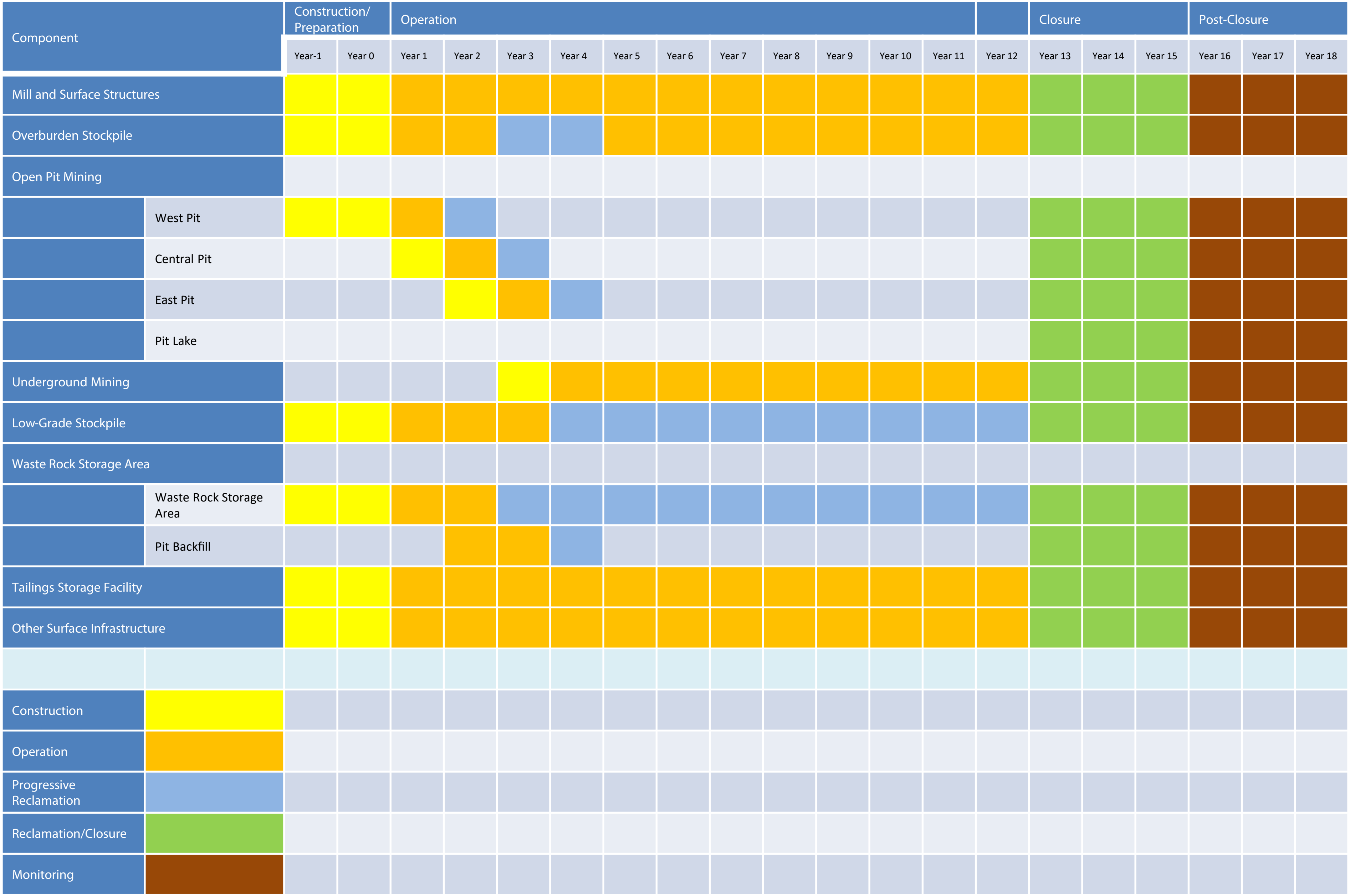


Figure 3.2-1 : Goliath Gold Project Phases and Schedule

Table 3.2-1: Key Project Components Listed by Phase

Project Phase	Duration	Key Components
Site Preparation and Construction Phase	2 years	Site Preparation • Water management and flood protection infrastructure • Surface drainage diversion structures and water realignment channels/ditches • Access roads for planned infrastructure • Support buildings and infrastructure required for the construction phase
		Construction • Additional site access roads and realignment of existing roads • Construction of the (initial) Tailings Storage Facility • Site drainage works, including pipelines from freshwater/recycled water sources • Construction facilities • Associated building and facilities • 115 kV transmission line including on-site substation
Operations Phase	12 years	• Open pit • Underground development • Process plant • Waste Rock Storage • Overburden Storage • Low-Grade Stockpile • Staged construction to expand TSF capacity
Closure Phase	3 years	• Project site area reclaimed to a naturalized and productive biological state; physically and chemically stable
Post Closure Phase (care and maintenance)	3-6 years	• Filling of the pit lake • Monitoring • Site is without infrastructure

3.2.1 Site Preparation and Construction Phase

Before mining operations and ore production can commence, Treasury Metals will need to prepare the site for constructions and construct the key elements of the Project infrastructure. The first step is site preparation, when the following activities must occur:

- Establish and implement environmental protection and monitoring plans.
- Dewater the footprint of proposed infrastructure.
- Establish water management and flood protection infrastructure.
- Staged construction of the surface drainage diversion structures. The construction of the perimeter runoff and seepage collection ditch will be staged to enclose the areas with active earthworks, and will collect and hold the runoff water from those areas under initial phases of construction. A berm will be constructed along the outer edge of the perimeter ditching to prevent non-project affected water from entering the operations area. This

infrastructure is required for compliance with MMER upon the commencement of construction activities.

- Construction of any access roads for planned infrastructure.
- Complete timber harvesting and initiate overburden stripping over the ore body, TSF location, and mill site.
- 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.

Treasury Metals will initiate construction once the site preparation activities have been completed; however, some of the construction activities may overlap with the site preparation activities. 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. The construction activities include the following:

- 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.
- Complete construction of the perimeter runoff and seepage collection ditch to encircle the Operations Area (Figure 3.0-1A). All runoff from the operations area will be collected for use in the initiation of the processing. A berm will be constructed along the outer edge of the perimeter ditching to prevent non-project affected water from entering the operations area. This infrastructure is required for compliance with MMER upon the commencement of construction activities.
- Construction of additional site access roads, as required.
- Construction of the (initial) TSF using onsite non-PAG aggregate material or technically appropriate material from an offsite supplier.
- Establishment of onsite water management works, including pipelines from freshwater and recycled water sources. The construction of the effluent treatment system and final discharge to Blackwater Creek would also be constructed at this point.
- Development and installation of construction facilities.
- Construction of associated building and facilities.
- Preparation of on-site mineral waste handling facilities.
- Construction and energizing of a 115 kV transmission line including on-site electrical substation.

3.2.2 Operations Phase

The operation phase will start as soon as ore production is initiated. 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 5.5 million tonnes of open pit ore and 3.5 million tonnes of underground ore over the 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 is intended to 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. Environmental 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.

3.2.3 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 detailed closure plan be filed for any mining project 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. The terms naturalized and productive are interpreted to mean a reclaimed site without infrastructure, which, although different from the existing environment, is capable of supporting plant, wildlife and fish communities, and other land uses. A conceptual closure plan is described in Section 3.14 and in Appendix KK.

Treasury Metals expects the active closure period of the Project will take approximately three years after operations cease.

3.2.4 Post Closure (Care and Maintenance)

Until such time that the final pit is fully flooded, Treasury Metals will hold the site in care and maintenance. Modelling indicates that the open pit should take between 6 and 8 years to fill with water. Environmental monitoring and potential effluent quality management will occur during this passive period of reclamation. 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 closure activities. The final timeline for post closure is anticipated to be greater than 10 years and will ultimately last until such time as the respective authorities can determine that the Project site has been successfully closed. During this time it is assumed that Treasury Metals will hold control of the property. Once closure has been deemed complete, it is assumed that Treasury Metals would hand control of any and all Crown lands that were used for the Project back to the Crown.

3.3 Open Pit Mine

3.3.1 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 to 15 m. The stripped overburden material will be stockpiled south of the pit for use in site reclamation activities. Clay that is removed as part of the stripping for the open pit will be used for TSF construction if the material properties are suitable. 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 3.3.1-1.

3.3.2 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 during normal operations by means of a field-fit berm and/or ditch. This water will be collected and will then form part of the recycled water used for processing in the plant facility. Further information on mine water management is described in Section 3.8.

Figure 3.3.1-1: Aerial View of Proposed Open Pit

It is anticipated that the ultimate predicted inflows to the pit will be reached shortly after pre-production stripping commences. This is beneficial because the water will be required to provide the initial charge of water for the TSF to meet process plant water requirements. In addition, the zone of influence (water table drawdown) will prevent any seepage from the Operations Area to the surrounding environment.

3.3.3 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 tpd to the mill. The maximum extent of the pit will be approximately 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.

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.

3.3.4 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 a typical mining shift schedule such as 2 × 12-hour shifts or 3 × 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 to 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 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.

It is anticipated that approximately 300 to 500 g of explosive would be blasted for each tonne of rock mined, with no significant difference between the blasting methods for waste or ore rock. Under normal operations, it would be anticipated that blasting could occur five times per week. Treasury Metals will work with blasting specialists to determine a maximum charge per delay to minimize both noise and vibration. Treasury Metals will also endeavor to limit the number of blasts per week. Explosives will not be manufactured on site but delivered as required by a contractor to an on-site storage facility, as shown in Figures 3.0-1A and 3.0-1C. Explosives storage is further detailed in 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.

3.3.4.1 Related Buildings and Infrastructure

The open pit mining operations will require an on-site 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.

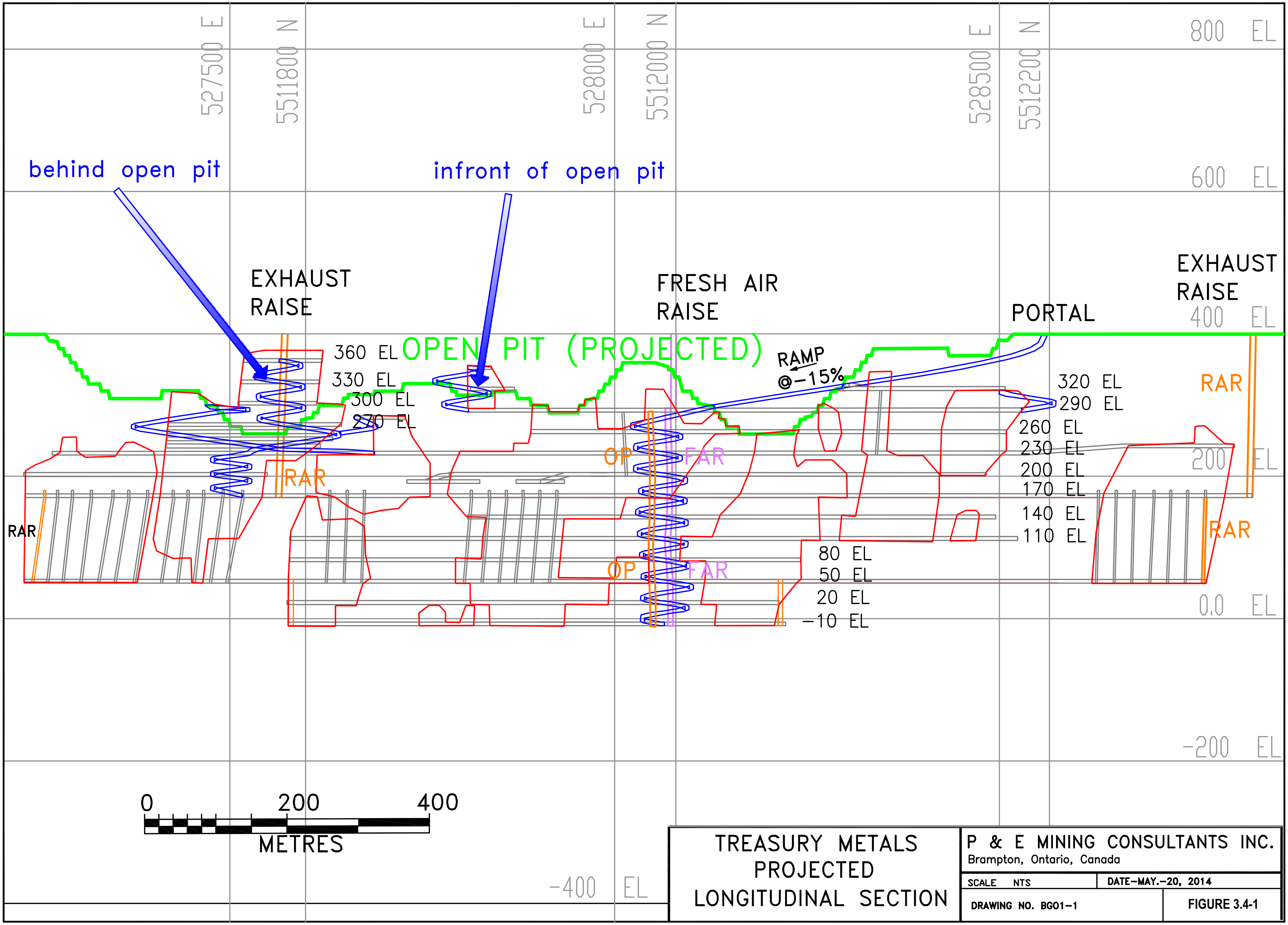
Warehousing for spare parts and other maintenance necessities will take place in the existing structures at the former tree nursery. Some small warehousing requirements will take place within the proposed maintenance facility. Additionally, a small laydown area may be used to accommodate larger items and will be located within the general footprint of the maintenance and mill facilities.

The main mine offices will be located at the current Treasury offices at the former tree nursery site. Some auxiliary offices such as a mine foreman/controller will be located either within the proposed buildings or at a separate portable/modular office (ATCO trailer for example) located close to the maintenance and mill facilities. Mine dry (shower and change area) will be located within the processing plant building and will provide space to accommodate the required male and female workforce.

3.4 Underground Mine

The underground mine will be used to extract ore that is either impractical or uneconomical to mine using open pit methods. Underground mining development will be scheduled so that a steady mill feed of 2,700 tpd is maintained while open pit production falls off and underground production is ramped up. After closure of the open pit mine, the underground mill feed will be blended with the low grade stockpile (Figure 3.0-1A) to create a consistent mill feed grade to the processing plant.

The underground mine production is anticipated reach 1,800 tpd at full production. Current resource definition to allow for the underground mine design has been completed to the proposed depth of 600 m (Figure 3.4-1). The ore body sits generally directly below the 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. However, Treasury Metals is not in a position to make any reasonable or quantifiable estimate on this possibility.



TREASURY METALS
PROJECTED
LONGITUDINAL SECTION

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

SCALE NTS | DATE-MAY.-20, 2014

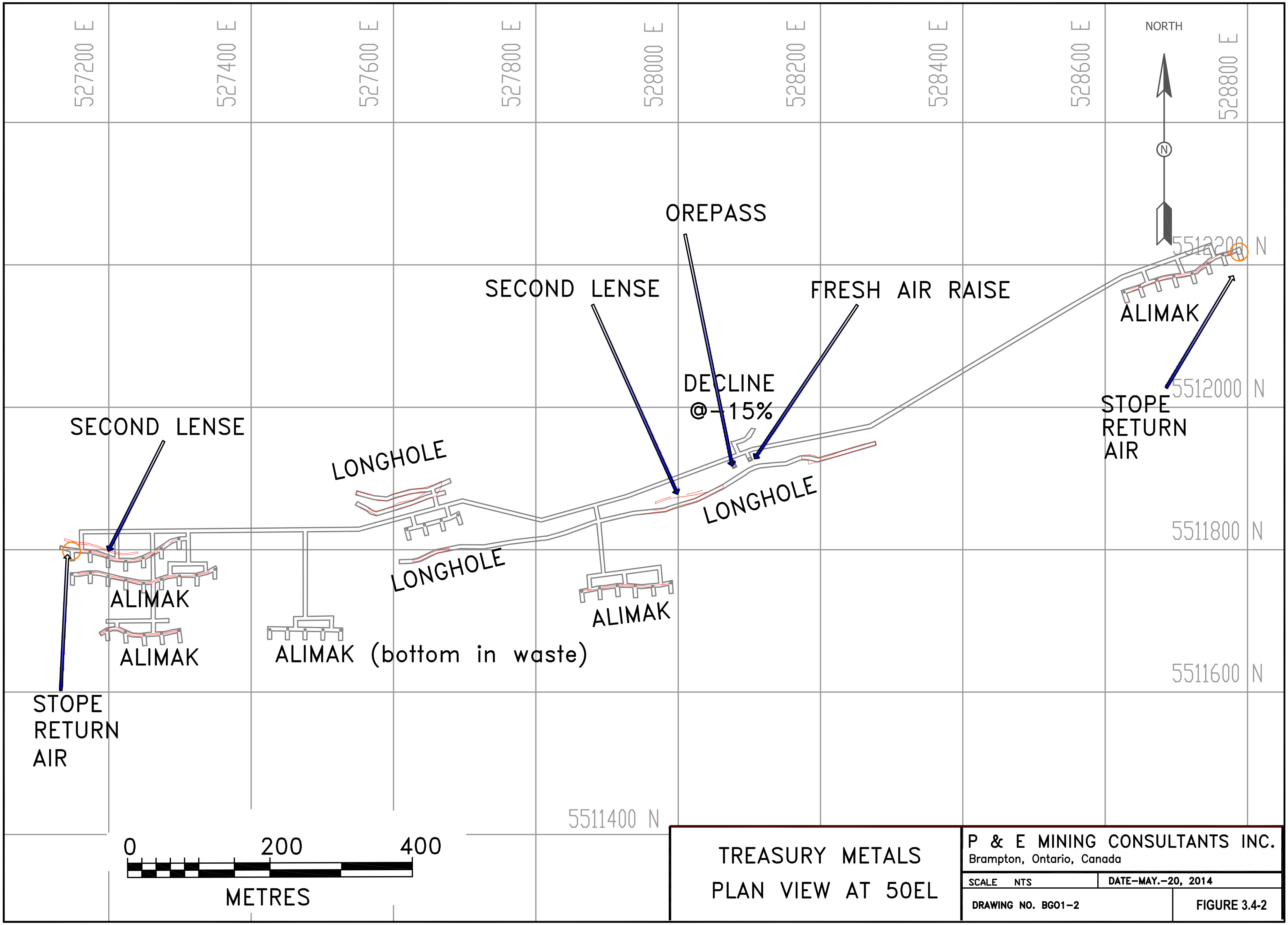
DRAWING NO. BGO1-1 | FIGURE 3.4-1

The underground mine will be accessed with a ramp system from surface (Figures 3.4-1 and 3.4-2). 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 underground 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 as well as a retreat method as a possibility. 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.

Mining operations will be carried out in a conventional manner using jumbo drilling machines (which are typical mining development machines used to drill horizontal drives) to drill and blast lateral development. Broken rock will then be loaded into trucks by Load Haul Dump vehicles (LHD) and hauled to their respective dump location. Ground support can then be installed using a standard process such as a bolter. Production drilling will be carried out by a standard longhole drill. These drilled holes will be loaded with explosives and blasted to break the rock. The ore will then be loaded by similar LHDs and hauled to surface for processing using the same fleet of trucks.


527200 E
527400 E
527600 E
527800 E
528000 E
528200 E
528400 E
528600 E
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 3.4-2

3.5 Stockpiles

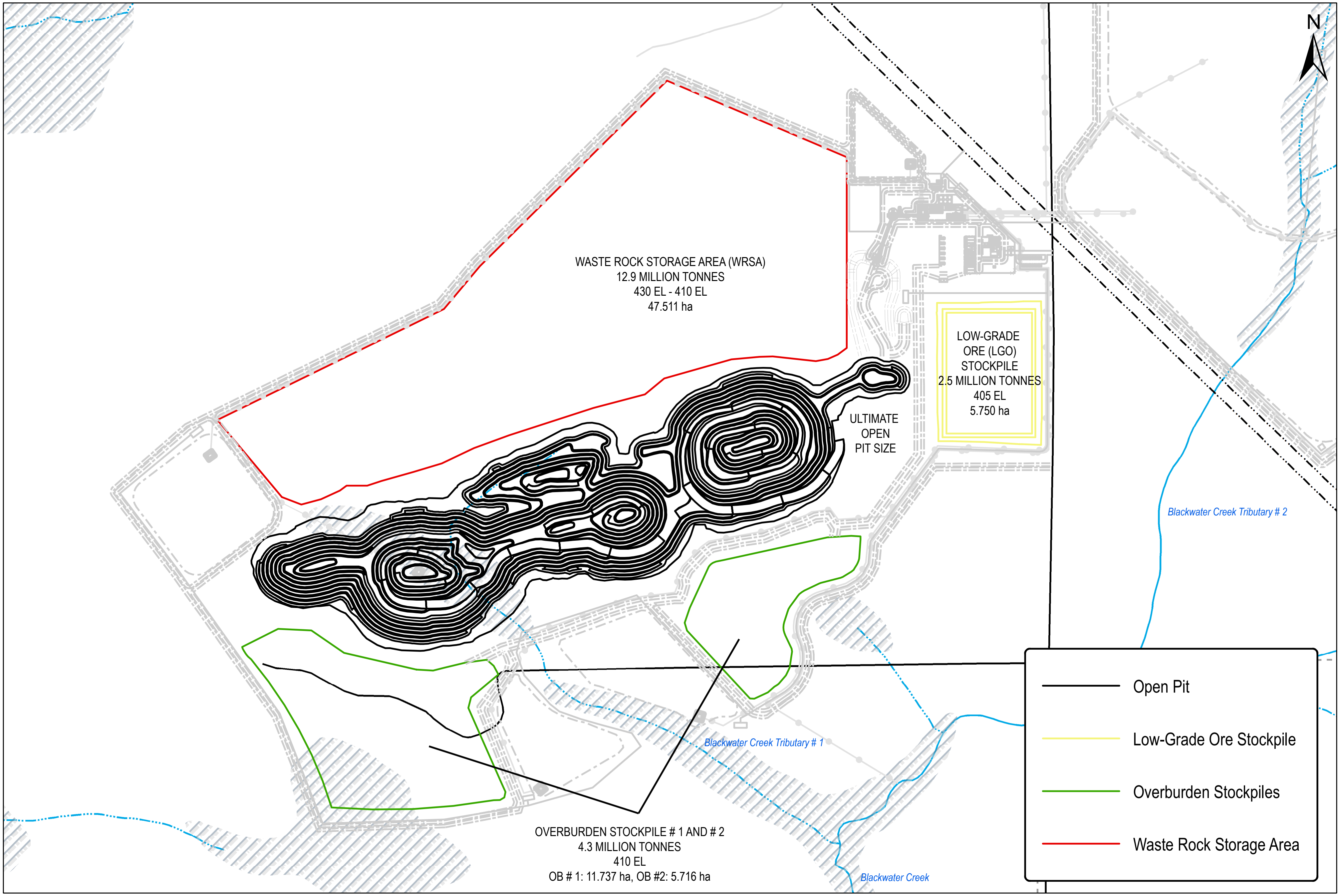
Mining operations are expected to generate 26.6 million tonnes of waste rock and 5.9 million tonnes of overburden. The principle considerations for stockpile location selection were:

- 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 potentially ARD rock.

3.5.1 Mine Rock Stockpile

Approximately 24.6 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 3.5.1-1). 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 could be used to backfill the pits and minimize the volume and footprint of the waste rock stockpile north of the pit (Figure 3.5.1-2). The waste rock stockpile are anticipated to 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 Metals. Due to the conservative design factors placed on the mine rock 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.

During production and where possible, 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.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Ultimate Open Pit, Waste Rock, Overburden, and Low-Grade Ore Stockpiles

Figure 3.5.1-1 REV.02

DESIGN:	MP	13/03/2018
GIS:	MP	13/03/2018
CHECK:	MW	13/03/2018
REVIEW:	MW	13/03/2018

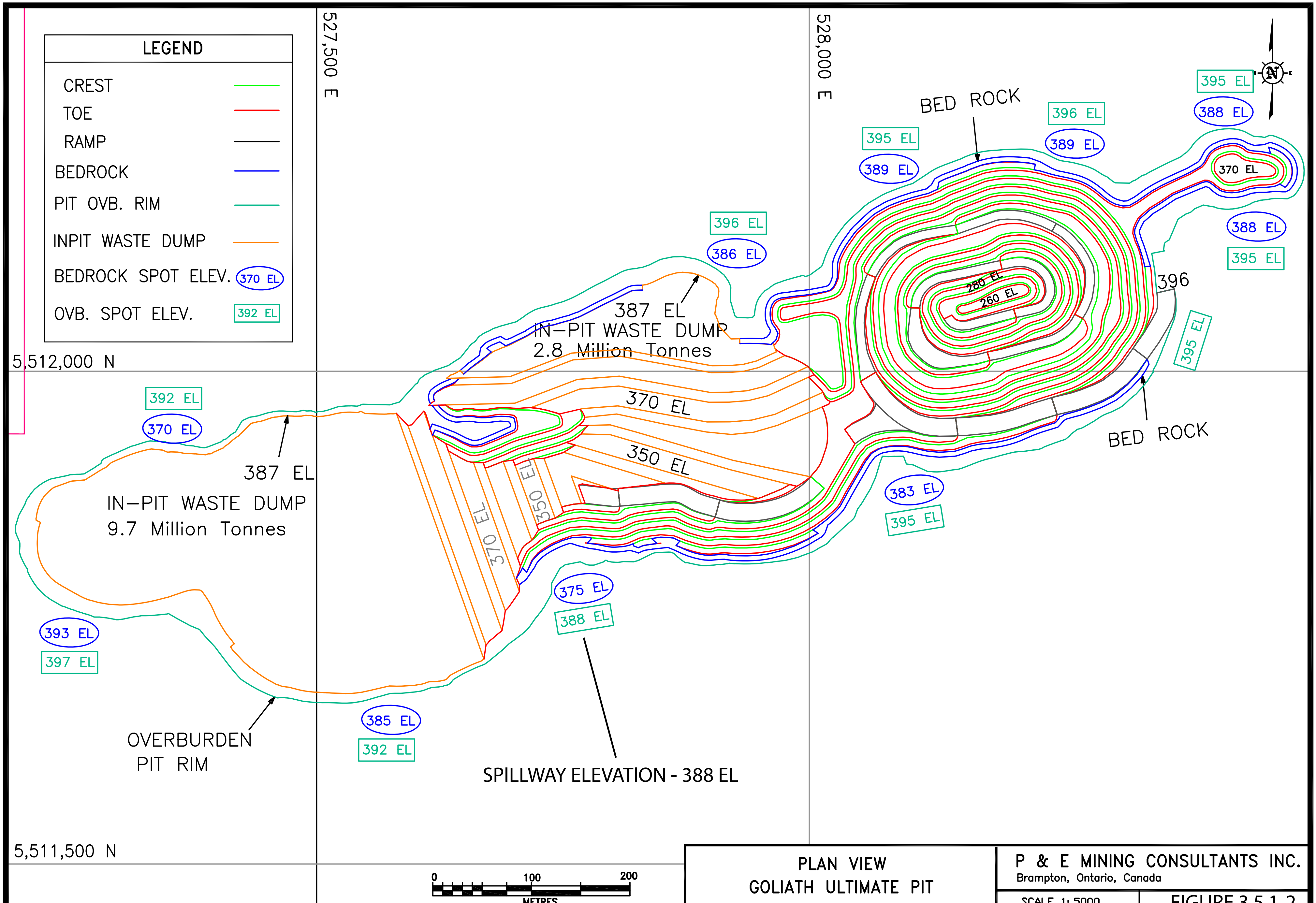
Hydro Line
Natural Gas Pipeline
Railway
Provincial Parks
Highway
Local Road
Resource Road
Contours (10 meters)
Wetland
Waterbody
Intermittent Stream
Permanent Stream

SCALE 1:10,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 100 200 300 400 500
Meters

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group
Sedgman
Notes:
All details preliminary and subject to change as engineering designs are updated.



PLAN VIEW
GOLIATH ULTIMATE PIT
WITH INPIT WASTE ROCK DUMPS

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

SCALE 1: 5000

FIGURE 3.5.1-2

Ditching and seepage collection will be created around the outer edges of the stockpile (to ensure the perimeter ditching and seepage control encompasses the entire operations area) to collect and direct surface water runoff and seepage. This water will be collected and directed towards the overall water management system for possible treatment or recycling within the milling process (Section 3.8). A berm will be constructed along the outer edge of the perimeter ditching to prevent non-project affected water from entering the operations area.

3.5.2 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 (see Figure 3.5.1-1). As proposed this stockpile has been separated into two separate piles that straddle Blackwater Creek Tributary 1. This change was made to avoid physically placing materials within Blackwater Creek Tributary 1 that will provide fish and fish habitat once flows are re-established following closure of the site. The overburden stockpile will have a footprint of approximately 26 hectares, a maximum height of 20 m above grade, and a total capacity of 5.9 million tonnes. Slopes will generally follow similar to the mine rock stockpile at a grade of 3 horizontal width to 1 vertical height (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.

Slopes may be protected from erosion by vegetation until needed for reclamation. Ditching and seepage collection will be installed around perimeter of the site to collect surface water runoff and seepage. This water will be collected and directed towards the overall water management system for possible treatment or recycling within the milling process (Section 3.8). A berm will be constructed along the outer edge of the perimeter ditching to prevent non-project affected water from entering the operations area.

3.5.3 Low-Grade Ore and Other Stockpiles

A low-grade ore (LGO) stockpile will be constructed during the open pit phase of mining (see Figure 3.5.1-1). 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 the Operations Area to collect any surface water runoff or seepage from the stockpile. This water will be collected and directed towards the overall water management system for possible treatment or recycling within the milling process (Section 3.8).

The location for the low-grade stockpile was selected to minimize travel for mine haulage equipment from the open pit 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.

3.6 Processing

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.

As described in Section 2.4.2, the preferred location of the process plant site will be to the east of the mining pits, and immediately west of Tree Nursery Road (Figure 3.0-1A). With this location there would be no requirement to divert Tree Nursery Road around the processing plant. The plant security gate and car park access will be from Tree Nursery Road (Figure 3.0.-1B). 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. Aerial view of proposed processing plant can be seen in Figure 3.6-1.

Figure 3.6-1: Aerial View of the Proposed Processing Plant Location

3.6.1 Process Description

The processing plant at the Project site will consist of a standard gravity/carbon-in-leach (CIL) circuit with cyanide destruction of CIL tails. 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. Although test work has indicated that the Goliath ore is not preg robbing (the absorption by carbonaceous components which preferentially absorbs gold and gold-cyanide complexes), a CIL circuit has been selected over carbon-in-pulp (CIP) due to its typically lower capital cost, simplicity, and smaller footprint. Carbon-based recovery from solution is more robust both mechanically and chemically, and generally significantly lower in both capital cost and in operating cost as compared to the Merrill Crowe process. Because the Goliath ore leaches quickly, the additional carbon inventory in CIL vs. CIP is only expected to be 10% to 15%.

3.6.2 Site Layout and Infrastructure

In general, all process areas will be housed in a building covered with pre-finished, insulated metal roof and wall cladding. Internal partition walls will be concrete block or drywall over metal stud. Interior operating areas will be interconnected such that it is not necessary to go outside in moving from one area to another, including connection of the surge bin via an enclosed conveyor gallery. Other conveyors will be covered but not fully enclosed, as they will carry material but will not serve as a walking route for plant personnel. The emergency stockpile will not be covered, and the primary crushing plant will be enclosed below the run of the mill (ROM) bin.

The largest building on the site will be the mill building. The entire building will sit under an overhead crane rated to lift the mill drive equipment as the heaviest lift to a drop down bay that will allow mobile access into the adjacent workshop. 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 of agitator gearboxes, intertank screens, carbon transfer pumps and the carbon sizing screen. The crane drop down bay will be at the mill building end with forklift access to the adjacent workshop. The gallery enclosure will have ridge ventilation for fume exhaust. The CIL tank 1 will be the northernmost tank and will be pump fed. A space allowance for up to two additional CIL tanks is provided. Containment of CIL area spillage will be achieved via a concrete containment bund that will drain to the event pond.

The acid wash and elution columns will sit adjacent to CIL tanks 1 and 3. The carbon recovery screen above the columns will sit at the top-of-CIL tank level in a covered building annex. This annex will provide a covered route for operators moving between the CIL and the elution/reagents/ water services area. The main pipe rack will be located inside the building, which will significantly reduce pipe heating and insulation requirements.

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 adjacent to the feed end of 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.

3.6.2.1 Water Supply

During the early stages of construction a perimeter ditch will be constructed around the entire operations area. All runoff from the operations area will be collected and stored on site for use in the process, and for initiating the TSF once operations start. It is expected that there will be a sufficient inventory of water collected during the site preparation and construction phase to support the process and operations without the need for accessing additional sources of water off-site.

During operations, the process plant will require approximately 3,044 m^3/d of water. This water will come from a number of sources, including runoff from the site, water from the dewatering of the open pit and underground mine, and water reclaimed from the TSF. There would also be an intermittent need for a relatively small amount of fresh water from outside the operations area for the makeup of select reagents, various spray nozzles, carbon elution, plant wash down, and potable water. To the extent possible, the water management philosophy for the Project (see Section 3.8) is to maximize the use the available water within operations area so as to minimize the amount of water that needs to be treated and released to the environment, as well as minimizing the amount of fresh water required.

There preferred sources for fresh water are three former irrigation ponds within the Administration Area (Figure 3.0-1C). These ponds were used for irrigation during the historical operation of the former MNRF tree nursery. These ponds are situated on the creeks referred to as Thunder Lake Tributary 2 and Thunder Lake Tributary 3, as presented in Figures 3.0-1A and 3.0-1C. These creeks have been gauged and the analysis indicates there is sufficient flow to meet the process plant requirements without needing to take more than 5% of the flow of in these tributaries. To help ensure this objective, a real-time flow measurement procedure will be used to determine the allowable withdrawal from the creeks. The pump intake will be designed in accordance with Fisheries Canada (DFO) guidelines for pump intakes to minimize the effects on any fish present.

3.6.2.2 Communication Systems

External communication systems are not considered. An integrated voice and data network infrastructure will be provided in the process plant. Telephone and voice mail system will provide voice functionality via this network. This system will be linked to the main telephone switchboard for connection to outside lines. Radio sets will be provided for operations personnel.

3.6.2.3 Heating, Ventilating, and Air Conditioning (HVAC) Systems

An allowance per square metre of building area has been applied in the capital cost estimate to allow for HVAC systems. The process plant and ancillary buildings will require varying degrees of ventilation and air conditioning. Ventilation will be provided by thermostatically controlled exhaust fans and dampers. Heat for the process plant and ancillary buildings for the winter months will be provided by natural gas heaters located around the buildings. Ventilation and air conditioning for the control room and electrical room will be provided by packaged air conditioning units. Rooms including offices will be maintained under positive pressure to prevent dust infiltration. Exhaust fans will be used to provide ventilation of the washroom areas.

3.6.2.4 Building and Fire Protection Systems

An allowance per square meter of building area has been applied to the capital cost estimate for building fire protection systems. 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.

3.6.2.5 Plumbing and Drainage Systems

Hot and cold plumbing will be provided to each fixture. Domestic hot water will be stored in insulated hot water tanks, with the tank volume based on the number of fixtures and daily requirements for shift change shower demand. The domestic sanitary sewer piping system will be designed to collect all non-process waste from sanitary fixture units and non-process building floor drains. 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.

3.6.2.6 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.

3.6.3 Pipelines

Plant tailings will be transported via pipeline to the 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 is anticipated to bring natural gas from a main pipeline running adjacent to the Trans-Canada 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 Metals and the gas distributor in the region (Union Gas). The regulatory process, including engagement, and associated construction of a natural gas pipeline to provide gas to the Project will be the responsibility of Union Gas. The requisite pipeline will not be within the care-and-control of Treasury Metals.

3.6.4 Crushing, Ore Storage and Mill Feed

The crushing circuit will consist of a static grizzly over a run-of-mine (ROM) bin, apron feeder, 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 ROM ore will be stockpiled on the ROM pad and reclaimed by an FEL. The FEL will dump onto a static grizzly situated on top of a ROM bin. Ore will be withdrawn from the bin by an apron feeder and fed to the primary jaw crusher. Crushed ore discharged onto the primary crusher product conveyor, will feed a 30-minute capacity surge bin. Ore will be withdrawn from the surge bin at a controlled rate by an apron feeder onto the SAG mill feed conveyor. Overflow from the surge bin will be conveyed to an emergency stockpile and stored for future reclaim by FEL during periods of crusher downtime to maximize mill availability. Dry lime will be added to the SAG mill feed conveyor for pH control of the leach circuit. Dust collectors will be utilized at transfer points and at the primary crusher to keep fugitive dust emissions to a minimum. Conveyors will be covered.

3.6.5 Milling

The milling circuit will consist of a SAG mill with discharge trommel, mill discharge hopper, cyclone feed pumps, cyclone cluster, drive-in sump and sump pump. The gravity gold recovery circuit is discussed separately.

The single stage SAG mill will operate in closed circuit with hydro-cyclones and will be fed new ore, process water, and cyclone underflow. The SAG mill will discharge through a trommel for scats separation with the undersize flowing into the discharge hopper where the slurry will be combined with gravity tails, additional process water, and leach residue from the intensive cyanide leach reactor. The cyclone feed pumps (one standby one operational) will supply the cyclone pack and the gravity circuit with slurry from the discharge hopper. The cyclone pack and feed pump are designed to operate at higher pressures to achieve the target grind size at a higher solids fraction, thereby eliminating the need for a pre-leach thickener.

A single stage SAG mill with hydro-cyclones was selected as the optimum milling configuration. Having only one crusher and one mill minimizes capital and maintenance, and will reduce operational complexity. 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. This configuration is ideal for an indoor, cold weather, small gold plant. The single stage mill provides inherent flexibility in terms of throughput and product grind size, and a proven high availability. As this milling circuit is wet, noise will be the only emission. A surge bin configuration has been selected to minimize capital cost.

3.6.6 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 (Figure 3.6.6-1). The ore will be primary crushed with a jaw crusher and then ground to the target leaching P80 using a single stage SAG mill and classifying cyclones.

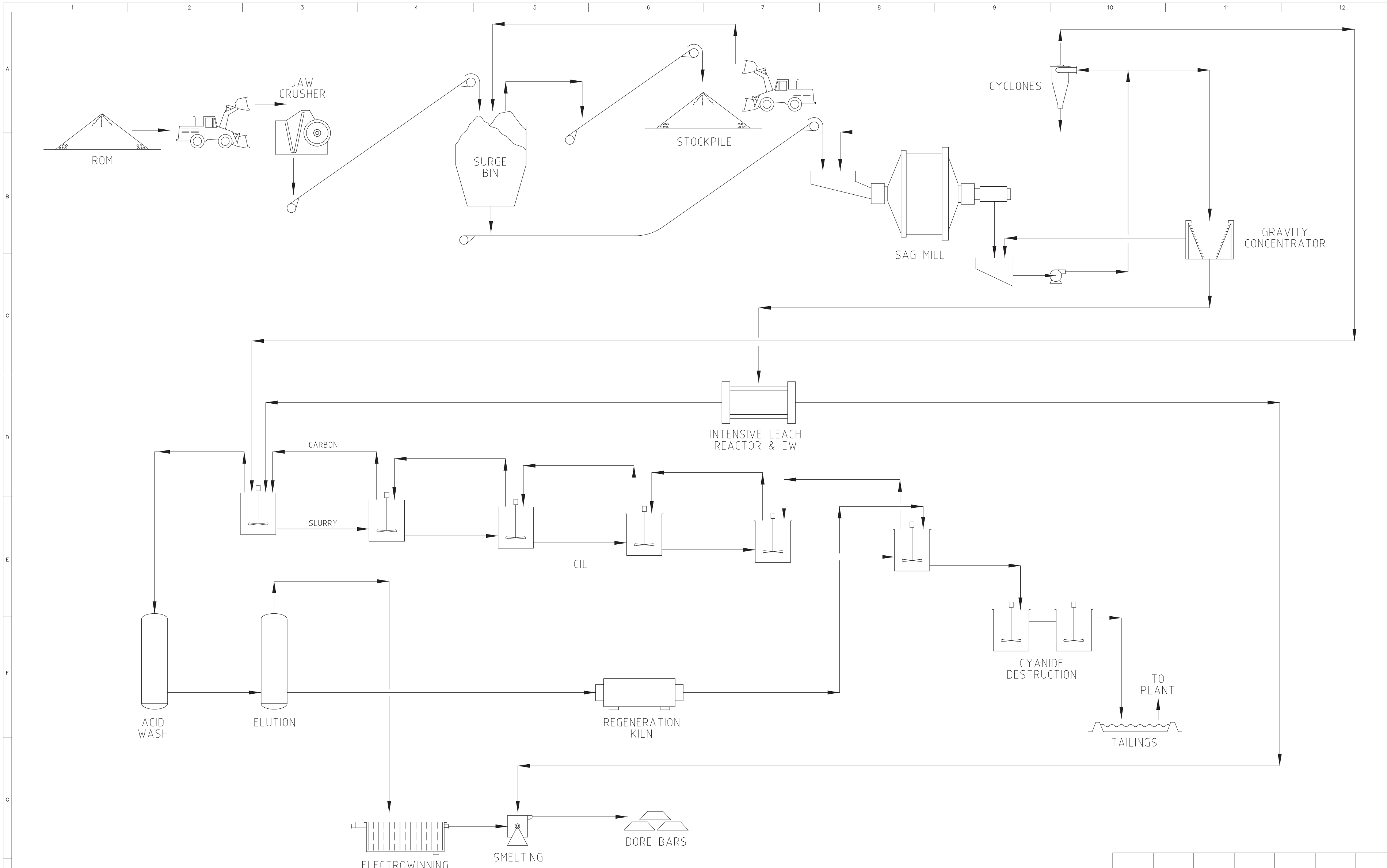


Figure 3.6.6-1

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

DRG No — REFERENCE DRAWINGS

CLIENT: TREASURY METALS INC.

PROJECT: GOLIATH GOLD

Lycopodium

Lycopodium Minerals Canada Ltd Corp. No. 767 852-5
5060 Spectrum Way, Suite 202, Mississauga, Ontario L4W 5N5
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DRAWN	CHECKED	DESIGN	SENIOR ENG	DESIGN APP'D	PROJ APP'D	CLIENT APP'D

DRAWING TITLE: OVERALL PROCESS PLANT PREFERRED OPTION PROCESS FLOW DIAGRAM

SCALE	DRAWN	DATE	JOB No.	DWG No.	REV.
NTS	SH	11FEB13	5027	000-F-101	A

A1

The cyclones will be selected to produce a cyclone overflow density suitable for the leach circuit and eliminate the need for a leach feed thickener. A gravity circuit consisting of a scalping screen and centrifugal concentrator will be fed from the cyclone feed distributor.

The gravity concentrate will be batch treated in an intensive leach reactor (ILR) with the pregnant solution treated by electrowinning. Cyclone overflow will pass through a trash screen prior to entering the CIL circuit. In CIL, the ore slurry 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 will be acid washed and then gold and silver will be stripped from the carbon into solution using the AARL method. The stripped carbon will be re-activated in a kiln and returned to the CIL circuit, while the eluate containing gold and silver will be passed through electrowinning cells to recover the metals. The electrowon metal sludge will be smelted to produce doré. Leached slurry from the CIL circuit is processed in a cyanide destruction circuit (Section 3.8.7) prior to discharge into the TSF.

3.6.6.1 Gravity Recovery Circuit

The test work has shown a high portion of gravity recoverable gold in the Goliath ore. The gravity circuit is designed to process the equivalent of the new feed to the grinding circuit. The gravity circuit will comprise of a vibrating screen and a centrifugal concentrator. The vibrating screen oversize will be returned to the mill discharge hopper along with the gravity concentrator tail. The gravity concentrate will be leached in an intensive cyanide leach reactor and gold will be directly electrowon from the leach solution. The leached tails will report to the CIL circuit via the grinding circuit. Gold sludge from the dedicated electrowinning cell will report to the retort oven along with the gold sludge from the elution circuit’s electrowinning cells. Alternatively, the pregnant leach solution could be combined with the pregnant solution from the elution circuit.

3.6.6.2 Leaching Circuit

The leaching circuit will consist of a trash screen, feed distributor, six CIL tanks with agitators and air spargers, air blowers, two sump pumps, carbon advance airlifts, inter-tank screens, a loaded carbon pump, carbon recovery screen, carbon safety screen, and a cyanide analyzer.

Cyclone overflow from the milling circuit will flow to the trash screen, which will remove unwanted (trash) material from the slurry to prevent downstream carbon screening problems. Undersize from the screen will report to the CIL feed distributor while trash will be directed to the tailings pump hopper for disposal with the CIL tailings stream. The feed distributor will allow bypass of CIL tank 1 if offline, and provide a single point for reagent addition. Barren solution from the elution circuit, gravity leach residue, loaded carbon screen undersize slurry, and cyanide will all be added at the distributor. The leaching circuit will consist of 6 stirred reactor tanks in series with maintenance by passes around each tank. The leach reactor tanks will allow for 24 hours of slurry residence time. The leaching slurry will flow through the series of tanks by gravity, while the activated carbon will flow counter-current by means of submersible carbon advance pumps.

Metals in the ore will be leached into solution using cyanide and oxygen, and then be adsorbed onto activated carbon. The oxygen required for leaching will be provided by air sparging. Slurry containing loaded carbon will be pumped from the first CIL tank to the loaded carbon screen to remove slurry from the carbon. From the loaded carbon screen, the carbon (screen oversize) will report to the acid wash column. Carbon that has been stripped and reactivated will be added to the last CIL tank to replace the carbon removed from the first tank. From the final leach tank, the leached ore slurry will be passed over a carbon safety screen to capture any carbon that would otherwise report to the tailings. Detectors and alarms will be installed to alert workers to leave the CIL tank area if hazardous levels of HCN gas are detected. Any spillage in the leaching area will be contained inside dedicated lined containment areas and returned immediately to the process.

3.6.6.3 Cyanide Detoxification

The SO_2-air destruction process acting on the cyanide recovery thickener underflow has been chosen as the preferred method for cyanide destruction. The SO_2-air process is efficient at removing cyanide from slurry solutions. 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. Movement of slurry through the detoxification circuit will be by gravity. The cyanide detoxification circuit is intended to be designed to destroy cyanide to the lowest reasonable limit prior to discharge to the TSF. Further natural cyanide degradation will take place within the TSF prior to final treatment and discharge to the environment. Additional details regarding the management of cyanide are provided in Section 3.8.7.

3.6.6.4 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. In previous iterations of the Project design it was assumed that exposure of beached of tailings material could occur. However, it is the intention of Treasury Metals with the current iteration of the Project design to manage the placement of tailings materials and water levels within the TSF to ensure that beached tailings materials are not exposed to the atmosphere and that a water cover will be maintained at all times during operations to limit environmental effects such as dust and ARD.

3.6.6.5 Elution, Electrowinning, and Gold Room

Loaded carbon in the first CIL tank will be passed over the carbon recovery screen for slurry removal and then discharge to the acid wash vessel. Carbon is acid washed with dilute hydrochloric to remove inorganic foulants, such as precipitated salts, which detrimentally affect gold adsorption. The acid washed carbon will then be transferred to the elution column for stripping of gold and silver using the AARL process. Heated barren solution containing cyanide and caustic will pass through the loaded carbon removing the gold from the carbon into solution. This now pregnant solution will be stored in a tank and circulated through electrowinning cells where gold sludge will be removed from the solution and deposited onto cathodes. The barren solution will be returned to the elution circuit. From time to time, barren solution will be bled from the eluate circuit back to the CIL and made up with fresh treated water. The gold/silver sludge from the elution and gravity circuit electrowinning cells will be filtered then dried in a mercury retort and smelted in a furnace to produce doré bars. Emissions from the gold room equipment are controlled through extraction hoods integral to the electrowinning cells, over the flux mixing and smelting furnace areas and through the mercury retort. All extracted streams are cleaned through bag houses or wet scrubbers.

3.6.6.6 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 as described in more detail within Section 3.9.

3.6.6.7 Air and Water Services

Air services will consist of air compressors for plant and instrument air supply, leach aeration and carbon transfer airlifts. Water services will consist of raw / fire, potable, and process water storage tanks and distribution pumps and include additional reticulation for domestic consumption, safety showers, gland water, dust suppression and cooling water systems.

Water services, where distribution lines are outside of climate controlled buildings or enclosures, will be insulated and heat traced for protection from freezing.

3.7 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 a low-permeability engineered facility.
- Maintain a water cover and ensure the tailings solids are kept in a saturated condition to minimize the potential for acid generation, 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.

- 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 primarily occupy the sub-catchment of Blackwater Creek Tributary 2 (Figure 3.0-1A), thereby minimizing the inclusion of area that is currently within the Thunder lake catchment and minimizing the need to divert non-contact runoff from the north portion of the Blackwater Creek Tributary 2 catchment around the TSF. As indicated on Figure 3.0-1A, the northern perimeter of the TSF is subject to minor changes during detailed design optimization when catchment boundaries and dam foundation conditions are investigated and confirmed. Effects predictions evaluate the TSF footprint presented herein because detailed design optimizations have not yet been undertaken.
- The TSF will be initially constructed with a Stage 1 dam embankment height, which is wholly within the footprint of the proposed facility 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-potential acid generating (non-PAG) mine waste rock can be utilized for construction and raising the embankments.
  - Reduces construction and fill requirements at pre-production.
  - Postpones the incorporation of the Blackwater Creek Tributary 2 within the TSF to allow more time for Schedule 2 of the MMER to be amended.
  - 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.
  - 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 3.7-1. The staging of construction will be determined during detailed TSF design.

Figure 3.7-1: Aerial View of Proposed Tailings Storage Facility Location

3.7.1 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 (summarized in Section 2.4.2, and presented in Appendix D-1) and the natural ground topography that has been used to align the dam embankments to maximize storage capacity while minimizing embankment fill volumes (Figure 3.7.1-1). Tailings solids generation for the Project has been identified at 2,700 dry tpd 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% is intended to 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

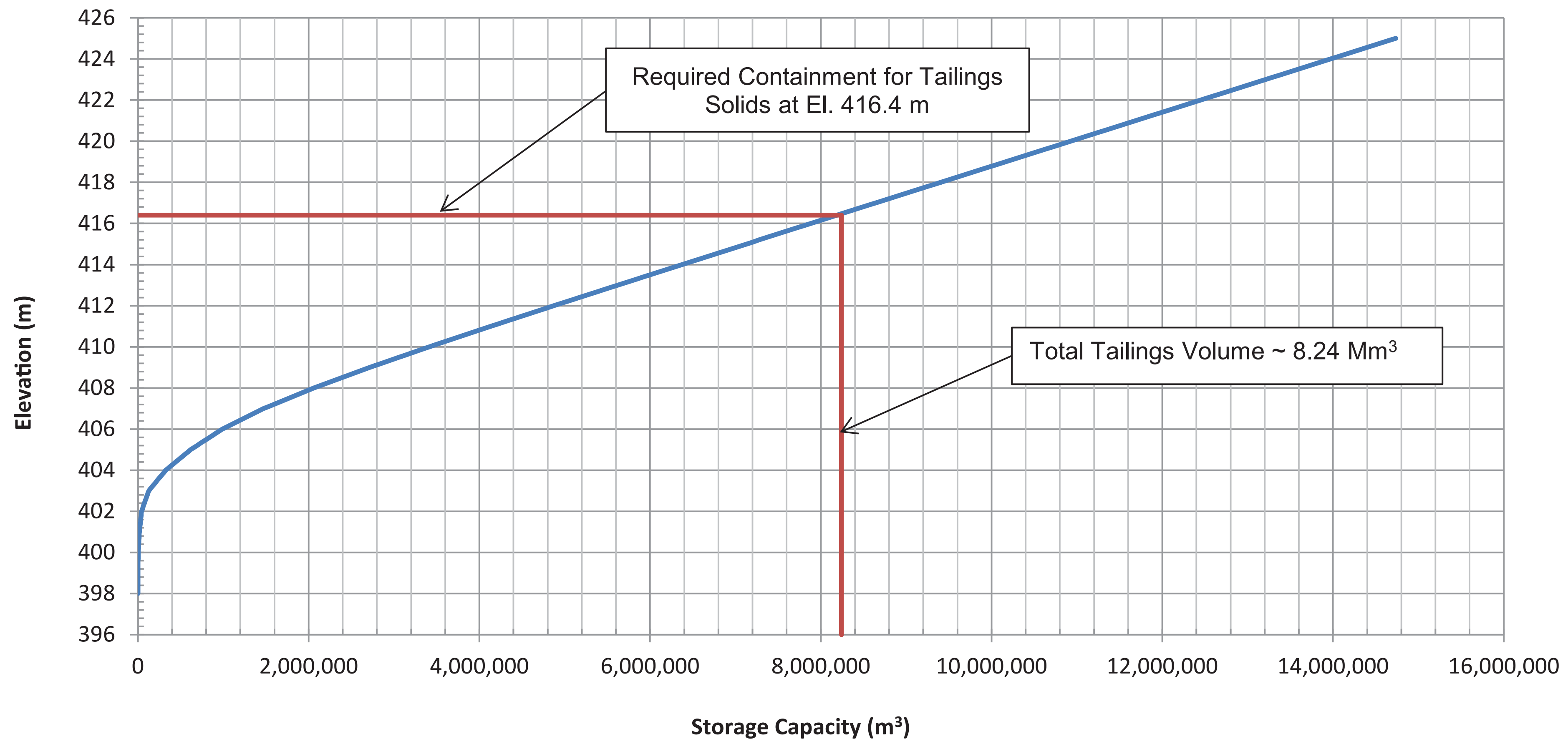
TSF. The actual fraction of tailings solids that can be directed to the underground mine workings as well as the schedule will be confirmed as the mine design is advanced.

Laboratory testing of the tailings solids or small-scale pilot projects can be used to quantify the tailings in-situ density when deposited. At this stage of the Project, laboratory testing or pilot projects have not been completed and therefore an estimate of the tailings solids in situ density has been developed to estimate the volume of tailings solids that will require storage within the TSF. An in-situ density of 1.1 t/m^3 has been estimated for the project that is based on literature and experience with similar projects. The in-situ density of the tailings can be optimized with laboratory testing as the project is advanced as well as monitoring during the operations. Applying the in-situ dry density of 1.1 t/m^3 adopted for the design results in a total tailings volume of approximately 8,242,364 m^3 that will be directed to the TSF.

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 storm water management (Figure 3.7.1-2). 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.

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.



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

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WSP

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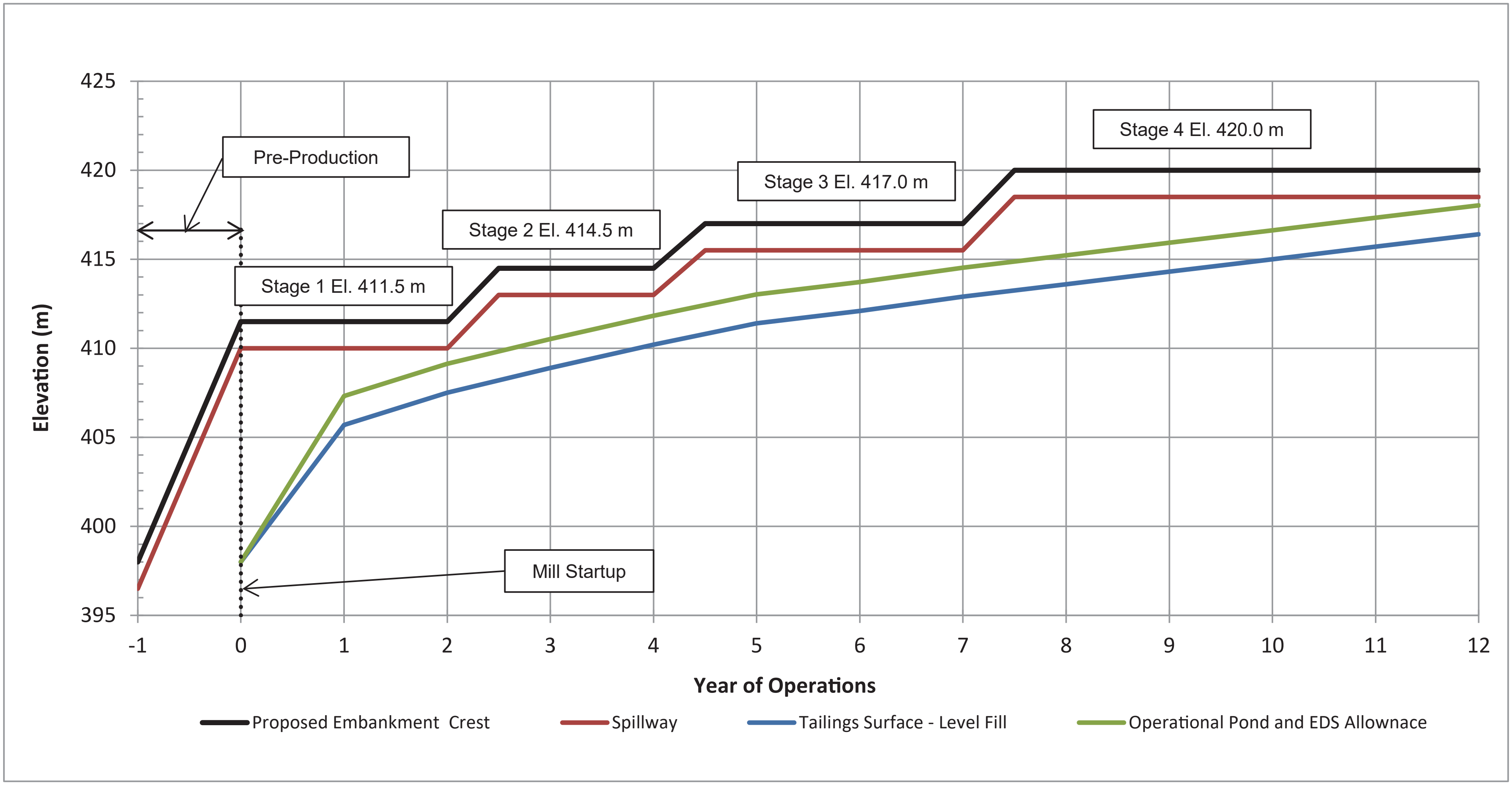
GOLIATH PROJECT

LOCATION 1
STAGE-STORAGE CURVE

FIGURE 3.7.1-1	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.

TREASURY METALS Inc.	TREASURY METALS INC.
	GOLIATH PROJECT ALTERNATIVES ASSESSMENT
WSP	LOCATION 1 EMBANKMENT STAGING
FIGURE 3.7.1-2	Project No.: 141-12598-00 — Ref. No.: A

Prepared By:	BRP	Checked By:	HBW	Approved By:	HBW

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 MNRF Best Management Practices. The freeboard for each embankment stage has been assigned at 1.5 m above the spillway invert.

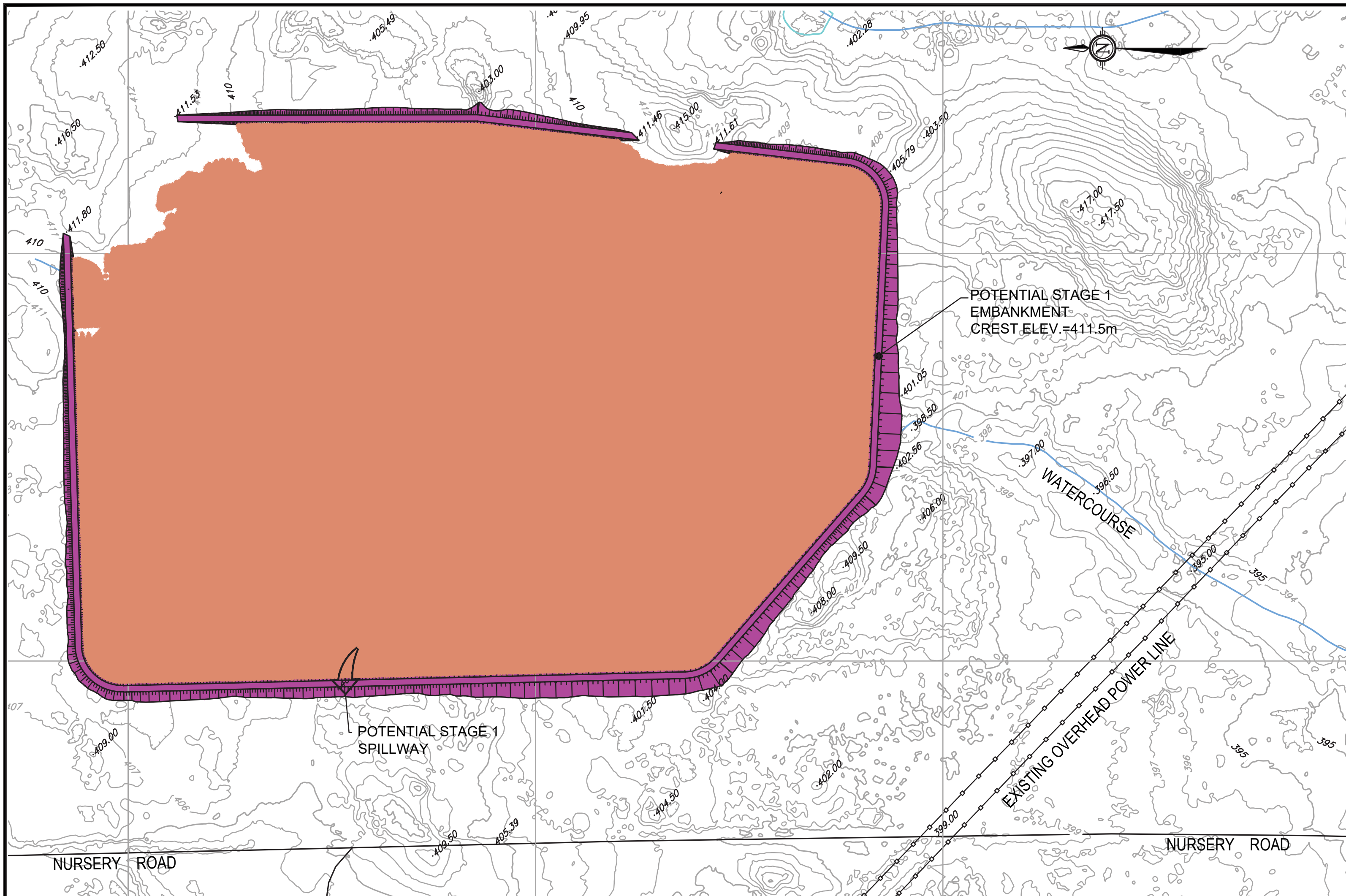
3.7.2 Tailings Storage Facility Embankment

The preliminary embankment cross section for the TSF has been developed with the Alternatives Assessment and will form the basis for advancing to subsequent levels of design. The embankments will be constructed in a staged approach, as discussed above, with the initial stage constructed at pre-production (Figure 3.7.2-1) with subsequent embankment raises during the life of mine to accommodate tailings solids storage, operational and storm water management (Figure 3.7.2-2). The upstream slope of the embankment has been assigned at 2.5H:1V and the downstream slope at 2.25H:1V for the initial embankment. Subsequent raising of the embankments will utilize non-PAG mine waste rock with downstream slopes of 1.5H:1V while maintaining the upstream slope at 2.5H:1V. The downstream waste rock slopes for embankment raising can be stepped with benches to accommodate covering the Stage 1 downstream embankment. The internal drain and transition zones will be constructed at a slope of 2.5H:1V for Stage 1 and the type of embankment raising will dictate the drain and transition slopes for subsequent raises. 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 3.7.2-3). 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 earthfill 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 earthfill 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.

3.7.2.1 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.



LEGEND

- CONTOUR
- ROAD
- WATERCOURSE
- POWER LINE
- PROPOSED SPILLWAY
- PROPOSED TAILINGS FILL AREA
- PROPOSED EMBANKMENT

NOTES:

1. DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. PRELIMINARY STAGE 1 EMBANKMENT FOR ALTERNATIVE 1D (LOCATION 1 WITH FUTURE CO-DISPOSAL OF TAILINGS).
3. INFORMATION PRESENTED IS PRELIMINARY ONLY AND NOT INTENDED FOR CONSTRUCTION.

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PROJECT:	TREASURY METALS - GOLIATH PROJECT TAILINGS STORAGE FACILITY ALTERNATIVES ASSESSMENT
TITLE:	LOCATION 1, STAGE 1 PLAN
PROJECT NO:	141–12598–00
SCALE:	1:5000
DRAWN BY:	
CHECKED BY:	
ISSUE/REVISION:	INTERNAL ISSUE — A
ISSUE DATE:	MARCH 28, 2014
FIGURE NO:	Figure 3.7.2-1

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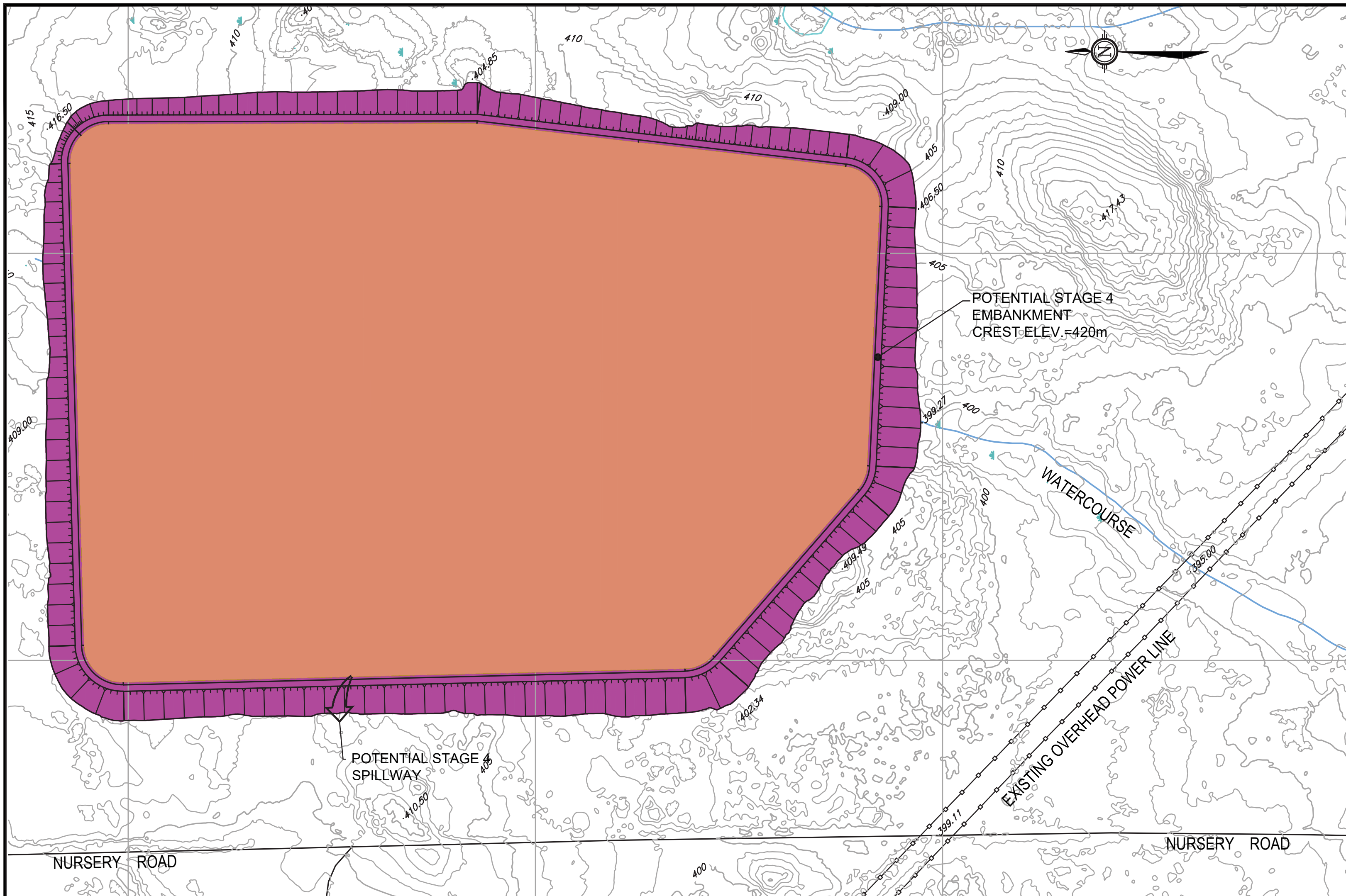

LEGEND

- CONTOUR
- ROAD
- WATERCOURSE
- POWER LINE
- PROPOSED SPILLWAY
- PROPOSED TAILINGS FILL AREA
- PROPOSED EMBANKMENT

NOTES:

1. DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. PRELIMINARY STAGE 4 EMBANKMENT FOR ALTERNATIVE 1D (LOCATION 1 WITH FUTURE CO-DISPOSAL OF TAILINGS).
3. INFORMATION PRESENTED IS PRELIMINARY ONLY AND NOT INTENDED FOR CONSTRUCTION.

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TAILINGS STORAGE FACILITY
ALTERNATIVES ASSESSMENT

TITLE: LOCATION 1, STAGE 4 PLAN

PROJECT NO:	141–12598–00
SCALE:	1:5000
DRAWN BY:	
CHECKED BY:	
ISSUE/REVISION:	INTERNAL ISSUE A
ISSUE DATE:	MARCH 28, 2014
FIGURE NO:	Figure 3.7.2-2

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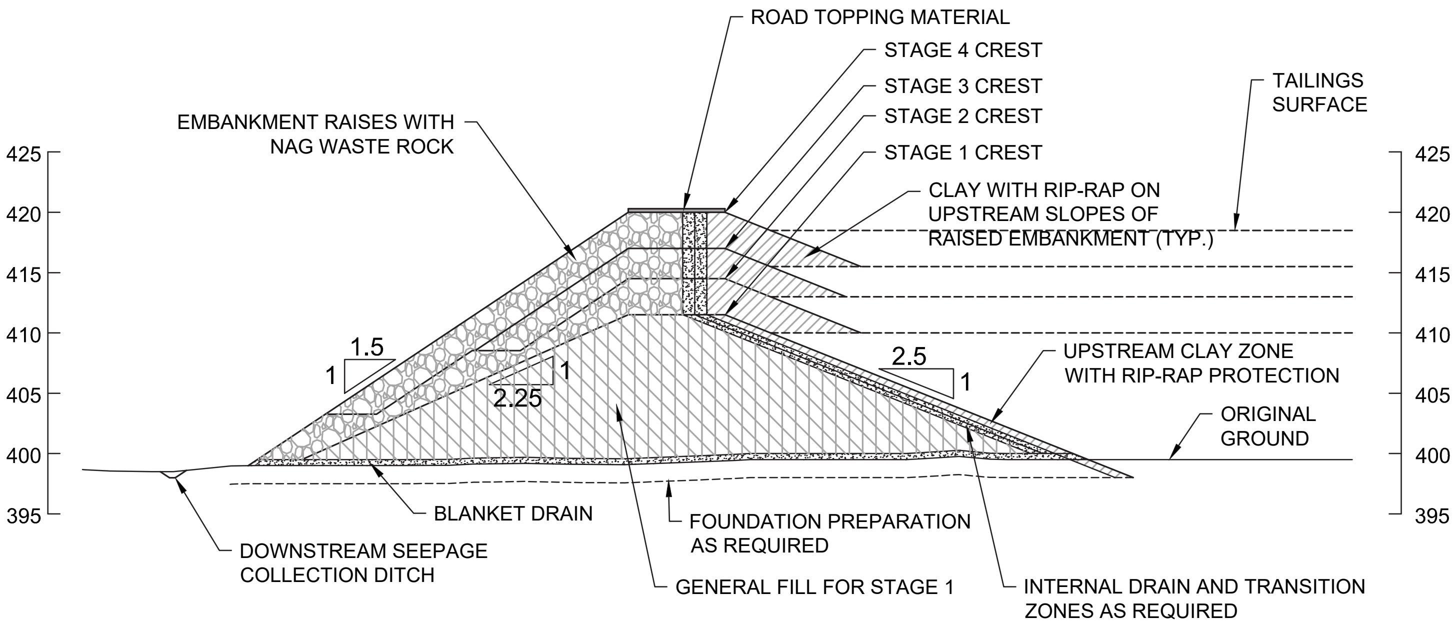

NOTES:

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

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PROJECT: TREASURY METALS - GOLIATH PROJECT
TAILINGS STORAGE FACILITY
ALTERNATIVES ASSESSMENT

TITLE: LOCATION 1
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 3.7.2-3

TREASURY METALS Inc.

The main section of the dam will be constructed on a prepared foundation of native materials. Although it was initially hoped that there was a sufficiently thick low-permeability horizon beneath the TSF to contain the tailings, Treasury Metals are now planning to line the TSF. At a conceptual level, this would consist of an HPDE the liner laid over a prepared basin (e.g., sand or comparable material) such that the HPDE liner is supported once it begins to bear weight. Based on literature (Rowe et al., 2016; Bada-Tweneboah and Giroud, 2016), only a small volume of seepage that would be able to pass through the membranes. For the size of the TSF for the Goliath Gold Project, the volume of seepage passing through the membrane would be about 2.4 m^3/d.

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. The management of seepage from the TSF is discussed in Section 3.7.3. The designs will be refined as the Project advances and in consultation with ECCC to ensure compliance with MMER requirements for runoff and seepage collection.

Foundation preparation within the basin area would consist of clearing all trees and shrubs and stockpiling with the overburden (Figure 3.0-1A). Cleared trees consisting of merchantable timber can be hauled to forestry operations. Non-merchantable timber can be chipped and spread on-site for use as erosion control. The foundation preparation phase will also include the necessary water management systems and drainage collection such that run off is collected prior to any treatment for release to the environment.

3.7.2.2 Embankment Zones

The embankment zones for the TSF have been preliminary 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 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.

Fill zone widths and the final dam width will be confirmed as the project is advanced based on stability, seepage and also graded filter designs based on geotechnical parameters obtained from site investigation activities.

The following provides a preliminary summary of the embankment zones for the TSF embankment:

- Low Permeable Upstream Clay Zone (Zone A) – Constructed with native material from the local borrow sources (i.e. stripping from the open pit mine area) will provide primary containment of tailings solids and stored water. The upstream and internal slopes at Stage 1 will be 2.5H:1V and can be raised vertically with embankment raises. At the final embankment height the clay zone width can be between 2 m to 3 m and will be determined from stability and seepage modeling. Geotextiles may be included with the design and placed on the downstream side of the clay zone to prevent migration of fines into the adjacent zone that will be determined with filter grading design as the project is advanced.
- Internal Filter (Zone B) – Will be constructed on the downstream face of the clay zone using screened sand from local borrow sources or local gravel pits in the Dryden area. The filter width will be determined with seepage analysis (typically 0.5 m to 1.0 m width) over the entire downstream face of the clay zone and will have the same upstream and internal slopes as the clay zone. The drain material can be raised vertically utilizing a centreline style of embankment raise. The filter will also serve to heal cracks that may develop in the core zone by retaining fines at the core/filter interface. The filter design will ensure sufficient permeability to drain the downstream face of the clay zone. The internal filter will also be connected to a blanket drain that is located on the downstream shell zone of the embankment.
- Transition (Zone C) – Will be constructed on the downstream side of the filter (Zone B) and will function to pass seepage and prevent the migration of fines from the adjacent. The transition zone width will be determined similar to the filter zone and can be constructed from screened local material or from a gravel source in the Dryden area. The width of the zone is anticipated to be about 1 m to 1.5 m. The transition zone will be placed at the same slope as the filter for Stage 1 and subsequent embankment rises.
- General Fill (Zone D) – Will be used to construct the main body, or downstream shell zone, for the Stage 1 embankment. The general fill material will be placed on the downstream side of the transition zone with an upstream slope of 2.5H:1V and downstream slope of 2.25H:1V. The downstream slope will be confirmed with stability assessments as the project is advanced. Materials for the general fill zone can be provided from local borrow sources at the site or alternatively as pit run material from gravel pits in the Dryden area.
- Waste Rock Shell (Zone E) – Will consist of non-PAG rock and will be provided from the mining operations should it be shown that non-PAG waste rock in sufficient quantities and

technical quality is available. Otherwise this rock will be source from off-site aggregate suppliers. The rock will be used as downstream shell zone material for embankment raises after Stage 1. The material gradation will be determined from the mine design as the project is advanced and be used in the graded filter design. The mine waste rock designated for potential use will require screening of waste rock to ensure that only non-PAG material is used in the construction of the TSF. The supply of aggregates for the construction of the TSF is discussed further in Section 3.13.3.

- Riprap (Zone F) – Will be placed on the upstream embankment slope and will function to provide protection from potential erosion, wave action and ice damage. Riprap can initially be provided from a local gravel pit for Stage 1 and constructions of future raises can utilize select mine waste rock for subsequent embankment raises. The zone will have the same slope as the upstream embankment at 2.5H:1V.

Other embankment zones will be included with the dam cross section, as required, as the design is advanced and input parameters become available.

Internal Drain System

The presence of HPDE liner under the TSF will contain the tailings and control the movement of water through the dam embankment. The phreatic surface within the embankment and foundation will be controlled with the engineered filters and drains. Two systems are in place to control seepage as secondary containment and control; one behind the core zone (as described above) and one over the prepared foundation of the downstream shell. These systems will collect and control seepage flows that pass through the core and prevent the finer particles from the core or foundation soils from migrating with the seepage flows. All potential seepage water will continue to be contained and would not be discharged from the site as the flows from the filter and drains would be conveyed beneath the shell zone of the embankment to the collection ditch, located along the downstream toe of the embankment, and will then be collected and routed (pumped) back into the TSF.

3.7.3 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. 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.

A finger drain will be constructed in the existing creek channel that bisects the TSF. Collected drainage will be conveyed to a pump station at the downstream (south) end of the TSF, as generally presented in Figure 3.0-1A, and used in the processing plant. 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. Typical cross sections of the perimeter collection ditch for the potential geotechnical conditions are provided in Figures 3.7.3-1 and 3.7.3-2.

3.7.4 Embankment Stability and Seepage

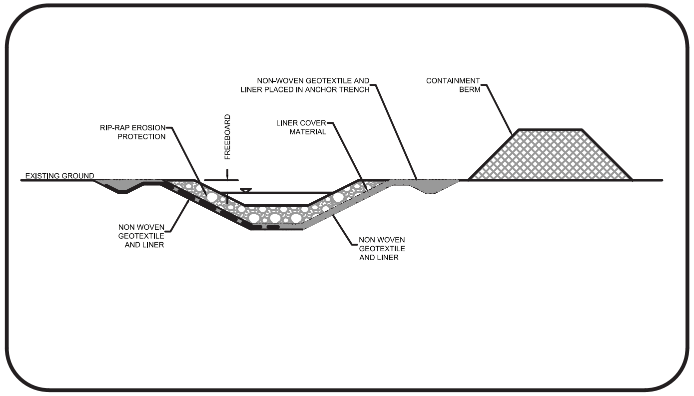
Stability and seepage assessments of the TSF embankments will be completed for each embankment stage of the Project. The assessments will be used to determine the required dam cross section, consisting of upstream and downstream slopes, required zone thicknesses and crest width, to maintain the required 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 3.7.4-1).

Table 3.7.4-1: CDA Guidelines

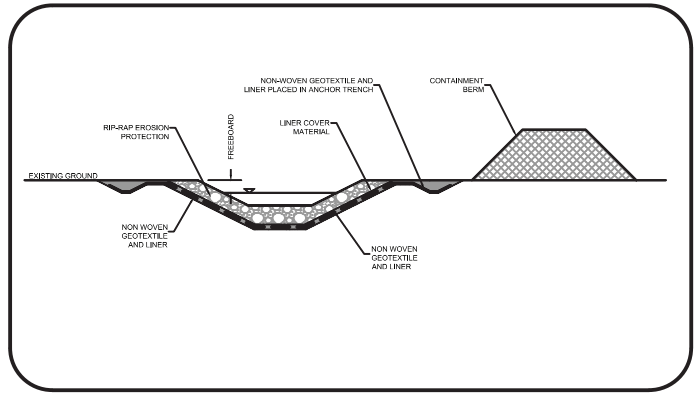
Loading Conditions	Minimum Factor of Safety	Slope
End of Construction (before reservoir filling)	1.3	Downstream and Upstream
Long-term (steady state seepage, normal reservoir level)	1.5	Downstream and Upstream
Full or partial rapid drawdown	1.2 - 1.3	Upstream
Pseudo-static	1	Downstream and Upstream
Post-Earthquake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

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.



RUNOFF COLLECTION DITCH TYPE B-1
RUNOFF AND SEEPAGE COLLECTION



RUNOFF COLLECTION DITCH TYPE B-1
RUNOFF COLLECTION AND TRANSPORTATION
TO COLLECTION PONDS

NOTES:

1. INFORMATION SHOWN IS CONCEPTUAL AND IS PROVIDED FOR DISCUSSION.
2. SELECTION OF DITCH SECTIONS FOR CONSTRUCTION TO BE DETERMINED FROM SITE INVESTIGATION RESULTS.
3. ALL DITCHES TO BE DESIGNED WITH FLOW CAPACITY FOR THE ENVIRONMENTAL DESIGN STORM FOR THE SITE. DITCH LINING TO INCLUDE EROSION AND SCOUR PROJECTION (I.E. RIPRAP) BASED ON PEAK VELOCITY.
4. LINER FOR CONTAINMENT TO CONSIST OF LOW PERMEABLE ENGINEERED PRODUCT (I.E. GCL, HDPE).
5. CONTAINMENT BERM TO BE CONSTRUCTED OF EXCAVATED MATERIAL FROM DITCH ALIGNMENT. CONTAINMENT BERM TO PROVIDE ADDITIONAL CONTAINMENT IF WATER BREACHES THE DITCH.
6. LINER COVER PLACED TO PROVIDE PROTECTION AGAINST DAMAGE. LINER COVER MATERIAL TO CONSIST OF FINER GRADED GRANULAR MATERIAL (I.E. SAND) AND WILL BE DEPENDENT ON THE LINER SUPPLIER RECOMMENDATIONS.
7. DITCH TYPE B-1 - TO WORK IN CONJUNCTION WITH SEEPAGE COLLECTION DITCH CONCEPTS BASED ON SUB-SURFACE SOIL CONDITIONS IDENTIFIED BY SITE INVESTIGATIONS.

PRELIMINARY
FOR DISCUSSION PURPOSES

NOT FOR CONSTRUCTION

CLIENT: TREASURY METALS Inc.

CLIENT REF. #:

PROJECT: GOLIATH GOLD PROJECT
WABIGOON, ONTARIO

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SEAL:

ISSUED FOR - REVISION:

IS	RE	DATE (M/D/Y)	DESCRIPTION
A		02/9/17	ISSUED FOR CLIENT REVIEW

PROJECT NO: 161-15853-00	DATE: NOVEMBER 2016
ORIGINAL SCALE: NOT TO SCALE	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm
DESIGNED BY: B.PLUMRIDGE	
DRAWN BY: G.HOOGWERF	
CHECKED BY:	

DISCIPLINE: MINING

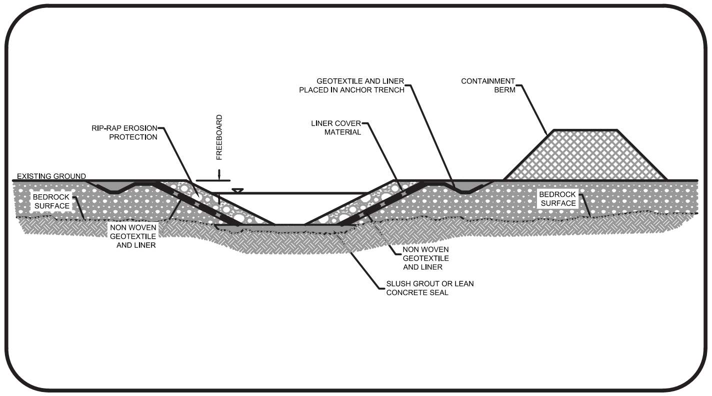
TITLE: CONCEPTUAL SEEPAGE/RUNOFF COLLECTION DITCHES

DOCUMENT NUMBER: FIGURE 3.7.3-1

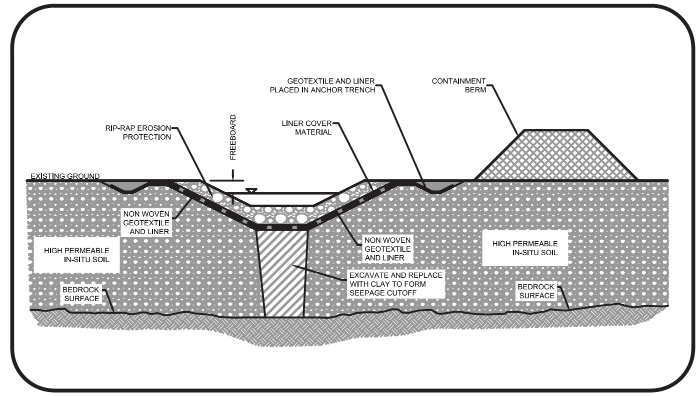
SHEET #: 2 OF 2

ISSUE: ISSUED FOR CLIENT REVIEW
DATE OF: FEBRUARY 9, 2017

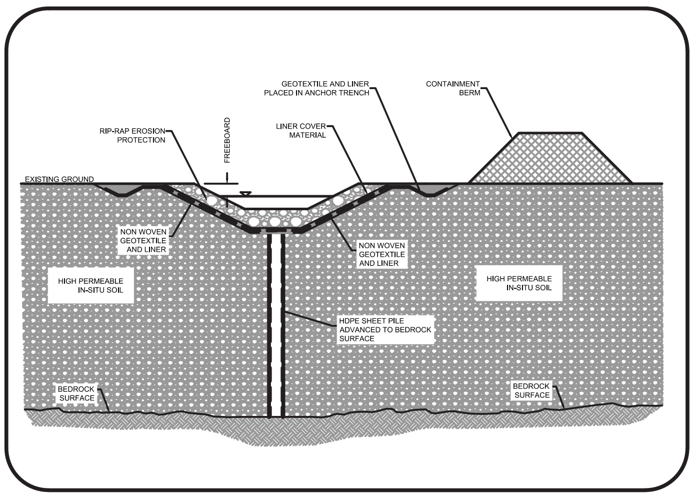
REV #: A



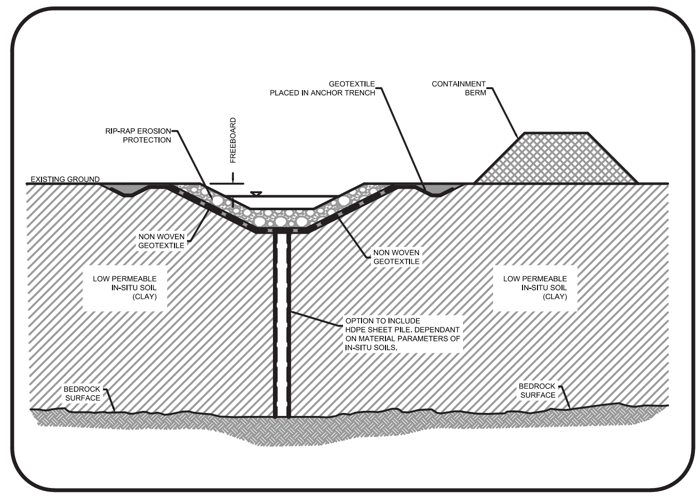
SEEPAGE COLLECTION DITCH TYPE A-1
BEDROCK AT OR CLOSE TO SURFACE



SEEPAGE COLLECTION DITCH TYPE A-2
SHALLOW BEDROCK WITH HIGH PERMEABLE SOILS



SEEPAGE COLLECTION DITCH TYPE A-3
DEEP BEDROCK WITH HIGH PERMEABLE SOILS



SEEPAGE COLLECTION DITCH TYPE A-4
LOW PERMEABLE SOILS OVER BEDROCK

NOTES:

1. INFORMATION SHOWN IS CONCEPTUAL AND IS PROVIDED FOR DISCUSSION.
2. SELECTION OF DITCH SECTIONS FOR CONSTRUCTION TO BE DETERMINED FROM SITE INVESTIGATION RESULTS.
3. ALL DITCHES TO BE DESIGNED WITH FLOW CAPACITY FOR THE ENVIRONMENTAL DESIGN STORM FOR THE SITE. DITCH LINING TO INCLUDE EROSION AND SCOUR PROJECTION (I.E. RIPRAP) BASED ON PEAK VELOCITY.
4. LINER FOR CONTAINMENT TO CONSIST OF LOW PERMEABLE ENGINEERED PRODUCT (I.E. GCL, HDPE).
5. CONTAINMENT BERM TO BE CONSTRUCTED OF EXCAVATED MATERIAL FROM DITCH ALIGNMENT. CONTAINMENT BERM TO PROVIDE ADDITIONAL CONTAINMENT IF WATER BREACHES THE DITCH.
6. LINER COVER PLACED TO PROVIDE PROTECTION AGAINST DAMAGE. LINER COVER MATERIAL TO CONSIST OF FINER GRADED GRANULAR MATERIAL (I.E. SAND) AND WILL BE DEPENDENT ON THE LINER SUPPLIER RECOMMENDATIONS.
7. TYPE A-4 - USE OF SHEET PILE DEPENDENT MATERIAL PROPERTIES OF THE POTENTIAL LOW PERMEABLE IN-SITU SOILS AND WILL BE DETERMINED BY LABORATORY TESTING ON SAMPLES COLLECTED FROM PLANNED SITE INVESTIGATIONS.

PRELIMINARY
FOR DISCUSSION PURPOSES

NOT FOR CONSTRUCTION

CLIENT: TREASURY METALS Inc.

PROJECT: GOLIATH GOLD PROJECT
WABIGOON, ONTARIO

CONSULTANT: WSP

ISSUED FOR – REVISION:

IS	RE	DATE (M/D/Y)	DESCRIPTION
1		02/9/17	ISSUED FOR CLIENT REVIEW

PROJECT NO: 161-15853-00
DATE: NOVEMBER 2016
ORIGINAL SCALE: NOT TO SCALE
IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm
DESIGNED BY: B.PLUMRIDGE
DRAWN BY: G.HOOGWERF
CHECKED BY:
DISCIPLINE: MINING
TITLE: CONCEPTUAL SEEPAGE/RUNOFF COLLECTION DITCHES
DOCUMENT NUMBER: FIGURE 3.7.3-2
SHEET #: 1 OF 2
ISSUE: ISSUED FOR CLIENT REVIEW
DATE OF: FEBRUARY 9, 2017
REV #: A

Once the TSF is constructed to its full extent, as presented in Figure 3.0-1A, the spillway to prevent crest overtopping will be positioned on the west side of the TSF so that overflow during an extreme flood event would drain to the open pit where it would be contained. The lined swale to connect the spillway with the pit is presented in Figure 3.0-1A.

3.7.5 Tailings Management

The Stage 1 TSF embankment will be stabilized at the pre-production stage and will be raised over the operational life of the facility to provide containment of tailings solid, operational and to provide a supporting role for the site-wide water management (see Figures 3.7.1-1 and 3.7.1-2; 3.7.2-1 to 3.7.2-3). 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.

This is generally carried out by closing one spigot and opening one spigot at the other end of the series. This is repeated on a daily or on an as required basis in order to maximize the tailings densities and to ensure a uniform tailings elevation across the storage.

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 deliver 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.

The design of the tailings deposition system line will utilize the maximum anticipated tailings flow rate over the life of the facility. The design of the tailings deposition pipelines will consider the design criteria for the tailings consisting of solids content, specific gravity and anticipated flow rates. The deposition pipeline will also be equipped with a series of single point off takes spaced at approximately 25 to 50 m centres along the pipeline. The spigot off takes will be comprised of tees, flexible hose and spigot clamps. The standard operating procedure under the tailings deposition plan will require frequent re-location of the tailings discharge to establish a uniform deposition of tailings solids along the entire perimeter of the tailings storage facility (TSF). The primary deposition method will be spigotting as long as the tailings slurry does not freeze before it exits the discharge pipeline. The risk of freeze-up is expected to be minor because slurry typically exits a CIL process at more than 20 degrees Celsius and also because the operating practice will be to discharge tailings during winter months as close to the mill as possible to minimize pumping distances to the tailings discharge point.

The spigotting method of tailings deposition promotes a uniform deposition across a large section of dam embankment. Furthermore, the tailings grind is considered “ultra-fine”, which will promote a flat tailings deposition slope and further minimize the risk of prolonged exposure of tailings in an elevated beach. The current design of the Project calls for the maintenance of tailings solids in a saturated state, with a water cover over the majority of the TSF surface. Tailings will be managed to ensure that any exposed tailings beach areas will not be exposed long enough to allow for oxidation of the tailings or the development of acid drainage conditions. Additionally, the tailings will be maintained in a manner that keeps them saturated so as to prevent the onset of acidification.

The tailing delivery pipeline will be routed on the surface between the plant and TSF embankment. A sand berm is to be placed (on top of the pipe) at intervals to act as a thrust support along the pipe route. Pipe routing under roadway access shall be installed in a corrugated galvanized culvert to allow minimal roadway disturbance, ease of inspection and maintenance requirements. Applicable slurry isolation valves shall be provided at each end of the pipes to allow for minimal downtime in the event of pipe switchover and drains at low point locations with containment as required along the pipe route.

The deposition pipeline can be relocated to the top of each embankment stage for each raise. 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.

All pumps and pipelines will need to be supplied as acid resistant due to the potentially acidic nature of the materials being handled. Pipelines will also be insulated and heat traced to ensure that the lines do not become frozen during winter operations.

3.7.6 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 field 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.
- The facility will be inspected by a qualified geotechnical engineer on an 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 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. A description of the groundwater follow-up program is provided in Sections 13.10 and 13.11.

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.

Monitoring will be in accordance with standard engineering practice as well as requirements of the ECA and the LRIA approval.

3.8 Water Management

3.8.1 General Approach

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 (alkalinity will be applied within the Operations Area as required to maintain near neutral runoff and ensure it is suitable for the process plant); 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; and
- Collection of runoff and seepage from the entire Operations Area.

The runoff and seepage collection is proposed to be managed by a perimeter ditching system to collect water for use in the process or controlling dust. These ditches will surround the operations area such that water can be intercepted prior to leaving the operations area and reaching the natural environment. A berm will be constructed along the outer edge of the perimeter ditching to prevent non-Project affected water from entering the operations area. The water management system will also include several collection ponds or sumps in strategic areas surrounding the operations area such that water can be collected for use in the process or for managing dust. The collections ponds, as well as the minewater pond, will be used to hold collected water for future use in the process plant or for managing dust. Excess water will be treated and then released from site into Blackwater Creek through an engineered discharge structure. The perimeter ditching system will be designed and operated such that it will have the capacity to operate within the relevant storm events that may occur.

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. There is one final discharge point from the Operations Area, as shown in Figure 3.0-1A.

3.8.2 Mine Water Management

Model inputs and outputs for the supplemental water balance modelling for the ultimate envisioned Project footprint is provided in Appendix F. This updated modelling has been undertaken to estimate dewatering, water management, effluent discharge volumes, and water requirements for a 1:20 dry hydrologic year, average hydrologic year, and a 1:20 wet hydrologic year. Mining dewatering requirements, as estimated in Appendix M of the revised EIS, are expected to be 1,320 m^3/d of groundwater influx for the 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. This system will progress over time as the pit and underground operations advance throughout the mine life. 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.

A minewater pond (MWP) will be constructed south of the Tailings Storage Facility (TSF). Mine water from the pit and the underground mine workings will be pumped to the minewater pond. Suspended solids will be quickly settled in this pond through the use of coagulants and/or flocculants. Biological oxidation of ammonia in the MWP will be promoted through the use of in-pond aerators and the placement of media to provide increased surface area for ammonia oxidizing bacteria. This is similar in fashion to the contingency measures as described further in Section 3.8.5. Water from the minewater pond would be used in the underground mine, the Process Plant and for dust suppression within the Operations Area. Water that is used within the Operation Area that does not evaporate will be contained by the perimeter runoff and seepage collection ditch and subsequently treated within the effluent treatment system and discharged to Blackwater Creek. Surplus water in the minewater pond will be pumped to the effluent treatment system for treatment and discharge to Blackwater Creek. Adequate freeboard will be maintained in the minewater pond at all times to manage the EDS.

3.8.3 Water Supply for Process Plant Operations

During the early stages of construction a perimeter ditch will be constructed around the entire operations area. All runoff from the operations area will be collected and stored on site for use in the process, and for initiating the TSF once operations start. It is expected that there will be a sufficient inventory of water collected during the site preparation and construction phase to support the process and operations without the need for accessing additional sources of water off-site.

During operations, the process plant will require approximately 3,044 m^3/d of water. This water will come from a number of sources, including runoff from the site, water from the dewatering of the open pit and underground mine, and water reclaimed from the TSF. There would also be an intermittent need for a relatively small amount of fresh water from outside the operations area for the makeup of select reagents, various spray nozzles, carbon elution, plant wash down, and potable water. The amounts of water available from the various sources, as well as the amount of water to be released would vary based on the meteorological conditions, as described in the updated water balance discussed in Section 3.8.6. Model inputs and outputs for the supplemental water balance modelling for the ultimate envisioned Project footprint is provided in Appendix F. This updated modelling has been undertaken to estimate required effluent discharge volumes and to determine how process water requirements would be met for a 1:20 dry year, average hydrologic year and a 1:20 wet year.

The fresh water requirements for the Project are to be provided from three former irrigation ponds within the Administration Area (Figure 3.8.3-1). These ponds are situated on the creeks referred to as Thunder Lake Tributary 2 and Thunder Lake Tributary 3, as presented in Figures 3.0-1A and 3.0-1C. These creeks have been gauged and the analysis indicates there is sufficient flow to meet the process plant requirements without needing to take more than 5% of the flow of in these tributaries. Real-time flow measurement procedure will be used to determine the allowable withdrawal from the creeks. The pump intake will be designed in accordance with Fisheries Canada (DFO) guidelines for pump intakes to minimize the effects on any fish present.

3.8.4 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 approximately 20 m^3/day required. This water will be used for specialized purposes within the plant process along with personnel uses such as showers and sanitary services. 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.

Figure 3.8.3-1: Tree Nursery Irrigation Ponds for Water Intake

Freshwater 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 runoff collection pond or the MWP as it will not require further treatment for use.

3.8.5 Tailings Storage Facility Water Management

Water management for the TSF will be required primarily for operations water as storm water and minewater will be managed separately. That stated, there will need to be sufficient capacity built into the management of water within the TSF to accommodate precipitation falling on the surface of the TSF. Because testing has identified the tailings solids as being PAG, the tailings will need to be managed in a saturated state or under a water cover to restrict contact with the atmosphere, and to minimize acid generation. Treasury Metals has committed to maintaining a water cover over the majority of the TSF, and has proposed an average water cover depth of 1.2 m. Spigotting will be used in a fashion that surrounds the TSF to deposit material in an evenly distributed manner. While the company realizes that tailings material will not be deposited in a strictly uniform and/or flat manner it is reasonable to assume that 1.2 metres of water on top of the bulk of the TSF would be achievable.

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. While in operation, the TSF will therefore contain all operational water and also provide containment of the EDS for storm water management. An emergency overflow spillway will be included to maintain embankment stability during the occurrence of significant storm water events. The spillway will be positioned on the west side of the TSF so that overflow during an extreme flood event would drain to the open pit where it would be contained. 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 yr., 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 Inflow Design Flood (IDF) that will be determined once the dam's Hazard Potential Classification has been established.

The limiting nutrient for algal blooms and eutrophication (in waters such as those found in Northern Ontario) is typically phosphorus and not nitrogen (Horn and Goldman 1994). Phosphorus is not present in blasting agents, process plant reagents or leachate from rock based on shake flask extraction tests with de-ionized water (refer to Appendix C of the geochemistry report presented in Appendix K of the revised EIS). The shake flask extraction tests with de-ionized water are regarded as more representative of field conditions compared to the acid wash extraction because the tailings storage facility (TSF) water from a Carbon in Leach (CIL) gold recovery process is alkaline. Although grey water will be pumped to the TSF, phosphorus free soaps and detergents will be used at the Project site and grey water is not expected to contain a significant amount of phosphorus.

Contingency measures to quickly reduce phosphorus concentrations in the TSF supernatant pond would include the addition of metal based coagulants or other non-toxic water treatment chemicals that are used to precipitate or sorb phosphorus and render it non-biologically available. These measures can be implemented on short notice and do not require significant lead time or suitable conditions (i.e., temperature, pH, water chemistry) as is often the case with biological treatments. The reclaim pump in the TSF supernatant pond will be over-sized so that it can circulate water within the supernatant pond and reduce the likelihood of it becoming anoxic. In the event that anoxic conditions prevail in any of the on-site ponds and phosphorus in sediment is solubilized into the water column, Treasury Metals would deploy industrial aerators to increase dissolved oxygen and prevent this occurrence. Aerators would be deployed carefully to avoid increasing suspended solids concentrations.

3.8.5.1 Water Transfer System

A water transfer system will be used to transfer water from the TSF to the plant site as reclaim for use in the processing operations as well as potential surplus water for treatment. The expected transfer rates of water, and the water balance based on the current Project configuration are provided in Section 3.8.6 and Appendix F, will be determined with the water balance that will be prepared during detailed design as the Project is advanced. The water transfer system can consist of a floating pump barge with an HDPE pipeline or, alternatively, a stationary reclaim system and will be dependent on the detailed water/solids balance modeling as the Project is advanced.

3.8.5.2 Water/Solids Balance

A monthly water/solids balance will be completed as the design is advanced to determine the effect of various precipitation conditions on the overall water management requirements for the TSF and to confirm that the operational and storm water pond levels will be maintained over the life of the facility. The analyses were completed for the planned 12 years of operations based on the tailings solids volume that is planned for deposition into the TSF with co-disposal occurring into the mine workings.

The water/solids balance will be used to determine the quantity of water that must be transferred to the water treatment plant based on net inputs from precipitation on catchments, process water and other water inputs that includes underground mine dewatering. The analysis will also be used to confirm that the proposed water cover can be maintained during periods of low precipitation conditions. The water/solids balance analyses will utilize a computer add on program called @RISK to statistically determine pond elevations. Water/solids balance modeling utilizing the program @RISK permits cell inputs to be modelled as distributions rather than as single values. The @RISK software has the capability to perform Monte Carlo type simulations and track the various outputs that result from variations in the input. The model can run several iterations (i.e., 1,000 or more) such that 1,000 or more different sequences of monthly precipitation over the year are considered and the resultant pond levels tracked. This analysis will produce the average as well as the high and low pond levels during the planned years of operations. This analysis will be used to establish the required pond operational limits and identify the maximum operating water level.

3.8.5.3 Tailings Deposition

Tailings deposition into the facility will result in development of a tailings surface that will rise over the operational life and dictate the required embankment heights at each stage to provide containment. A deposition plan will be required for the planned years of operation, based on the total volume of tailings that will be deposited into the TSF. Deposition will consist of approximately 8,242,364 m³ of tailings from the embankment crest by spigotting. The primary deposition method will be spigotting as long as the tailings slurry does not freeze before it exits the discharge pipeline. The risk of freeze-up is expected to be minor because slurry typically exits a CIL process at more than 20 degrees Celsius and also because the operating practice will be to discharge tailings during winter months as close to the mill as possible to minimize pumping distances to the tailings discharge point. The spigotting method of tailings deposition promotes a uniform deposition across a large section of dam embankment. Furthermore, the tailings grind is considered “ultra-fine,” which will promote a flat tailings deposition slope and further minimize the risk of an elevated beach. Other operations using this deposition method have seen tailings beach slopes on the order of 0.5%.

The elevation of the tailings surface would be monitored by bathymetry as well as physical measurement around the perimeter of the tailings facility to ensure that tailings are maintained in a saturated condition, or beneath a water cover during operations during operations. Contingency measures to ensure tailings are maintained in a saturated conditions or under a water cover during operations may include:

- Relocation of the active tailings discharge point.
- Temporary reduction of water reclaim from the tailings facility
- Implementation of a floating discharge point

The water balance will be updated and refined during operations. The data collected during operations will be used to predict the minimum sustainable water cover required, post operations, prior to the implementation of the final closure cover.

The yearly rate of tailings flow is not consistent over the life of the operations as tailings will be deposited initially into the TSF only, followed by a period when a portion of the tailings solids being directed to the underground mine workings for disposal (Table 3.8.5.3-1).

Table 3.8.5.3-1: Tailings Rate of Rise

Year of Operation	Dry Tonnes per Year	Total Tailings Volume
1	985,500	895,909
2	985,500	1,791,818
3	985,500	2,687,727
4	985,500	3,583,636
5	985,500	4,479,545
6	591,300	5,017,091
7	591,300	5,554,636
8	591,300	6,092,182
9	591,300	6,629,727
10	591,300	7,167,273
11	591,300	7,704,818
12	591,300	8,242,364

These yearly volumes are based on the design solids content of 43% and a corresponding in-situ dry density of 1.1 t/m³. A reduction in the tailings deposition will occur after Year 5 to approximately 0.7 m per year based on a percentage of tailings being routed to co-disposal. The tailings rate of rise will be determined in parallel with the detailed design and construction staging. The tailings surface, over time, will be used to confirm and optimize the required embankment heights, pond levels for operations and storm containment and also identify the required embankment freeboard.

3.8.5.4 Model Inputs and Outputs

Model inputs and outputs for the supplemental water balance modelling for the ultimate envisioned Project footprint is provided in Appendix F. This updated modelling has been undertaken to estimate required effluent discharge volumes and to determine how process water requirements would be met for a 1:20 dry year, average hydrologic year and a 1:20 wet year. The only fresh water withdrawal from outside the Operations Area will be the withdrawal of no more than 5% of the flows in the two creeks at the tree nursery ponds.

3.8.5.5 Methodology

The monthly water/solids balance will be completed by applying various precipitation conditions over the planned years of operations. The water/solids balance will be completed as a spreadsheet analysis and applied the design constraints, as listed above, with the @RISK simulation. The analysis will be used to ensure that operational pond levels are maintained to provide the water cover over the tailings beach and do not infringe above the prescribed maximum operational pond level established for each embankment stage.

Runoff into the pond will be from the contributing drainage basin areas and estimates of the runoff coefficients for each. Snowmelt parameters will be included within the model to account for the effects of snowpack and spring melt. Accumulated snow up to the months of March, April and May can be assigned to melt at a rate of 10% in March, 20% in April and 70% in May, meaning that 100% of the accumulated snow has melted by the end of May. A percentage of monthly snowfall will also be converting to runoff during the winter months. Consideration for the freezing conditions at the site during the winter months will also be included with the model by applying pond ice thickness. Pond levels in the TSF may need to be maintained to provide some unfrozen water to ensure that the pond does not become completely frozen to depth and to ensure that makeup water to the mill is provided on a yearly basis. Allowing the pond to freeze through its depth can result in growing ice as additional water is discharged onto the frozen surface which can also cause damage to intakes and reclaim pumps.

3.8.5.6 Storm Water Management

The Maximum Operating Pond Level and allowances for containment of the EDS will be used for water pond management for each embankment stage during the project. As part of normal operations, pond operating procedures will be established in the Operations Manual and ponds will be drawn down as necessary to maintain adequate capacity to manage the EDS.

The storm water modelling for design of the emergency overflow spillway for each embankment stage will involve assessing the IDF event for the facility based on the HPC. The HPC is the classification system established by the CDA as a selection criteria used to determine the overall hazard potential based on the effects of a dam failure. Each dam is generally classified in accordance with the severity of the hazard resulting from the failure of the dam or its associated structures and the perceived risk of occurrence. This hazard potential classification forms the basis for the design requirements and ongoing surveillance activities. Classification of each dam is carried out based on consideration of the potential consequences of failure, which includes Population at Risk, Potential Loss of Life, Environmental and Cultural Values and Infrastructure and Economics. The criteria that is used to determine the HPC for dams in accordance with the CDA guidelines and MNRF Best Management Practices is provided in Appendix D-1, inclusively. The required IDF based on the HPC is provided in Appendix D-1 for the CDA guidelines and MNRF Best Management Practices, inclusively. These criteria will be used to identify the HPC and corresponding IDF for the TSF as the project is advanced.

The prescribed IDF will be routed thought the facility and will be used to design the emergency overflow spillway. The spillway design will be completed with HydroCAD®, which is a computer program that utilizes accepted methods of hydrologic analysis to estimate the runoff flows resulting from a particular storm routed through a watershed(s) with specified characteristics. The IDF design event will be assessed by distributing the precipitation over time using the SCS (Soil Conservation Service) Type II distribution. Typically this method of analysis determines the time of concentration (tc) for each sub catchment based on the soil cover, average land slope and hydraulic length for each area. The time of concentration is the time required for runoff to arrive at the outlet of the sub-catchment from its most remote point. The soil cover is categorized using the runoff curve number (CN) numbers based on SCS runoff curve numbers ranging from 1 to 99. The analysis will set the starting pond elevation at the invert of the spillway to model the potential worst case condition assuming that all potential allowances for water storage have been used.

Due to the anticipated pond area corresponding to the starting elevation (spillway inverts) at the start of the model, a large portion of the catchment will be modelled as pond (open water) with a CN of 99. Additional inputs into the models included pond storage characteristics and spillway geometry. To determine the required spillway configuration for the selected embankment crest elevations, HydroCAD® uses the IDF, catchment and storage information to develop a discharge rate and water level over time for a given spillway configuration. The spillway configuration is required to meet two principle design objectives, which include passing the peak flow within the designated freeboard allowance (minimum freeboard) and ultimately discharging the total IDF volume and returning the pond to normal levels within a reasonable period of time. The designated minimum freeboard allowance above the peak flood level is included to account for wave run-up. Freeboards for the facility will be determined utilizing the *Lakes and Rivers Improvement Act* and the CDA guidelines.

3.8.6 Water Balance

Since the submission of the original EIS, Treasury Metals has been advancing their engineering for the Project, including refining the water balance for the site. The overall concept for managing water at the Project varies by phase in the following manner:

- **Site preparation and construction phase**: A perimeter ditch/berm runoff and seepage collection system around the operations area will be developed as part of the water management system during the site preparation and construction activities. This system will collect the runoff from the site for use in the start-up of the tailings storage facility (TSF) and the processing plant. A series of runoff collection ponds will be constructed to manage the runoff from the site. During this phase, dewatering of the overburden will begin so the material can be stripped in preparation for mining operations. A minewater pond will be constructed at the toe of the TSF to help manage this water. Construction will also start on the TSF, and any excess water will be directed to the newly constructed facility. During the site preparation and construction phase there will be no surface water discharges once the water management systems are in place.
- **Operations phase**: During operations, all of the runoff from the operations area will be collected for use in the water management system. The open pit and underground mine will need to be dewatered to provide a safe working environment. This water will be used to supplement the processing requirements, and will be managed onsite to balance the water available to meet the requirements during the year, as detailed below. Water will be used to process the ore and recover the resources present. A steady supply of water for the process plant is required as a portion of the water sent to the TSF will remain bound in the tailings and will no longer be available for use. The process water needs will be supplied largely be water reclaimed from the TSF, as well as water from the runoff collection and minewater ponds. If required, fresh water to support the Project will be taken from the irrigation ponds at the former MNRF tree nursery. These ponds are located on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. The amount of water withdrawn from these ponds will vary based on the season and weather conditions, but will not exceed 5% of the flow into either of the irrigation ponds. During operations, excess water not required at the site will be treated to meet the Provincial Water Quality Objectives (PWQO) prior to discharge to Blackwater Creek through an engineered discharge structure.
- **Closure phase:** During the closure phase, the facility will be decommissioned and the open pit and underground mine will be allowed to start filling with water. The operations are will be graded to direct all of the runoff towards the open pit. The supernatant water within the TSF will be withdrawn, treated and used to help fill the pit. During the closure phase, there will be no discharges of surface water to the surrounding watercourses.
- **Post-closure phase:** Water management during the first few years of the post-closure phase will be similar to the closure phase conditions. All of the runoff from the site will continue to be directed to the open pit and there will be no discharges of surface water

until the pit is fully flooded. Once this occurs, water from the open pit will be released into Blackwater Creek Tributary 1 through an engineered spillway. Groundwater inflow will continue to the open pit in the post-closure phase.

The operations phase water balance is provided in Appendix F to the revised EIS. The water balance provides estimates of the required effluent discharge volumes and process water requirements for a 1:20 dry year, average hydrologic year and a 1:20 wet year. A flow diagram showing the conceptual water balance for the Project is provided in Figure 3.8.6-1. The operations water balance makes the maximum use of the water available at the site. The only fresh water withdrawal from outside the operations area will be the withdrawal of no more than 5% of the flows into the former irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3.

The water balance for the Project will vary between the wet year, average year and dry year, as well as from one month to the next in any individual year, as detailed in Appendix F. Table 3.8.6-1 provides the conceptual monthly water balance for the average climatic year. Similar tables for the 1 in 20 dry year, and the 1 in 20 wet year can be found in Table 3.8.6-2 and 3.8.6-3, respectively.

Design basis confirmation and sensitivity analyses will be undertaken at the detailed design stage.

Contingencies that would be implemented in the event of a freshwater shortfall include treatment of TSF supernatant pond water so that it can be used as freshwater in the process plant and also the use of dust suppressants to reduce water that is consumed for dust suppression purposes.

3.8.7 Cyanide Management

Cyanide solution management is an important component of the overall water management strategy to ensure that wildlife, including waterfowl and aquatic life, are protected. Additionally, effective cyanide management will help minimize the cyanide consumption and help prevent the inadvertent release of cyanide into the environment. Treasury Metals will employ a two part strategy for managing cyanide at Project, namely: reduce and re-use; and treatment or destruction.

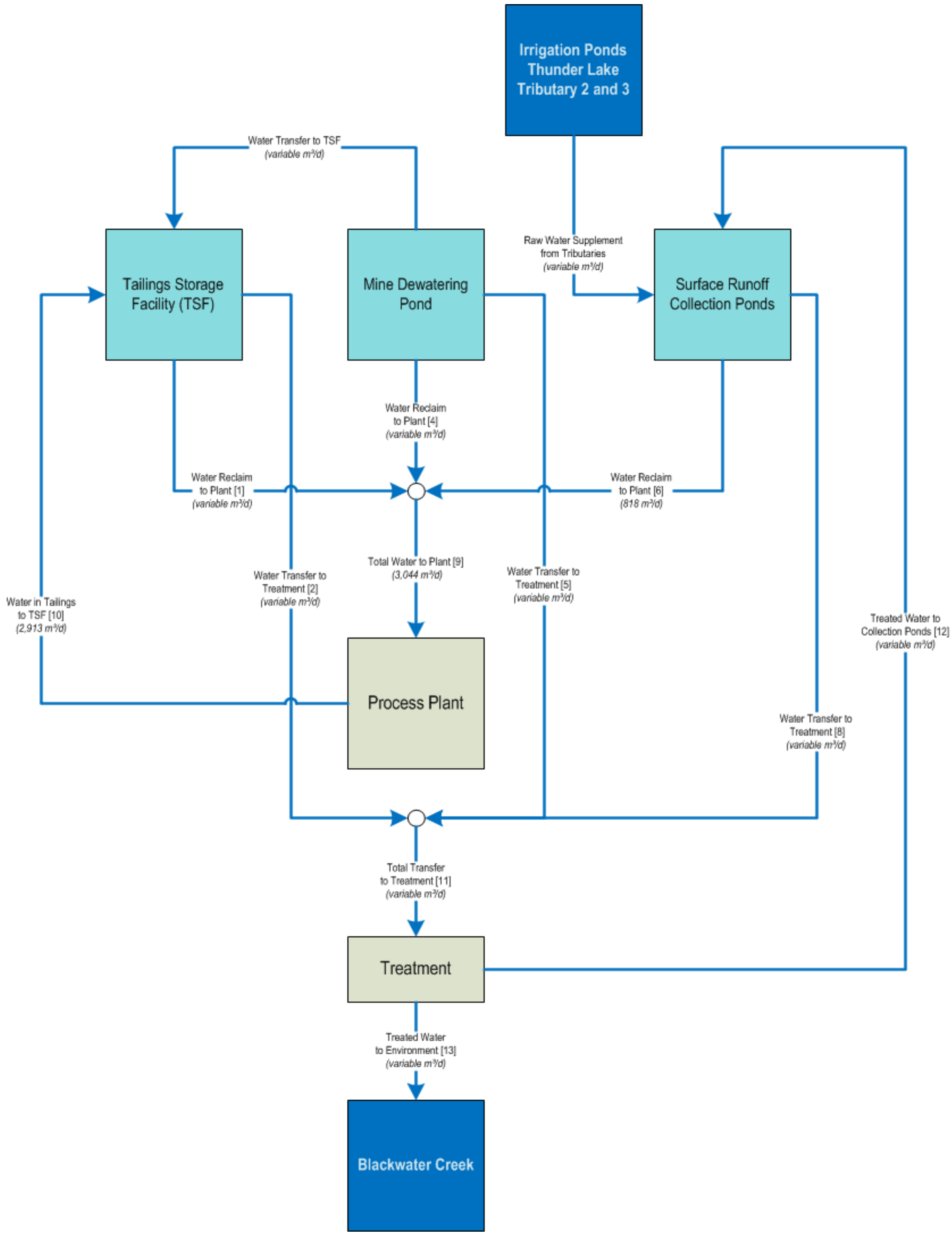


Figure 3.8.6-1: Conceptual Water Balance Flow Diagram

Table 3.8.6-1: Conceptual Water Balance for Operations (average year)

Water Transfer	Average Flow (m³/day)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TAILINGS STORAGE FACILITY												
Water Reclaim to Plant (1)	1,592	1,647	1,960	2,226	1,163	1,485	989	1,098	2,174	2,172	2,226	1,615
Water Transfer to Treatment (2)	0	0	0	1,180	0	0	0	0	0	0	147	0
MINE DEWATERING POND												
Water Transfer to TSF (3)	0	0	0	0	0	0	0	0	0	0	0	0
Water Reclaim to Plant (4)	634	579	266	0	1,063	741	1,237	1,128	52	54	0	611
Water Transfer to Treatment (5)	715	799	1,276	2,376	924	1,558	918	871	2,079	1,861	1,758	749
SURFACE RUNOFF COLLECTION PONDS												
Water Reclaim to Plant (6)	818	818	818	818	818	818	818	818	818	818	818	818
Fresh Water from Tributaries (7)	158	119	138	11	0	0	0	0	0	0	0	274
Water Transfer to Treatment (8)	0	0	0	0	0	0	416	407	557	263	58	0
PROCESS PLANT												
Total Water to Process Plant (9)	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044
Water in Tailings to TSF (10)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
TREATMENT PLANT												
Total Transfer to Treatment (11)	715	799	1,276	3,556	924	1,558	1,335	1,277	2,637	2,124	1,963	749
Treated Water to Collection Ponds (12)	0	0	0	0	0	0	0	0	0	0	0	0
Treated Water to Environment (13)	715	799	1,276	3,556	924	1,558	1,335	1,277	2,637	2,124	1,963	749

Note: The values in parentheses correspond to the flow diagram in Figure 3.8.6-1.

Table 3.8.6-2: Conceptual Water Balance for Operations (dry year)

Water Transfer	Average Flow (m³/day)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TAILINGS STORAGE FACILITY												
Water Reclaim to Plant (1)	1,575	1,613	1,830	2,226	115	144	0	7	1,336	1,625	2,116	1,591
Water Transfer to Treatment (2)	0	0	0	504	0	0	0	0	0	0	0	0
MINE DEWATERING POND												
Water Transfer to TSF (3)	0	0	0	0	0	0	357	0	0	0	0	0
Water Reclaim to Plant (4)	651	613	396	0	2,111	2,082	2,226	2,219	890	601	110	635
Water Transfer to Treatment (5)	689	747	1,078	2,043	0	0	0	0	0	264	1,514	713
SURFACE RUNOFF COLLECTION PONDS												
Water Reclaim to Plant (6)	818	818	818	818	818	818	818	818	818	818	818	818
Fresh Water from Tributaries (7)	45	33	40	337	382	204	189	74	122	147	118	78
Water Transfer to Treatment (8)	0	0	0	0	0	0	0	0	0	0	0	0
PROCESS PLANT												
Total Water to Process Plant (9)	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044
Water in Tailings to TSF (10)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
TREATMENT PLANT												
Total Transfer to Treatment (11)	689	747	1,078	2,548	0	0	0	0	0	264	1,514	713
Treated Water to Collection Ponds (12)	483	489	416	0	0	0	0	0	0	264	595	642
Treated Water to Environment (13)	206	258	662	2,548	0	0	0	0	0	0	918	71

Note: The values in parentheses correspond to the flow diagram in Figure 3.8.6-1

Table 3.8.6-3: Conceptual Water Balance for Operations (wet year)

Water Transfer	Average Flow (m³/day)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TAILINGS STORAGE FACILITY												
Water Reclaim to Plant (1)	1,609	1,681	2,090	2,226	2,055	2,226	2,130	2,023	2,226	2,226	2,226	1,638
Water Transfer to Treatment (2)	0	0	0	1,842	0	417	0	0	700	447	403	0
MINE DEWATERING POND												
Water Transfer to TSF (3)	0	0	0	0	0	0	0	0	0	0	0	0
Water Reclaim to Plant (4)	617	545	136	0	171	0	96	203	0	0	0	588
Water Transfer to Treatment (5)	740	850	1,474	2,708	2,103	2,696	2,424	2,091	2,426	2,123	1,893	785
SURFACE RUNOFF COLLECTION PONDS												
Water Reclaim to Plant (6)	818	818	818	818	818	818	818	818	818	818	818	818
Fresh Water from Tributaries (7)	0	0	0	0	0	0	0	0	0	0	0	0
Water Transfer to Treatment (8)	0	0	0	0	842	1,812	1,492	1,122	1,325	792	424	0
PROCESS PLANT												
Total Water to Process Plant (9)	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044
Water in Tailings to TSF (10)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
TREATMENT PLANT												
Total Transfer to Treatment (11)	740	850	1,474	4,549	2,945	4,925	3,915	3,213	4,451	3,362	2,720	785
Treated Water to Collection Ponds (12)	0	0	0	0	0	0	0	0	0	0	0	0
Treated Water to Environment (13)	740	850	1,474	4,549	2,945	4,925	3,915	3,213	4,451	3,362	2,720	785

Note: The values in parentheses correspond to the flow diagram in Figure 3.8.6-1

Cyanide addition will be minimized through continuous monitoring of cyanide levels in the leaching circuit, permitting optimum leaching efficiency while preventing over dosing. The process will be adjusted over the life of the mine to continually optimize cyanide addition rates to minimize cyanide use. The process also employs a cyanide recovery thickener prior to the cyanide destruction circuit. The thickener will recover up to 40% of the cyanide, which will be returned to the milling circuit.

After a portion of the cyanide is recovered through the cyanide recovery thickener, the leached slurry will be treated to destroy the remaining cyanide, reducing the levels of cyanide in the tailings released to the TSF. Treasury Metals is committed to reducing the amount of cyanide released to the TSF and further feasibility studies will be completed to confirm that level at which it will be discharged to the TSF. While there may be times when the detoxification circuit may not reach 100% efficiency and discharge could occur in the range of 10-50 mg/L CN_{WAD}, Treasury Metals will strive to maintain an the average target cyanide concentration within the TSF over the long term basis. As cyanide continues to degrade naturally in sunlight, further natural cyanide degradation will take place within the TSF. The estimated retention time over the life of the facility will vary with a minimum of 271 days, maximum of 451 days with an average over the 12 years of operations of 394 days.

The SO_2-air destruction process acting on the cyanide recovery thickener underflow has been chosen as the preferred method for cyanide destruction. The SO_2-air process is efficient at removing cyanide from slurry solutions. The cyanide recovery thickener discharge provides the most concentrated slurry stream such that reagent consumption is minimized and higher destruction efficiencies are achieved. The cyanide detoxification circuit will consist of two stirred reactors with air sparging as well as copper sulphate, sodium metabisulphite (or liquid SO_2), and lime addition. Lime and ferric chloride can be added to the second reactor to maximize metals precipitation if required. The amount of copper in the feed slurry solution is expected to be approximately 25% of the concentration required for reaction catalysis and therefore copper reagent addition will be required. Piping arrangements will allow one reactor to continue reduced operation in the event that the other reactor is offline. The detoxification circuit will receive washed and thickened CIL tails and discharge treated slurry to the tailings hopper for subsequent disposal in the TSF. Movement of slurry through the detoxification circuit will be by gravity.

In the unplanned or upset process event of the detoxification circuit being offline, CIL tailings could potentially be discharged to the TSF for short period of time at the feed concentrations nominated above while still meeting the MMER limits. While there may be times when the detoxification circuit may not reach 100% efficiency and discharge could occur in the range of 10-50 mg/L CN_{WAD}, Treasury Metals will strive to maintain an the average target cyanide concentration within the TSF over the long term basis. In addition, contingency measures, such as hydrogen peroxide treatment to the TSF supernatant water, and incorporation of hydrogen peroxide into the effluent treatment process will be considered as part of the sewage Environmental Compliance Approval (ECA) process with the Ministry of the Environment and Climate Change (MOECC).

3.8.8 Process Effluent Treatment and Discharge

Process water will be treated in the cyanide destruction circuit prior to discharge to the TSF. As noted in Section 3.8.7, the SO_2-air destruction process has been chosen as the preferred method for cyanide destruction. The tailings solution chemistry (Table 3.8.8-1) coming from the detoxification circuit was modelled using the PHREEQCI model, using results presented in literature (Devuyst et al., 1988; Devuyst et al., 1989) for comparable free milling gold circuits. In the modelling, typical SO_2-air removal factors were assumed. Ammonia has been assumed at a value of 6 mg/L which is a common target when using the SO_2-air cyanide destruction process.

Table 3.8.8-1: Process Effluent Discharge Qualities

Parameter	Predicted Tailings Supernatant (mg/L)	MMER Max Monthly Mean (mg/L)
Average solution hourly flow m^3/h	61.1	—
Aluminum	0.199	—
Ammonia (as N)	6*	—
Antimony	0.002	—
Arsenic	0.018	0.5
Barium	0.012	—
Beryllium	0.0005	—
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	<1**	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	—

Table 3.8.8-1: Process Effluent Discharge Qualities (continued)

Parameter	Predicted Tailings Supernatant (mg/L)	MMER Max Monthly Mean (mg/L)
Sulphur	22.94	—
Thallium	0.642	—
Tin	0.0005	—
Titanium	0.003	—
Uranium	0.005	—
Vanadium	0.004	—
Zinc	0.04	0.5

Notes:

* Assumed Values

** While there may be times when the detoxification circuit may not reach 100% efficiency and discharge could occur in the range of 10-50 mg/L CN_{WAD}, Treasury Metals will strive to maintain an the average target cyanide concentration within the TSF over a long-term basis.

3.8.9 Final Effluent Treatment

Excess water not required in the process or for controlling dust will be pumped to the effluent treatment plant for treatment prior to through an engineered structure into Blackwater Creek. In the effluent treatment plant, excess water is proposed to be treated in three distinct process steps including an advanced oxidation process for residual cyanide destruction, multimedia filtration, and reverse osmosis membrane filtration.

The excess water will be pumped from a transfer tank to a three chamber multimedia filtration system, operating in parallel, via three multimedia filter feed pumps. The transfer tank may also be used to capture any out-of-compliance reverse osmosis permeate water which can be diverted from discharge.

In addition, this tank could be utilized as a temporary short term storage volume for the diversion of reverse osmosis reject water in order to continue operation of the reverse osmosis system while other areas of the facility are shut-down for routine repair or maintenance. Both sulphuric acid and sodium bisulphite will be dosed into the water stream prior to the multimedia filtration step. Sulphuric acid will be used to lower pH and sodium bisulphite is required to consume any excess oxidants. A polymer or coagulant addition will also be included as a flocculation agent. In the intermediate step of the treatment process, particle filtration will include depth filtration down to a nominal 1.0 micron range. Filtration media will consist of a combination of anthracite, silica sand, and garnet.

In the next step, filtrate from the multimedia filter will be dosed with sulphuric acid, if required for pH adjustment, as well as an anti-scalant to protect the reverse osmosis (RO) membranes and reduce the requirement frequency for clean-in-place of the membranes. As a safety precaution, filtrate will be passed through cartridge filters prior to the RO system to remove any residual solids and prevent membrane damage.

The resulting effect of these pre-treatment steps is to enable the RO to operate at recoveries as high as 90%. Scaling calculations will indicate the upper limits on recovery and efficiency. High pressure pumps will then boost the pressure of the feed water to the reverse osmosis system from a minimum of 25 psig up to 250 psig. This feed pressure overcomes the natural osmotic pressure allowing for the rejection to waste of greater than 98% of all contaminants including: in-organics, organics [greater than 200 nominal molecular weight limit (NMWL)], bacteria and suspended solids as small as 0.003 microns depending upon their shape and strength. The pre-treated feed water will be split into three streams: product, reject and recycle. The recycle stream enables higher recovery by reducing the effects of concentration polarization and creating better cross flow to reduce system cleaning frequency.

The RO permeate is stored in the permeate storage tank, from where it is returned to the process or discharged to the environment via a diffuser in Blackwater Creek. If permeate quality is out of specification it can be diverted to the transfer tank for retreatment. The RO reject will report to the residual cyanide destruction process tanks. Hydrogen peroxide (oxidant) and copper sulphate (catalyst) will be dosed in-line prior to a static mixer. Dosed wastewater will flow by cascading gravity sequentially through the cyanide destruct reactors, where cyanide will be eliminated and complex dissolved metals will be precipitated. The treated reject stream will be pumped to the TSF.

The use of the RO treatment system will result in treated water that contains low total dissolved solids that are below background concentrations in Blackwater Creek. To mitigate any risks to the receiving environment, treated effluent will be re-mineralized by passing it through a filter canister containing crushed limestone. Based on experience of established suppliers of RO treatment systems, this step typically increases hardness to above 40 mg/L. This detailed design of the re-mineralization step and the target hardness concentration will be subject to provincial approvals including the sewage Environmental Compliance Approval that is issued by the Ministry of the Environment and Climate Change

Reverse osmosis (RO) treatment systems are currently commercially available from long established vendors, and have been used successfully for both short-term and long-term mining applications. Expected final effluent qualities were estimated using standard simulations to model the final effluent quality, based on vendor information, influent quality (see Table 3.8.8-1), and based on previous operating experience of these systems.

The RO process itself does not typically impart energy to a water stream. Provided that the RO unit and associated piping are sized adequately for the water flow, the concentrate and permeate water temperate are generally considered to be equal to the influent water temperature. Since only excess water will be treated in the RO plant before discharge to the environment, the influent water will be similar in temperature to the water in the surrounding catchment sources, and will vary naturally with the ambient temperature conditions and seasons. With the final treatment providing an insignificant change to the temperature of the effluent water it is then assumed that treated effluent will be discharged to near natural water temperatures. This water management strategy will be confirmed and modified as needed during the operations phase of the Project to ensure that the most natural state reasonably possible is maintained within the Black Water Creek system.

Treasury Metals has made the commitment to treat the effluent discharged from the Project during operations to a level that will not affect the receiving environment. For most parameters, the effluent will be treated to meet Provincial Water Quality Objectives (PWQO) criteria prior to discharge. The PWQO are established to be protective of sensitive aquatic organisms. For parameters with no PWQO, Treasury Metals has committed to meet the Canadian Environmental Quality Guidelines (CEQG) from the Canadian Council of Ministers of the Environment (CCME). Finally, Treasury Metals has committed to operations effluent discharges qualities for mercury that are at, or below, the background levels of mercury in Blackwater Creek. A listing of the final effluent discharge quality is provided in Table 3.8.9-1.

Table 3.8.9-1: Final Effluent Discharge Quality

Parameter	Effluent Concentration (mg/L)
Aluminum	0.075
Antimony	0.020
Arsenic	0.10
Beryllium	0.011
Boron	0.20
Cadmium	0.0002
Chloride	120
Chromium	0.0089 (1)
Cobalt	0.0009 (1)
Copper	0.005
Cyanide	<1
Iron	0.30
Lead	0.005
Mercury	0.00002
Molybdenum	0.040 (1)
Nickel	0.025
Nitrate	13
Phosphorus	0.030
Selenium	0.10
Silver	0.0001
Thallium	0.0003
Uranium	0.005
Vanadium	0.006 (1)
Zinc	0.030

Note:

(1) Chromium, cobalt, molybdenum and vanadium have been updated from Table 9.0.1 of the original EIS to reflect current PWQO criteria (or interim PWQO when there is no firm PWQO criteria).

3.8.10 Effluent Discharge Structure

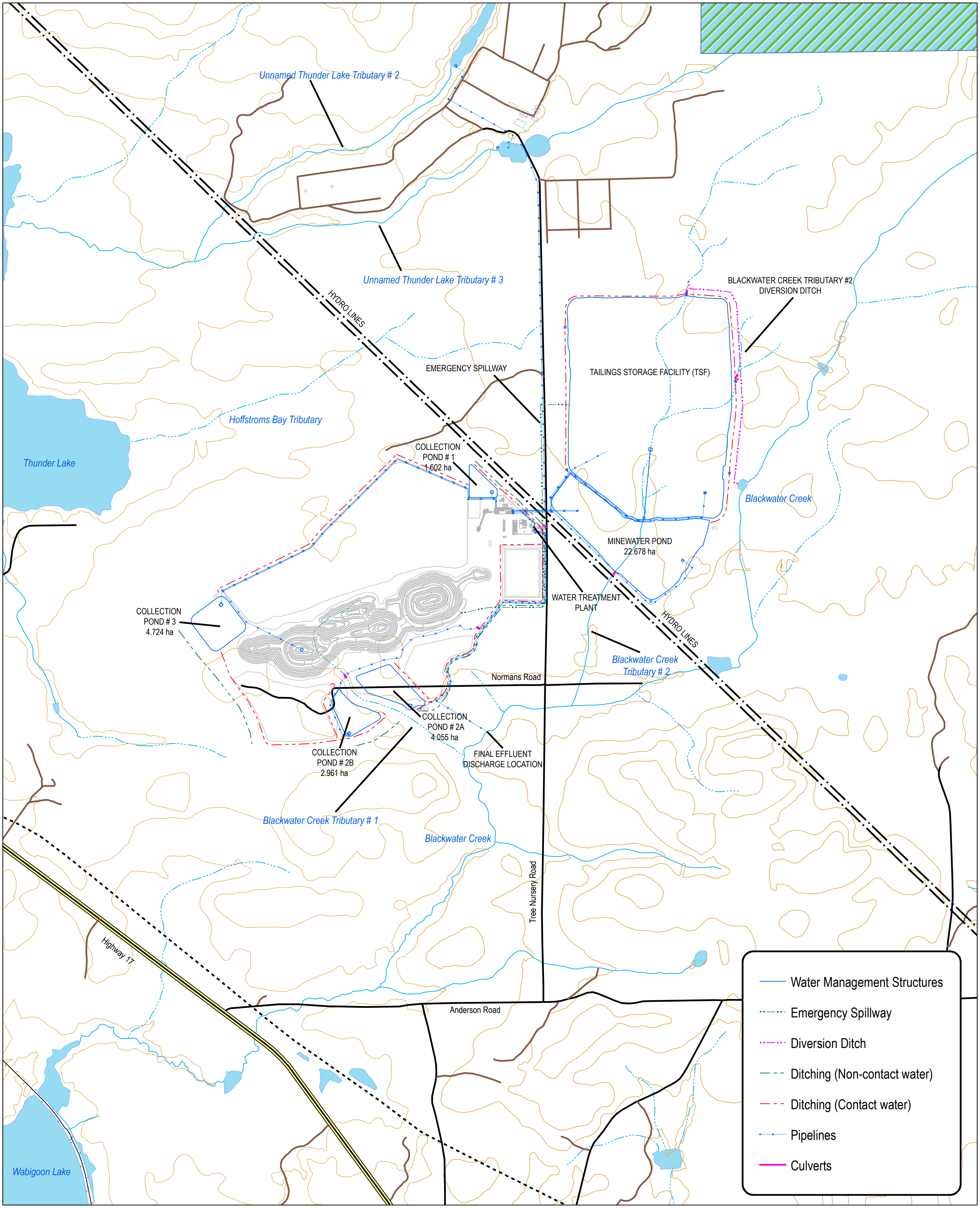
Effluent water will be pumped to the selected discharge location in Blackwater Creek (see Figure 3.0.1A) via a pipeline and discharged into a constructed pool through an in-stream diffuser in order to minimize risks of erosion due to the potentially high flow at the end of the pipe. It is envisioned that the constructed pool will reflect the natural environment with a graded, vegetated slope, with woody debris present, and likely the pond will include sufficient depth to ensure that the discharge remains unfrozen during the winter months.

3.8.11 Water Management Structures

A perimeter runoff and seepage collection ditch will be constructed to encircle the Operations Area to prevent any direct releases of runoff to the environment. This would include the area generally on the north side of the waster rock storage area, the area generally south and west of the open pit and overburden stockpiles, the area generally south and west of the processing plant its associated infrastructure – including the low grade stock pile – and the areas to all side of the TSF if required. Spoils from the ditch excavation will be windrowed, compacted in successive lifts, and erosion proofed immediately downstream of the ditch to serve as a containment berm. The berm will be designed to exclude non-contact water from the operations area. The ditch will provide additional freeboard for the perimeter collection ditches by way of compaction of the underlying overburden. This compaction process will also reduce the flow of groundwater through overburden into the operations area due to open pit dewatering. Generally, these berms will impound runoff so that flow decants to the open pit during an extreme flood event. However, engineered spillways would be incorporated into the perimeter berm where appropriate to prevent overtopping.

The water management system will also use a series of collection ponds or sumps such that water can be collected and pumped via pipe for use in the process, for controlling dust, or for treatment and release to the environment (see Figure 3.8.11-1). It is proposed that there would be three collection ponds; one on the west side of the open pit to collect surface water from the WRSA, one to the south of the overburden stockpiles to collect water from the aforementioned stockpiles and any areas south of the open pit and one on in the general area to the north of the processing plant facility to collect water from this area. The pond to the south of the open pit will be made up of two smaller ponds located on either side of the former channel of Blackwater Creek Tributary 1. By constructing these ponds outside of the creek channel, it is hoped that the habitat within Blackwater Creek Tributary 1 can be readily re-established once the open pit fills following closure, and excess waters are passively released from the pit lake into the former channel of Blackwater Creek Tributary 1 through an engineered spillway. The design volumes are:

- Collection pond No. 1: 16,000 m^3;
- Collection pond No. 2: 79,000 m^3;
- Collection pond No. 3: 140,000 m^3; and
- Minewater pond: 85,000 m^3.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Water Management Structures
Goliath Gold Project

Figure 3.8.11-1 REV.02

TREASURY METALS Inc.

DESIGN:	MP	01/03/2017
GIS:	MP	01/03/2017
CHECK:	MW	01/03/2017
REVIEW:	DB	01/03/2017

Hydro Line
Natural Gas Pipeline
Railway
Expressway / Highway
Local Road
Resource / Recreation Road
Provincial Parks
Waterbody
Intermittent Streams
Permanent Streams

SCALE 1:25,000

NAD 83, UTM Zone 15

N

0 1,000
Meters

Base Data:
Treasury Metals Inc., LIO Database,
KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.

Ditching around the TSF will be incorporated within the design of the TSF to operate in conjunction with the seepage collection systems. It is proposed that this ditching will take the form of a small ditch separate from, but surrounding the toe of the dam facility itself.

Construction of the perimeter ditching system will take place in a phased approach and generally during the site preparation and construction phases. For example, the mine water pond will be required as one of the initial elements constructed for the storage and possible treatment of water during the construction phase, ditching and water collection for the processing plant area will need to occur prior to any construction work on the plant itself to ensure that all water is collected and sent to the mine water pond and ditching surrounding the WRSA may be delayed slightly for logistical purposes only being completed directly prior to the start of open pit mining and subsequent use/construction of the WRSA itself.

As the TSF will be constructed within the Blackwater Creek Tributary 2 watershed, there will be a need to construct a diversion ditch to redirect the runoff from the portions of the Blackwater Creek Tributary 2 watershed that are upstream of the TSF. This channels of this ditching will constructed to appear natural, and to accommodate fish passage should there be sufficient flows.

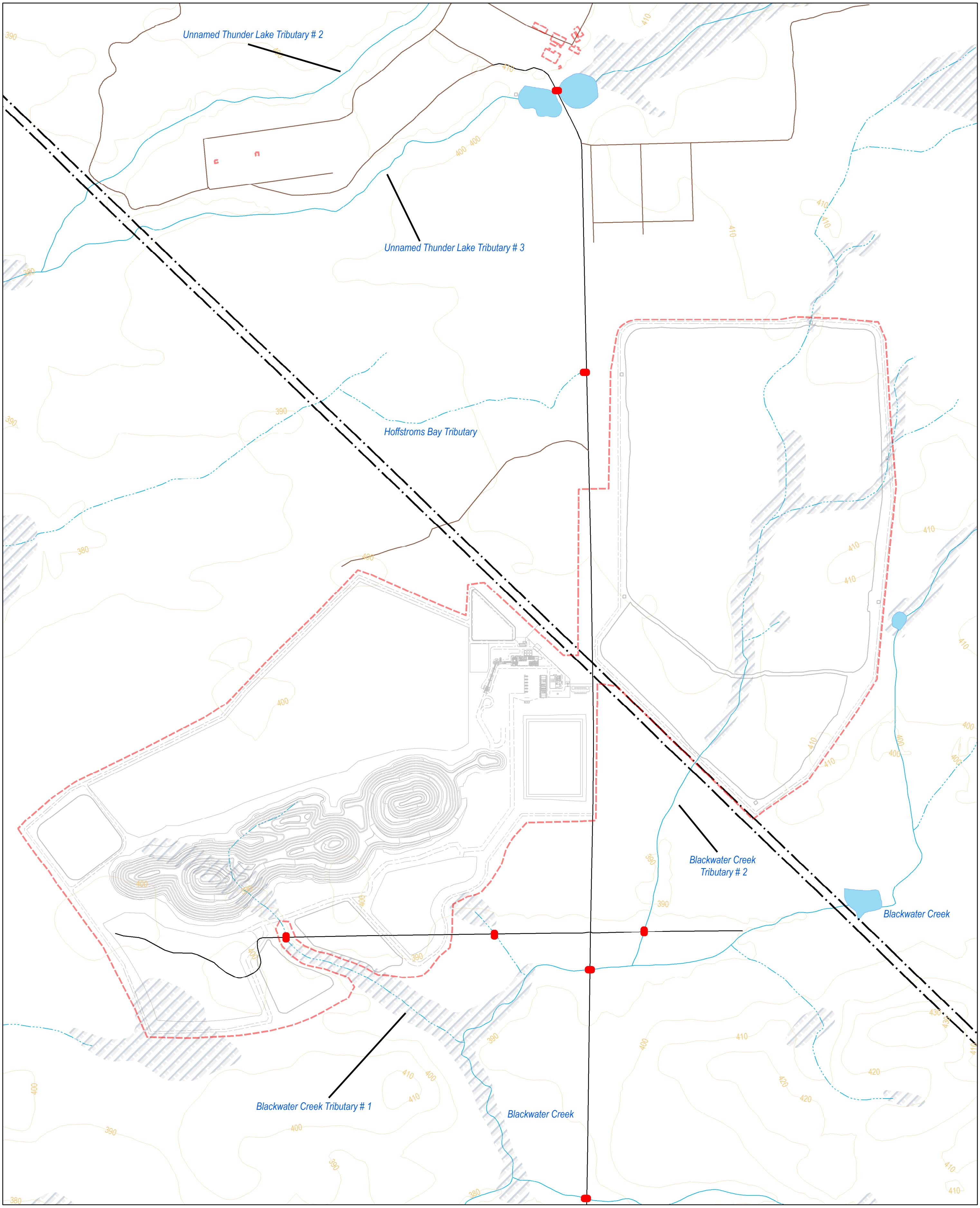
These design elements will be integrated into the design basis going forward. Proposed water management structures are presented in Figure 3.0-1A.

3.8.12 Alterations to Surface Water Bodies

The Project area is a mixture of abandoned homesteads, small hobby farms and residential dwellings, with a series of small creeks. The majority of the Project is located in the Blackwater Creek watershed, which drains generally to the south into Wabigoon Lake. Little Creek and Hoffstrom's Bay Tributary are located to west of the Project. Thunder Lake Tributary 2 and Thunder Lake Tributary 3 are located to the north of the Project. Hoffstrom's Bay Tributary, Little Creek, Thunder Lake Tributary 2 and Thunder Lake Tributary 3 all drain into Thunder Lake, which then drains into Wabigoon Lake. Figure 3.8.12-1 illustrates the Project features and the waterbodies in and around the Project.

3.8.12.1 Blackwater Creek

While none of the main stem of Blackwater Creek will be overprinted as a result of the Project, the operations area will overprint portions of the Blackwater Creek watershed. During the site preparation and construction phase, a perimeter ditch and berm will be constructed around the operations area. This structure will collect all of the runoff within the operations area and directed to the water management system. All of the surface waters released from the Project will go to the Blackwater Creek watershed.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Project Features and Surface Water Bodies

DESIGN:	MP	03/27/2017
GIS:	MP	03/27/2017
CHECK:	MW	03/27/2017
REVIEW:	DB	03/27/2017

Figure 3.8.12-1 REV.01

Legend:
- Hydro Line
- Natural Gas Pipeline
- Railway
- Provincial Parks
- Expressway / Highway
- Local Road
- Resource / Recreation Road
- Existing Culverts
- Waterbody
- Intermittent Streams
- Permanent Streams
- Wetland

SCALE 1:16,000

NAD 83, UTM Zone 15

0 750
Meters

N

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
Harvest will be contained within operations area.

While most of the operations area sits within the Blackwater Creek watershed, a small portion of the watershed for the Hoffstrom's Bay Tributary and Little Creek watersheds will be enclosed within the operations area, and the runoff from those areas will be directed, ultimately, towards the Blackwater Creek. Additionally, the runoff from the sections of the Blackwater Creek Tributary 2 watershed that are upstream of the TSF will need to be diverted around the TSF and into the main stem of Blackwater Creek (see Figure 3.8.12-1). Because portions of the Blackwater Creek watershed are underlain by granular materials, groundwater modelling has identified that the dewatering of the open pit and underground mine may cause a reduction in flows within Blackwater Creek.

The above alterations to Blackwater Creek Tributary 1 will have an effect on surface water flows (as described in Section 6.9), fish and fish habitat (as described in Section 6.14), and wetlands (as described in Section 6.15).

3.8.12.2 Blackwater Creek Tributary 1

The upper reaches of Blackwater Creek Tributary 1 will be overprinted by the open pit (see Figure 3.8.12-1). As shown in Figure 3.8.12-1, the overburden stockpiles and collection ponds 2a and 2b have been constructed so as to not overprint Blackwater Creek Tributary 1. However, most of the watershed feeding Blackwater Creek Tributary 1 will be contained within the perimeter ditch and berm that will be constructed around the operations area for the Project (see Figure 3.8.12-1). As a result, there is expected to be little or no flow in the section of this tributary downstream of the operations area during the site preparation and construction, operations and closure phases of the Project. Following the end of mining operations, the dewatering activities will cease and the open pit will be allowed to gradually fill with water. Once the open pit has filled, excess water will be allowed to passively leave the open pit into the former channel of Blackwater Creek Tributary 1 through an engineered spillway.

The above alterations to Blackwater Creek Tributary 1 will have an effect on fish and fish habitat (as described in Section 6.14), and wetlands (as described in Section 6.15).

3.8.12.3 Blackwater Creek Tributary 2

The preferred location for the TSF and minewater pond (see Section 2.4.2) are located to the northeast of the open pit, within the Blackwater Creek Tributary 2 watershed. Both the TSF and minewater pond will overprint portions of Blackwater Creek Tributary 2, and will require an MMER Schedule 2 regulatory amendment. The runoff from the sections of the Blackwater Creek Tributary 2 watershed that are upstream of the TSF will need to be diverted around the TSF and into the main channel of Blackwater Creek, as shown in Figure 3.8.12-1. The sections of Blackwater Creek Tributary 2 downstream of the TSF and minewater pond will not be overprinted by Project elements; however, as the upstream catchment areas are lost there is expected to be little or no flow in this section of the tributary.

The above alterations to Blackwater Creek Tributary 2 will have an effect on fish and fish habitat (as described in Section 6.14), and wetlands (as described in Section 6.15).

As part of the revisions to the Project since the original EIS, the preferred location for the plant site has been moved to an area north of the open pit and west of Tree Nursery Road (see Figure 3.8.12-1). As a result, there is no longer a requirement for a re-alignment lower reaches of Blackwater Creek Tributary 2.

3.8.12.4 Thunder Lake Tributary 2

As described in Section 3.8.3, the fresh water requirements for the Project will be met using water from the irrigation ponds within former MNRF tree nursery (see Figure 3.8.12-1). Two of these ponds are located Thunder Lake Tributary 2, either side of Tree Nursery Road. The amount of water required from Thunder Lake Tributary 2 will vary by season and climatic conditions, but will not 5% of the daily flow in the tributary. Because portions of the watershed for Thunder Lake Tributary 2 are underlain by granular materials, groundwater modelling has identified that the dewatering of the open pit and underground mine may cause a reduction in flows within Thunder Lake Tributary 2.

The above alterations to Thunder Lake Tributary 2 will have an effect on surface water flows (as described in Section 6.9), and fish and fish habitat (as described in Section 6.14). The potential changes in flows as a result of groundwater drawdown are described in Section 6.11.

3.8.12.5 Thunder Lake Tributary 3

As described in Section 3.8.3, the fresh water requirements for the Project will be met using water from the irrigation ponds within former MNRF tree nursery (see Figure 3.8.12-1). One of these ponds are located Thunder Lake Tributary 3. The amount of water required from Thunder Lake Tributary 3 will vary by season and climatic conditions, but will not 5% of the daily flow in the tributary. Because portions of the watershed for Thunder Lake Tributary 3 are underlain by granular materials, groundwater modelling has identified that the dewatering of the open pit and underground mine may cause a reduction in flows within Thunder Lake Tributary.

The above alterations to Thunder Lake Tributary 3 will have an effect on surface water flows (as described in Section 6.9), and fish and fish habitat (as described in Section 6.14). The potential changes in flows as a result of groundwater drawdown are described in Section 6.11.

3.8.12.6 Little Creek

As part of the revisions to the Project since the original EIS, the footprint of the operations area was modified to minimize the encroachment beyond the Blackwater Creek watershed. However, there will be a relatively small area (11.8 ha) within the current watershed for Little Creek that will be captured within the perimeter ditch and berm to be constructed around the operations area (see Figure 3.8.12-1). As a result of the reduced watershed, there would be a reduction in the flows within Little Creek. Because the watershed for Little Creek is comprised primarily of clays and fine silts, groundwater modelling has identified that the dewatering of the open pit and underground mine should have no effects on the flows within Little Creek.

The above alterations to Little Creek will have an effect on surface water flows (as described in Section 6.9), fish and fish habitat (as described in Section 6.14), and wetlands (as described in Section 6.15).

3.8.12.7 Hoffstrom's Bay Tributary

As part of the revisions to the Project since the original EIS, the footprint of the operations area was modified to minimize the encroachment beyond the Blackwater Creek watershed. However, there will be a relatively small area (27.5 ha) within the current watershed for Hoffstrom's Bay Tributary that will be captured within the perimeter ditch and berm to be constructed around the operations area (see Figure 3.8.12-1). As a result of the reduced watershed, there would be a reduction in the flows within Hoffstrom's Bay Tributary. Because the watershed for Hoffstrom's Bay Tributary is comprised primarily of clays and fine silts, groundwater modelling has identified that the dewatering of the open pit and underground mine should have no effects on the flows within Hoffstrom's Bay Tributary.

The above alterations to Hoffstrom's Bay Tributary will have an effect on surface water flows (as described in Section 6.9), and fish and fish habitat (as described in Section 6.14).

3.8.12.8 Water Crossings

As described in Section 3.1, the Project area 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. As such, the Project will be accessed using an existing road network. There are no new watercourse crossings proposed as part of the Project.

There are currently several water crossings and culverts currently in place within the Treasury Metals property (see Figure 3.8.12-1), none of which is being proposed to be upgraded at this time. These culverts include following:

- Blackwater Creek Tributary 2 passing underneath Norman's Road to the east of Tree Nursery Road;
- An ephemeral tributary of Hoffstrom's Bay Tributary passing underneath Tree Nursery Road to the east of the TSF; and
- Thunder Lake Tributary 3 passing underneath Tree Nursery Road near the administration buildings.

There are two exiting crossings and culverts underneath Norman's Road to the west of Tree Nursery Road. This section of roadway is wholly under the control of Treasury Metals and its use will be discontinued once the operations start.

Access to the site will be along existing public roadways from Highway 17 via Anderson Road and Tree Nursery Road. Both Anderson Road and Tree Nursery Road are unpaved and maintained by the municipality. There are currently the following four water crossings and culverts along the access to the Project (see Figure 3.8.12-1), none of which have been identified as needing to be upgraded at this time:

- Blackwater Creek passing underneath Anderson Road to the west of Highway 17;
- Blackwater Creek Tributary 4 passing underneath Tree Nursery Road to the north of Anderson Road;
- Blackwater Creek Tributary 4 passing underneath Tree Nursery Road; and
- Blackwater Creek passing underneath Tree Nursery Road to the south of Norman's Road.

Within the operations area for the Project (see Figure 3.8.12-1), internal roadways will be constructed to allow for the extraction and processing of ore, as well as the maintenance, monitoring and safe operations. One of the roadways will be around the perimeter of the TSF and minewater pond (see Figure 3.8.12-1). While this roadway appears to cross Blackwater Creek Tributary 2 in two locations, the roadway will be within the perimeter ditch and berm, crossing sections of that former watercourse overprinted as a result of the Project. Similarly, an internal roadway will cross the former channel of Blackwater Creek Tributary 1 to the south of the open pit. This section of the watercourse is within the perimeter ditch and berm, and will be drained as part of the dewatering for the open pit.

3.8.13 Aquatic Habitat Rehabilitation

As described in Section 3.8.12, the Project will result alterations to certain waterbodies that will require an MMER Schedule 2 regulatory amendment, and other alterations that will require authorization under Section 35(2) of the Fisheries Act. The amendments and authorizations will likely require offsetting of the last or altered fish habitat. Appendix II provides a preliminary conceptual plan for offsetting and compensation requirements. Treasury Metals has had preliminary engaged with both Fisheries and Oceans Canada (DFO) and the Ontario Ministry of Natural Resources and Forestry (MNRF) to determine the most suitable option for aquatic habitat compensation associated with the Project. As per personal communication with MNRF (D. Brunner, MNRF Dryden), bank stabilization on Wabigoon Lake is a method for aquatic habitat rehabilitation preferred by MNRF. Treasury Metals will continue to engage the appropriate agencies (DFO, Environment Canada (EC), and MNRF) and First Nations in defining the offsetting strategy as part of the Fish Management Plan. Total rehabilitation and compensation efforts will be determined though negotiations with federal and provincial regulatory officials.

3.9 Fuel and Chemical Management

All deliveries of fuel and chemicals to the site would be done by regulated transport companies, who would be required to comply with relevant federal regulations such as the Transportation of Dangerous Goods Act. All carriers would be required under the Act to have in place detailed emergency response and contingency plans in the unlikely event of an accident during transport to the site.

Items such as oils, transformers, fuels or reagents will be stored on-site in adequately designed tanks within diked/bunded areas sized to capture 110% of the largest feasible spill, and will include one hour of fire suppression water from either fixed fire suppression systems or fire hose streams. Coarse gravels will be used to surround these structures and maintain a clear fire break.

Planning design and construction mitigation strategies to minimize the potential impacts of environmental effects from natural fires on the explosives facility, bulk fuel storage and process plant areas include:

- Clearing sufficient vegetation surrounding these facilities during construction to create an effective fire break, eliminating any potential impact from natural fire and possible flash over.
- Maintaining these fire breaks during plant operation.
- Ensuring the process plant and mine infrastructure fire suppression system is designed and operated in accordance with the National Fire Code of Canada (NFC), the National Fire Protection Agency (NFPA) codes and relevant FM global design guidelines.
- Fuel storage spills will be contained with ignition sources unlikely. Protection within fuel storage areas will be in line with the requirement of NFPA 30.
- The explosives storage facility construction and storage will be in compliance with the requirements of NFPA 495 Explosives Materials Code.
- The bulk fuel and explosive storage facilities will be classified as Hazardous areas with potential ignition sources being designed out of these areas, i.e. only intrinsically safe equipment/instrumentation will be installed, etc.
- Onsite fire suppression equipment will be provided to support trained responders in extinguishing and/or ensuring exposure protection from natural fires. Site hydrants will ensure that cooling water can be applied if threated by external fire source.
- Ensuring operations and construction personnel are adequately trained in responding to site natural fires.

All aspects of the Project associated with the handling, use and treatment of cyanide are designed to operate and comply with the International Cyanide Code. Cyanide that will be used in the process will be delivered by truck in the preferred form of dry (solid) sodium cyanide pellets or briquettes, to avoid the possibility of liquid spills during transport. Three to five days' worth of cyanide pellets will be stored in the processing plant, with additional storage (two to four days' worth) provided at the existing warehouse at the former MNRF tree nursery. All deliveries of cyanide to the site would be done by regulated transport companies, who would be required to comply with relevant federal regulations such as the Transportation of Dangerous Goods Act. All carriers would be required under the Act to have detailed emergency response and contingency plans in place in the unlikely event of an accident during transport.

Within the Project site, Treasury Metals has committed to develop detailed emergency response and contingency measures in the event of an accident or spill involving cyanide. These plans and safeguards would be consistent with the International Cyanide Code, and would, at the most fundamental level, be focused on procedures and safeguards to avoiding accidents.

Treasury Metals has committed to implementing secondary controls at the processing plant and chemical storage areas to prevent spills from entering the environment. Spill prevention procedures will be enforced to reduce the potential for spills. A detailed spill response plan will be developed as part of the final design and permitting process that will outline responsibilities and procedures that will be enacted in the unlikely event of a spill on-site. Incidental spills that occur during transport within the site, or associated with mobile equipment, will be contained and isolated to prevent the spread of the materials released, and then cleaned up at source. Contaminated soils removed during clean-up will be transported to a licensed off-site facility for safe disposal. All spills at the Project will be reported in accordance with the Ministry of the Environment and Climate Change (MOECC) protocols.

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.

3.10 Waste Management

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. Through conversations with the appropriate personnel it has been confirmed that the City of Dryden landfill currently has the capacity to support the future non-hazardous waste requirements for the Project.

Non-hazardous solid wastes, excluding demolition wastes at closure, will be disposed of at local Dryden landfill facilities. Non-hazardous wastes are expected to consist of the following materials:

- Domestic waste (food scraps, refuse, clothing);
- Combustible waste (wood, paper products); and
- Other inert wastes (scrap metals, clean glass, clean, plastics).

Life of mine estimated solid waste quantities is on the order of 3,520 tonnes waste and are summarized, by phase, below:

- Site Preparation and construction: 740 tonnes
- Operations: 2,580 tonnes
- Closure: 200 tonnes

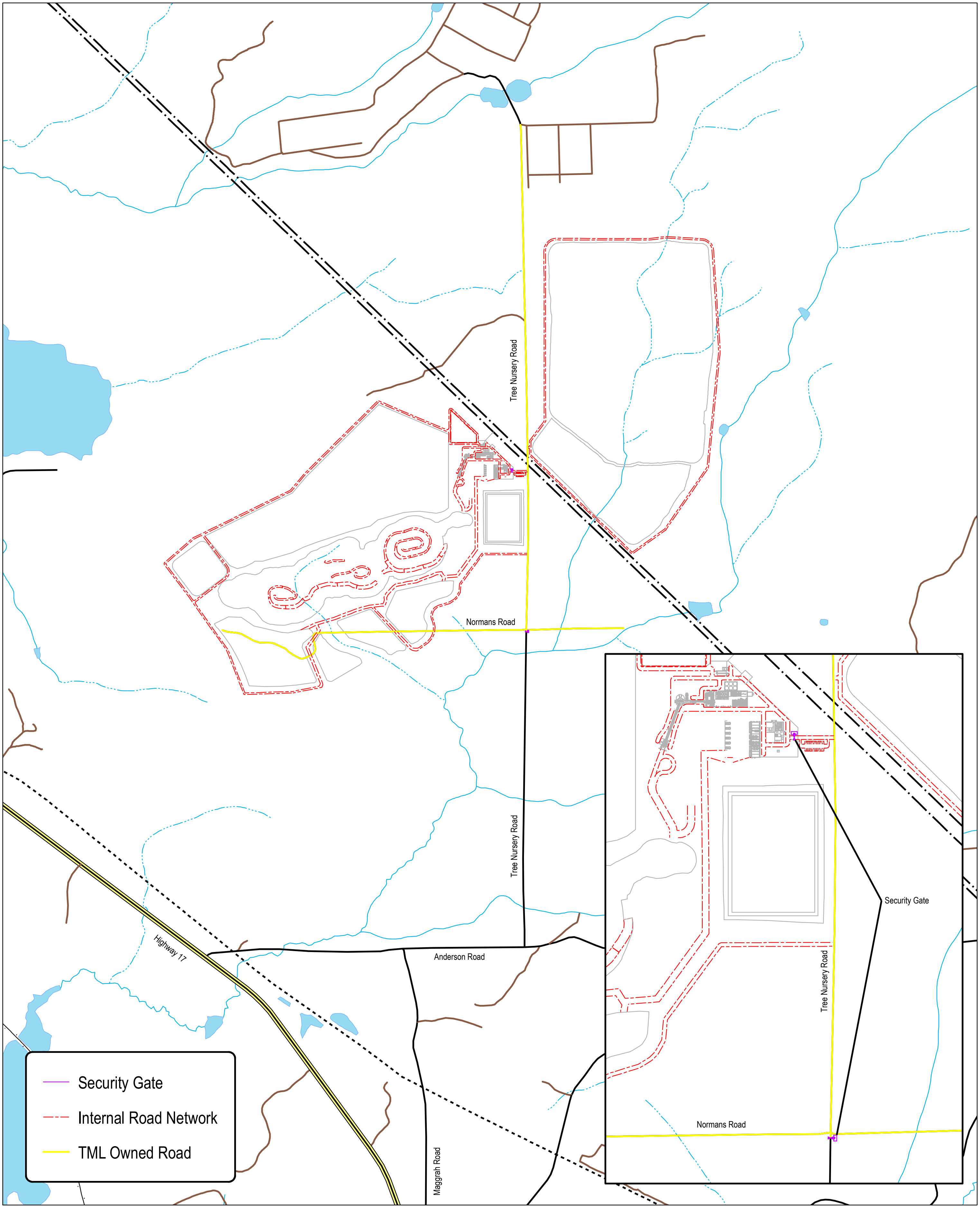
Waste oil and lubricants will be stored in appropriate containment double walled or equivalent vessels in bermed areas, and periodically removed by licensed haulers to an off-site licensed facility. Generally these materials would be stored within either the processing plant facility or any associated mechanics shops in which they are used. The storage of these waste materials would be subject to operating procedures for the mine and would be contained within a vessel that has been designed for such use and enclosed within an area of appropriate spill control. While no specific locations have been sourced at the time of writing, it is anticipated that this haulage would typically be done by truck. 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 stored on-site in receiving/holding tanks. The contents of the holding tanks are removed by truck and delivered to an off-site 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 on-site 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 current septic system at the former MNRF tree nursery will continue to used, and its capacity in support of the Project will be assessed.

3.11 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 3.11-1). This network will also include a number of stream crossings, as described in Section 3.8.

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.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	Hydro Line; Natural Gas Pipeline; Railway; Expressway / Highway; Local Road; Resource / Recreation Road; Provincial Parks; Waterbody; Intermittent Stream; Permanent Stream	SCALE 1:25,000
Access and Security Goliath Gold Project	DESIGN: MP 01/03/2017 GIS: MP 01/03/2017 CHECK: MW 01/03/2017 REVIEW: DB 01/03/2017		NAD 83, UTM Zone 15
Figure 3.11-1 REV.01			0 1,000 Meters

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.

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.

3.12 Power Supply

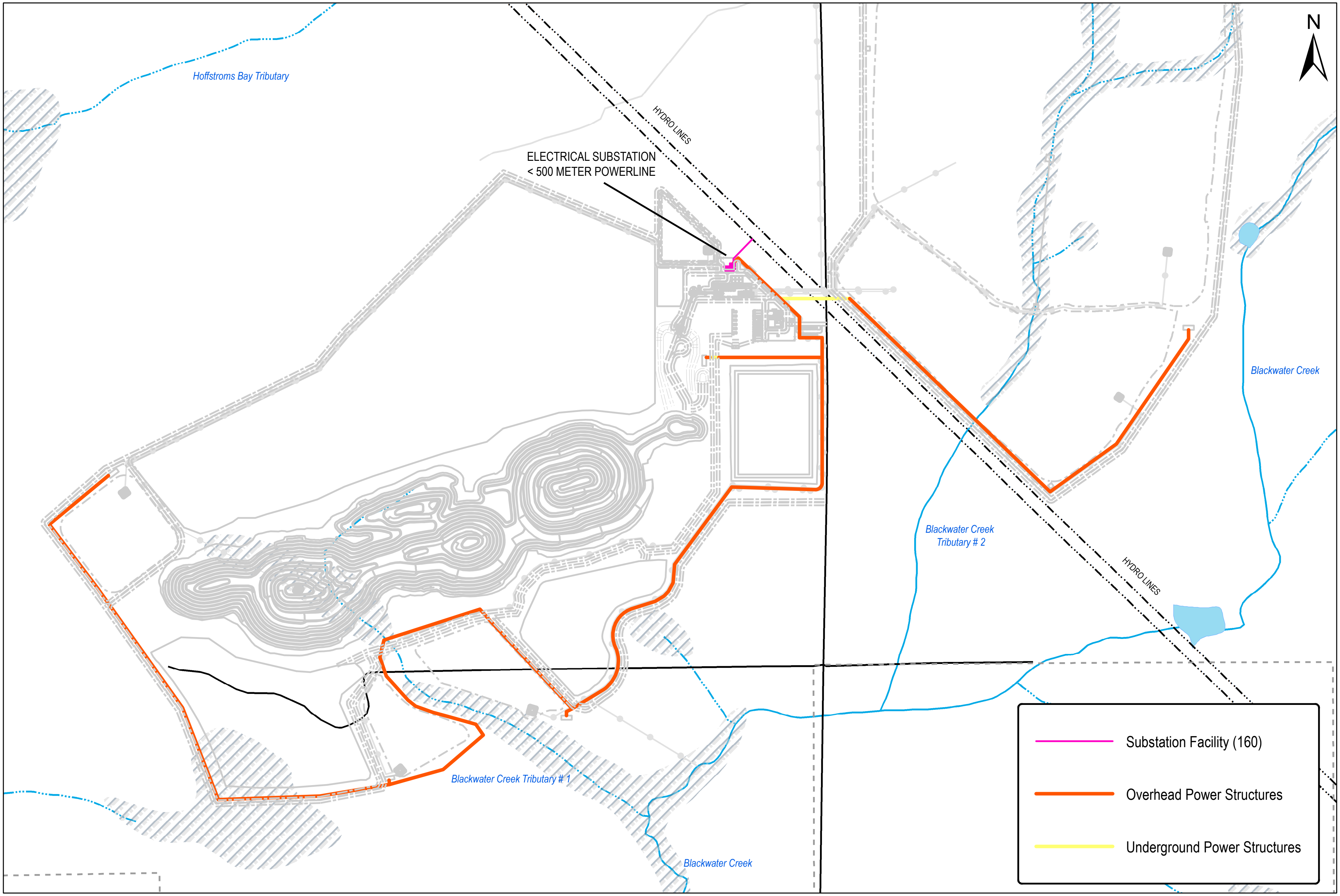
The power for the site shall be supplied from the Hydro One 115 kV power line circuit M2D (Figure 3.12-1) via one 138 kV 600A motorized disconnect switch 270-DS-001 in series with one 1200A, SF6 circuit breaker 270-CB-001. This transmission line currently runs directly adjacent to the Goliath Project. Aerial view of power lines can be seen in Figure 3.12-2.

3.12.1 Plant Distribution Services and Transformer

The plant shall be supplied from the Hydro One 115 kV power line circuit M2D to a plant 115 / 4.16 kV switchyard via one 138 kV 600 A motorized disconnect switch 270-DS-001 in series with one 1200 A, SF6 circuit breaker 270-CB-001 feeding a 5 / 7.5 MVA 115 kV / 4.16 kV transformer as shown in the 115 / 4.16 kV single line diagram (A392-07-01-0001) attached to this EIS response. This arrangement will supply power to the process plant for the open pit mining operation. A future motorized disconnect switch 270-DS-002, SF6 circuit breaker 270-CB-002 and 5 / 7.5 MVA 115 kV / 4.16 kV transformer will be installed to supply power for the future underground mine.

The scope of the HV electrical power supply works includes:

- Voltage level: 115 kV and 4.16 kV (metered at 4.16 kV).
- Allowable Voltage Variation: not to exceed ±10% on steady state and ±15% during large drive start-up. Voltage drops in excess of this could affect the operation of the process plant.
- Quantity / Capacity of transformers: 2 x 5 / 7.5 MVA 115 kV / 4.16 kV main transformers (ONAN / ONAF) with delta configured primary and wye configured secondary which is grounded via a resistor.
- Installation of an overhead line take-off structure at the proposed T-off point for the process plant and mine infrastructure
- Construction of approximately 50-100 m (to be confirmed) of an overhead 115 kV line from the T-off point to the plant outdoor switchyard location.
- Construction of a 115 / 4.16 kV, 1 x 5 / 7.5 MVA transformer / substation at the plant site during initial plant construction.
- Installation of the future 115 / 4.16 kV, 1 x 5 / 7.5 MVA transformer at the plant site to supply the U/G mine power requirements.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Plant Power Supply and
Power Distribution

Figure 3.12-1 REV.01

TREASURY METALS Inc.

DESIGN: MP 01/08/2017
GIS: MP 01/08/2017
CHECK: MW 02/08/2017
REVIEW: MW 02/08/2017

Hydro Line	Highway	Wetland
Natural Gas Pipeline	Local Road	Waterbody
Railway	Resource Road	Intermittent Stream
Provincial Parks	Contours (10 meters)	Permanent Stream

SCALE 1:12,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 100 200 300 400 500
Meters

Base Data:

Treasury Metals Inc., LIO Database, KBM Resources Group
Sedgman

Notes:
All details preliminary and subject to change as engineering designs are updated.

Figure 3.12-2: Power Line Infrastructure

The process plant HV switchyard and substation will be located in close proximity to the existing powerline corridor and will require a short 50-100 m overhead 115kV line to be run from the existing line to the new HV switchyard.

The 4.16kV substation will house the 4.16 kV facilities including HV switchgear and two 600 kVAr shunt capacitor banks together with station services, protection and controls. From here, buried or overhead 4.16kV powerlines will then be run from the individual feeders out to the plant area substations, i.e. Crushing, Milling, etc., as required. Cabling, power and controls would then be distributed from these area substations out to individual equipment and infrastructure as required.

The required construction schedule for tying into the Hydro One 115kV M2D line and extending it to the process plant HV switchyard location is approximately 60 weeks from commencement of the Project development phase. Power would then need to be available to enable commissioning of the facility.

The existing 115kV and 230kV M2D HV overhead lines are owned and operated by Hydro One. Design, installation and commissioning of the take-off structure required for the 115kV M2D line and installation of the new 115kV OH line to the process plant 115kV/4.16kV switchyard battery limit will be by Hydro One.

The process plant and mine infrastructure HV transformer switchyard and substation will be designed, procured, constructed and commissioned by the lead project contractor engaged by Treasury Metals Inc. The HV electrical 115kV/4.16kV switchyard equipment and substation will be installed by certified electrical contractors working for the head contractor. Commissioning of the HV switchyard/switchgear will be by HV certified electricians/engineers, with supervision provided by Hydro One.

During project design and procurement, Hydro One will provide HV equipment and installation technical specifications. Hydro One will also provide supervision during construction through periodic inspections.

The ownership of the facility shall form part of the negotiated agreement between Treasury Metals Inc. and Hydro One, which will be worked through as the project develops. However, Treasury Metals would likely take ownership of all project infrastructure downstream of an agreed battery limit at the 115 / 4.16 kV HV switchyard, likely to be nominated as upstream of the 115kV/4.16kV transformer. Hydro One would retain ownership of the existing and new infrastructure upstream of the agreed battery limit.

3.12.2 Emergency Power

Three diesel generating units are included to supply emergency power (Administration Building 150 kW, Concentrator 250 kW, and Mine 150 kW). The emergency power is not meant to be used for sustaining the operations of the plant. The purpose of the diesel generators is to provide power for the following consumers:

- Administration building power;
- Guard house;
- 30% of area lighting;
- Control room power;
- Thickener rake system;
- Thickeners underflow pumps (50%);
- Fire-detection system and dry-pipe fire-fighting system (main fire loop has diesel pump); and
- Mine administration building.

3.13 Other Facilities and Infrastructure

3.13.1 Explosives Storage Facility

Treasury is in communication with several explosives suppliers for the supply and storage of explosive on-site 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.

Consistent with the design basis for the Project, Project components are situated on land that is held by Treasury Metals (patented or leased surface and mining rights) to avoid the need to take up any additional land. Following a review of minimum permissible distances that are published by Natural Resources Canada (*Explosives Act*), a review of existing roads available to Treasury Metals and a review of the traditional trails in the vicinity of the Project that present a risk of being travelled by members of the public, only one suitable site for the explosives storage magazines was identified and this is presented in Figures 3.0-1A and 3.0-1C.

3.13.1.1 Bulk Emulsion Storage

Bulk emulsion explosive would be primarily used in the open pit. Emulsion would be delivered to a self-contained storage tank at the Goliath Gold Project in bulk by the supplier's transport truck in accordance with legislated requirements. Storage tanks are indoors with containment provided by sealed floors and walls.

Emulsion would be pumped from the delivery truck to a bulk tank inside a containment system. Hose connections from the truck to the tank would drain into the storage tank to prevent any spillage. Hoses would be capped following each transfer. Bulk emulsion explosive would be used during the life of the open pit by transferring emulsion from the storage tank to a dedicated truck for delivery to the blastholes in the pit.

Trucks that are delivering or removing emulsion from the storage tank would be parked on a concrete slab (or equivalent low-permeability slab) adjacent to the emulsion storage area with a formed sump so that any accidental spillage during the material transfer is contained. Water accumulating in the sump would be pumped out to the mill process on an as-needed basis to prevent any discharge from the concrete slab. A roof or other enclosure would be installed over the concrete slab to minimize the amount of precipitation reporting to the slab.

3.13.1.2 Packaged Explosives

Packaged emulsion and/or packaged ANFO would be used in the underground mine and potentially to a small extent in the open pit on a non-routine basis. Explosives would be delivered to site in plastic packaging and on wooden pallets by the supplier's truck, with pallets being loaded into the storage magazines upon delivery to the magazine. Product would be removed from the storage magazine by Treasury Metals' blaster on an as-needed basis for use in the mine. The unpackaging of explosives would only occur in the mine at the blasting site, at the time of use. There would be no unpackaging of explosives at the storage magazines.

3.13.1.3 Summary

Storage magazines and tanks are self-contained and transfers of product have no potential for spillage outside the containment structure and the adjoining concrete slab where trucks park during product transfers. As a result of these measures, there is no need for the collection of runoff from the laydown areas where the storage structures would be situated.

3.13.2 Employment, Accommodations and Traffic

The number of staff employed at the Project will vary by Project phase. Employment levels will be highest during the site preparation and construction phase, reaching a peak level of 400 full time equivalent staff, decreasing to 200 full time equivalent staff during operations. Employment levels during the closure phase would be comparable to operations. The employment levels and relevant educational requirements during the site preparation and construction, and operation phases are shown in Table 3.13.2-1.

Table 3.13.2-1: Project Employment

Parameter	Construction	Operations
Total Employment	400	200
Management	54	9
University Degree	10	19
College or Apprenticeship Certification	216	116
Secondary School and/or Specific Occupation Training	83	41
On-the-Job Training Usually Provided	37	15

Note: Employment levels are in person-years.

Based on the identified staffing levels, Treasury Metals are confident that there is sufficient housing and accommodation available in the local communities to meet the Project needs. No camp accommodations will be provided for staff or contractors during the construction, operations, or closure phase.

A traffic impact study for the Project (Appendix E) was completed as part of the work to support the EIS. The traffic study identified the traffic volumes associated with the Project, as well as the likely effects of that traffic on the level of service on Highway 17, Anderson Road, and the intersection of Anderson Road and the Highway 17. These effects are described and incorporated into the social assessment (Section 6.17). Table 3.13.2-1 lists the peak and average traffic volumes associated with the Project during the site preparation and construction phase, as well as during operations. Expected traffic levels will be considerably lower during the closure phase, while there would be virtually no Project traffic to and from the site following the completion of the closure activities.

Table 3.13.2-2: Project Related Traffic Numbers

Parameter	Construction	Operations
Total Daily Trips (1)	469	275
Employees	440	250
Gold transport	0	0.6
Supplies	11.3	11.3
Chemicals	4.4	4.4
Fuel	4.3	4.3
Waste	2	4
Maintenance and repairs	0.1	0.2
Construction traffic	7	0
Peak Hourly Volume (2)	200	119
Average Non-peak Hourly Volume (3)	35	19

Notes:

(1) Daily trips were based on the data presented in Table 9 of Appendix E.

(2) Peak traffic occurs at the stat/end of shifts.

(3) Average non-peak hourly traffic includes a safety factor of 5.

3.13.3 Aggregate Resources

As discussed in Section 2.4.13 of the revised EIS, Treasury Metals considered three alternatives with respect to aggregate materials, namely: using mine rock identified as non-PAG; developing an on-site aggregate pit(s); and obtain aggregate from an existing commercial aggregate supplier in the region. The preferred alternative is to use non-PAG waste rock as the primary source of aggregate as this reduces the volume of waste rock to be managed, would likely reduce the height of the waste rock storage area (WRSA), and would be more economical solution for Treasury Metals. The current drilling samples have indicated that the majority of the rock can be characterized as PAG. Treasury Metals is currently completing site investigations to determine the adequacy of the aggregate materials on site. These additional characterization studies will focus in peripheral areas of the open pit. It is hoped that suitable on-site areas where non-PAG waste rock will be identified within peripheral open pit limits. The approach recognizes that drilling to date has been largely focused toward mineralized areas of the future open pit and there has been less sampling in peripheral areas of the pit. Treasury Metals may need to look to outside sources of aggregate that does meet the technical specifications. If outside sources of aggregate are required it is anticipated that Treasury Metals would get the aggregate needed from existing commercial aggregate suppliers in the region. There are currently a number of aggregate vendors that Treasury Metals is looking into as possible sources of material should onsite aggregates not be suitable.

In the event, on-site segregation of non-PAG rock is to be completed to supply construction aggregate for the Project (including construction of TSF embankments), a standard operating procedure (SOP) would be developed to segregate suitable non-PAG rock. Any PAG rock would continue to be managed according to current management plans. A screening procedure of the blast rock volumes containing suitable non-PAG rock would developed using stream-lined (rapid) analysis to identify the volume of non-PAG rock that can be segregated (NP/AP >2). It is envisioned that analogue relationships for NP and AP would be confirmed during ML/ARD characterization of the non-PAG mine rock source. Based on available information for current in-pit mine rock, total carbon and total sulphur are expected to be suitable analogues for NP and AP respectively.

The anticipated SOP for segregation of non-PAG rock would therefore include the following:

- Analysis of blast hole cuttings for carbon and sulphur as an analogue for NP and AP respectively.
- Carbon and sulphur analysis would be completed using an on-site Leco analyser or by rush-turn-around at commercial laboratory.
- Analogue NP and AP analysis would be periodically checked against full ABA analysis to confirm previously defined analogue relationships (expect 1 in 10 samples initially declining to 1 in 20 samples or fewer as project experience dictates.
- A mining geologist would define mineable non-PAG rock volumes (NP/AP >2) to be segregated from the total blast volume based on the analogue NP and AP in blast hole cuttings results.
- The defined blast volume of non-PAG rock would then be extracted for use as construction aggregate and remaining rock would be managed as PAG rock according to current project plans.

3.14 Conceptual Closure and Decommissioning

Appendix KK includes a conceptual closure plan that has been prepared to support the EIS. The plan is purposefully structured in the same manner as set out in Schedule 2 of the Ontario *Mining Act* – Ontario Regulation 240/00, Mine Development and Closure under Part VII of the Act. The conceptual closure plan is not intended to constitute an entire closure plan nor fulfill requirements of the *Mining Act*, although aspects of this document will be used to develop the certified closure plan. The conceptual closure plan describes the main reclamation objectives, provides a summary of proposed progressive reclamation activities, the reclamation plan for final closure, and the anticipated post-closure site conditions.

3.14.1 Reclamation Objectives

The following closure objectives have been established for the Project:

- Provide for mine closure using currently available proven technologies in a manner consistent with sustainable development;
- Restore the Project Site to a land use that maintains public safety;
- Reclaim disturbed landscapes in a manner that includes:

- o Revegetation to stabilize surface materials
- o Provides protection from wind and water erosion
- o Improves the appearance and aesthetics
- o Enhances natural vegetation growth and establish self-sustainable vegetation growth;

- Ensure the long-term physical stability of tailings dams and other containment structures; and
- Meets applicable regulatory requirements, including the Mine Reclamation Code of Ontario (the Code) under Ontario Regulation 240/00 of the Ontario *Mining Act*.

In addition to and in consideration of the component objectives outlined in the Code, the conceptual closure plan also addresses progressive reclamation opportunities during operations.

3.14.2 Progressive Reclamation

Reclamation activities that can be performed prior to final closure and that do not pose a barrier to daily operations will be considered for progressive reclamation. Progressively reclaiming facilities and site features wherever practical will reduce the amount of work and time required at site closure. It also provides useful knowledge to improve final reclamation success. Progressive reclamation strategies are proposed for the open pit mine and various stockpiles, as described in Appendix KK.

3.14.3 Reclamation at Final Closure

3.14.3.1 Open Pit Mine

Final reclamation of the open pit will begin once mining operations cease. Once the pit is cleared of equipment, dewatering activities will cease and the backfilling of waste rock will continue (if not completed during progressive reclamation). The pit will be allowed to fill with water, keeping the level below that of the waste rock being actively backfilled (if any). The final filling of the open pit with water will be achieved by enhanced flooding through a combination of the following:

- Natural groundwater, flowing into the open pit at a rate of 700 cubic metres per day (m^3/d) once dewatering activities cease. The flow rate will decrease to 100 m^3/d as the open pit fills to the spillway elevation at 388 metres above sea level (masl) and to a final volume of approximately 12 million cubic metres (Mm^3).
- Surface water, from the graded operations area, directing 20 m^3/d from the capped WRSA, 10 m^3/d from the TSF, and all other precipitation runoff towards the flooding open pit. All runoff from the operations area will continue to be directed towards the open pit after the open pit is fully flooded.

- A one-time batch transfer of 970,000 m^3 of supernatant water present within the TSF will be withdrawn, treated and discharged into the open pit to aid in the filling process.

Hydrologic modelling indicates that enhanced flooding of the open pit should take between 6 and 8 years to fill with water, depending on the meteorological conditions experienced. Under average climatic conditions, the open pit is expected to take approximately 6.7 years to fill with water.

3.14.3.2 Underground Mine

Infrastructure and equipment of value in the Project underground mine workings will be removed, dismantled and taken off site for sale or reuse if economically feasible. Any non-hazardous waste material (i.e., concrete, steel, wallboard and other inert materials) will be placed in an approved, onsite demolition landfill. Equipment of no value will be left underground, after purging of lubricants, fuels and coolants to be left in an inert state. Any hazardous material will be removed from the site. 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 non-acid generating (NAG) rock. The entire ramp opening will be backfilled and overfilled with waste rock to ensure no potential entry point is visible or accessible. After sealing, the area will be regraded, covered with overburden and re-seeded.

3.14.3.3 Stockpiles

Treasury proposes to process all stockpiled ore during operations, therefore reclamation of the low grade ore stockpile should not be required. This is anticipated to remove most potentially acid-generating (PAG) rock from the Site. Any PAG rock that remains at the Site would be managed using one of the below alternatives:

- Re-location to the open pit and/or underground mine below the final static water level;
- Placement on the WRSA prior to installation of the final cover; and/or
- Placement on top of the tailings in the TSF prior to final flooding / rehabilitation.

The specific closure strategies for the WRSA, overburden stockpile and low-grade ore stockpile on site are described further in the sub-sections below.

3.14.3.4 Waste Rock Storage Area

For the area above surface containing PAG rock (i.e. WRSA, process plant site, etc.), Treasury proposes to design and place a multi layered, low permeability cover. The main purpose of this cover would be to control long term acid rock drainage (ARD) by achieving encapsulation and limiting oxygen to the PAG rock. The dry cover would be in accordance with Section 59 of the Mine Rehabilitation Code of Ontario (O. Reg. 240/00).

Confirmed PAG rock would be placed beneath the static water level in the open pit and/or underground mine to the extent practical, thereby minimizing the volume of PAG rock in the WRSA. If operational monitoring of the WRSA confirms that it is PAG, a low-permeability dry cover will be constructed over it at closure. Clay would not be used in the dry cover over the WRSA due to potentially poor performance associated with desiccation, freezing and cracking.

3.14.3.5 Overburden Stockpile

At closure the overburden will be used as cover material for the TSF closure as well as other reclamation activities requiring fill, including the berms surrounding the open pit. Any material remaining in the stockpile not used during progressive or final reclamation, will be graded and vegetated.

3.14.3.6 Low-Grade Ore Stockpile

The low-grade stockpile will be mixed and milled with the higher-grade ore produced during the underground mining phase. and will be depleted by the completion of underground mining. At closure, any residual ore or PAG material on the stockpile pad will be removed and placed in the TSF. The stockpile pad will then be covered with overburden and/or growth material and vegetated.

3.14.3.7 Tailings Storage Facility

At closure, the water in the TSF will be withdrawn, treated and used to help fill the open pit. The TSF will then be covered with a granular material to physically isolate the tailings. Next, either a low permeability cover (i.e., dry cover) or non-process water cover (i.e., wet cover) will be applied to ensure that the tailings are isolated from oxygen and water to preclude acidification.

As described in Section 2.5.4, it has been identified that there is an increased potential for ARD with a capping and reclamation option due to the potential for physical caps to degrade with time and allow oxidation to occur in the upper layers of the tailings. Therefore, based on the available geochemical information, seepage for the capping and reclamation option would be of a poorer quality and the potential for effects offsite would be increased. Therefore, permanent flooding of the TSF is the preferred option for closure of the TSF. However, Treasury Metals continue to investigate the suitability of these closure options.

To support this, the description of Project effects on geology and geochemistry (Section 6.3), surface water quality (Section 6,8) and surface water quantity (Section 6.9) provide predictions of Project effects for both the dry cover (capped) and wet cover (uncapped) closure options for the TSF. In keeping with the EIS Guidelines, residual adverse effects were determined after the application of technically and economically feasible mitigation. Therefore the residual adverse effects for these disciplines are based on the wet cover (uncapped) closure option. The effects on other disciplines linked to the water quality and quantity results (e.g., fish and fish habitat) are based on the residual adverse effects (i.e., the effects assuming a wet cover closure for the TSF).

3.14.3.8 Buildings and General Infrastructure

The following will be done with respect to structures and equipment at the site:

- 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.
- 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.
- 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.
- Any remaining explosives will be either detonated on site or disposed of in the appropriate off-site facility.
- Site roads and dedicated access 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.
- Improvements to Trans-Canada Highway 17 entrance will remain in place continuing to provide better access to local populace.
- Access trails built at the Site will remain in place to support local recreational activities after final closure when access is returned.
- The water reclaim pump, reclaim pipeline, and tailings delivery and distribution pipelines will be decommissioned and removed from the Site. Pipelines will be drained / purged, and either sealed and left in place; or dismantled and disposed of in the appropriate off-site facility.
- Power infrastructure, equipment and materials will be taken off site for sale or re-use where practical. Other power-related materials that have no salvage value will be dismantled and disposed of in the appropriate off-site facility.

3.14.3.9 Site Drainage and Water Structures

The pattern of general site drainage developed during operations will remain in place at closure, with the exception of the removal of culverts at water crossings during site road reclamation activities. A general arrangement depicting post-closure site drainage for the dry cover and wet cover alternatives are provided Figures 3.0.1D and 3.0.1E, respectively.

3.14.4 Post Closure Site Conditions

The overall vision of the site post-closure is to reclaim the mine site such that the long-term physical and chemical stability is achieved and public safety is maintained. The following sub-sections describe the post-closure site conditions of the infrastructure, the overall terrain, surface water and groundwater, and the aquatic and terrestrial environment.

3.14.4.1 Terrain

Terrain at the Site will be similar to pre-development conditions with the exception of the closed WRSA and TSF. At the WRSA, a low hill of approximately 37 ha and rising to 30 m above the pre-development terrain grade will remain. Contouring, reclamation, and vegetation will allow the hill to blend into the surrounding terrain. A flattop plateau of approximately 70.6 ha and 10 m above the pre-development terrain grade will remain at the site of the TSF where there was previously a depression. As with the WRSA, contouring, reclamation, and vegetation will blend the TSF into the surrounding terrain features. The remaining site will have limited topographic relief. It will be regraded to support drainage and after revegetation will blend into the surrounding terrain.

3.14.4.2 Aquatic Environment

Following closure, the portions of the Hoffstrom's Bay Tributary and Little Creek watersheds enclosed within the perimeter ditch and berm around the operations area will effectively remain within the Blackwater Creek watershed. The decreases in annual flow in Hoffstrom's Bay Tributary and Little Creek will continue following the closure of the Project.

The majority of the Project footprint will be located within the Blackwater Creek watershed. Blackwater Creek Tributaries 1 and 2 will be partially overprinted by the open pit and TSF, respectively. All runoff collected from the operations area will continue to remain within the Blackwater Creek watershed, including the runoff from those portions of the Hoffstrom's Bay Tributary and Little Creek watershed enclosed within the perimeter ditching around the operations area. As a result, an increase in annual flow in Blackwater Creek is predicted in the long-term,

Following operations, dewatering activities will cease and the open pit allowed to fill with water. It is estimated that it will take 6.7 years for the open pit to fully flood. The flooded pit will form a long, narrow pit lake comprised of three basins. The lake will be shallower in the west and increase in depth to the east, as a result of the waste rock backfill placed in the west and central basins of the open pit. The west basin will be shallow (i.e., 2 to 3 m) and well within the euphotic zone for primary productivity. The east basin will be deep (i.e., 140 m) while the central basin depth will provide a transition zone. The central and east basins are expected to undergo thermal stratification which would separate the epilimnion from the hypolimnion. The stratification could either be seasonal or permanent. Once the open pit is flooded, it will be allowed to passively discharge into the former channel of Blackwater Creek Tributary 1.

Once the dewatering activities cease, the groundwater will gradually return to near pre-development conditions. The open pit will continue to be a sink for groundwater once it is fully flooded.

3.14.4.3 Terrestrial Environment

All disturbed areas will be seeded with plant species selected for rapid growth and colonization to provide soil stabilization and prevent erosion. It is anticipated that the initial vegetation will gradually be replaced by natural vegetation communities through natural succession.

3.15 Refinement to the Project Incorporated in the Original EIS

As per the Federal EIS guidelines, the changes made to the Project since originally proposed have been summarized and include the benefits of these changes to the environment, Aboriginal peoples, and the public (Table 3-15-1).

Table 3.15-1: Changes to the Project since Initially Proposed

Changes to Project	Comment	Benefits to the Environment, Aboriginal Groups and Public
Ore processing plant and related infrastructure has been relocated to the southeast, versus the layout presented in the PD. The indicated footprint of the processing facilities is also reduced.	Smaller processing plant footprint reflects the results of more detailed engineering design through the efforts of an optimization study conducted for Treasury by Lycopodium Minerals Canada Ltd. The location of the processing plant and supporting facilities was moved several hundred meters south and east of the initial proposal to keep the processing plant on lands owned by Treasury and to take advantage of the smaller footprint.	• Reduced potential for environmental effects due to the smaller footprint. • Reduced potential effects to Crown land. • Reduced potential effects to treaty and aboriginal rights of the local Aboriginal populations by placing the processing plant on private versus Crown land.
TSF structure footprint and layout has been modified to reflect the results of more detailed engineering being completed after the original PD was submitted to the Agency. The TSF has now been designed to fit onto land owned primarily by Treasury.	The overall footprint of the TSF is slightly reduced based on more detailed engineering by WSP. The footprint of the TSF was also modified to constrain its boundaries largely to private property owned by Treasury.	• Reduced potential effects to Crown land. • Reduced potential effects to treaty and Aboriginal rights of the local Aboriginal populations by placing the TSF on private versus Crown land.
Addition of ditching and associated seepage collection ponds within the mine rock area (WRSA, OB and low-grade stockpiles).	Further technical information received from EcoMetrix has identified that a greater percentage of the waste rock may be PAG. In order to control any long term potential effects of the PAG waste rock, this design change was incorporated into the integrated water	• Reduced potential for environmental effects on water quality. • Reduced potential effects to Crown and private lands held by Treasury. •

Table 3.15-1: Changes to the Project Since Initially Proposed (continued)

Changes to Project	Comment	Benefits to the Environment, Aboriginal Groups and Public
	management plan and practices (allows for collection, treatment and monitoring).	
WRSA layout redefined.	The footprint of the WSRA area was modified, reflecting the results of more detailed engineering work being completed, and constraining the boundaries largely to private property owned by Treasury.	• Reduced potential for environmental effects on local receptors (water quality, air quality, noise, and visual aesthetics). • Reduced potential effects to Crown land.
OB stockpile layout redefined.	The profile and layout was changed to reflect an updated version of the mine plan and the decision to place the overburden on lands Treasury currently owns.	• Constraining the overburden stockpile to lands Treasury owns has had the effect of moving it further away from Blackwater Creek, making it simpler to keep any potential runoff away from the creek. • This change also provided a different profile than the original design, allowing the stockpile to be both more effective as a noise barrier and have less visual effect.
Modest alterations to the open pit footprint.	New pit layout and design reflects increased geological and engineering knowledge of the resource. This is based on subsequent infill and exploration drilling, combined with the development of a more detailed mine plan.	• These changes are anticipated to strengthen the case to open a mine which would provide socio-economic benefits to the local public and Aboriginal communities.
Water management and treatment options further developed resulting from process optimization work completed after the original PD.	An integrated water management system has been designed, reflecting an updated engineering design which incorporated a water recycle loop, reducing freshwater need requirements. Minimize the draw for fresh water intake to support process requirements.	• Reduce effluent discharge volumes from the TSF • Addition of water treatment technologies to ensure treated water discharge meets PWQO standards for Ontario • Minimizing fresh water intake reduces the potential for environmental effects related to taking water.
Effluent discharge point and receptor selected – Blackwater Creek.	The decision to use Blackwater Creek as the final treated effluent discharge point was the result of an alternatives assessment process. The option selected is the least complicated and disruptive of the options considered. A more in-depth engineering analysis supported this option selection. Additional waste water treatment technologies were introduced to the project to ensure effluent discharge meets Ontario PWQO standards. The	• Reduce potential for environmental effects to Crown and private land and landowners versus other options. This option eliminates effluent pipeline crossings at roadways, rail lines, natural gas pipelines and the trans-Canada highway. The potential for effluent pipeline failure and associated environmental risks and cleanup efforts is also eliminated. • Public concern regarding discharge of TSF effluent to Thunder Lake is eliminated (smaller water body than

Table 3.15-1: Changes to the Project Since Initially Proposed (continued)

Changes to Project	Comment	Benefits to the Environment, Aboriginal Groups and Public
	details of the treatment regime are embedded within in the EIS.	Wabigoon Lake, higher concentration of people living around the lake). • Some members of the local public have indicated the preference to avoid direct discharge to Wabigoon Lake. The option selected addresses that concern. • The application of additional treatment technologies, specifically an RO plant, will provide further environmental safeguards. This adds another layer of protection for the environment and the public.
Fresh water make up supply source changed from Thunder Lake to existing irrigation ponds located on the former OMNRF tree nursery site.	Final fresh water intake point selection is the result of an alternatives assessment review with inputs from additional hydrogeology studies, plant process engineering studies and a more detailed mine plan.	• Reduce potential for environmental effects related to constructing a water intake in Thunder Lake and running a pipeline over land to the processing plant site. • Reduced potential effects to Crown and private lands due to ongoing maintenance and inspection activities associated with the pipeline. • Reduced potential effects of fresh water runoff resulting from a pipe failure. • Reduced potential effects to treaty and Aboriginal rights of the local Aboriginal populations by placing the fresh water make up system on more private versus Crown land. • Some members of the public have also indicated the preference to avoid direct intake from Thunder Lake and Wabigoon Lake. This redesign for fresh water makeup addresses those preferences.
Blackwater Creek watercourse realignment.	Realignment of Blackwater Creek reflects further detailed engineering design work associated with relocating the processing plant to a different location than that outlined in the original PD. The creek realignment accommodates revised location of the processing plant, and associated infrastructure.	• Reduce potential for environmental effects. • Reduced potential effects to Crown land. • Reduced potential effects to treaty and Aboriginal rights of the local Aboriginal populations by placing the processing plant on private versus Crown land.

Table 3.15-1: Changes to the Project Since Initially Proposed (continued)

Changes to Project	Comment	Benefits to the Environment, Aboriginal Groups and Public
Optimization of electrical substation location.	Routing and location optimized to reflect revised infrastructure location.	• No significant additional benefits from this modification relative to the originally proposed electrical system takeoff point.

Changes to the Project reflect the following:

- Additional baseline information and other related knowledge;
- Additional engineering design and further definition of the Project, environmental effects, mitigation measures and management plans;
- Changes to land ownership, including the finalization of additional land purchase and land access agreements; and
- Comments received to date during consultation and engagement activities regarding the Project.

3.16 Refinements to the Project since Filing the Original EIS

Changes have been incorporated to the Project in response to the ongoing consultation process, Information Requests, engineering refinements, measures to ensure compliance with federal and provincial environmental protection legislation, and evolving environmental best practices that are applicable and feasible for the Project. This Section briefly summarizes the changes to the subject Project components, phases and activities that were described in Section 3 of the original EIS.

3.16.1 Perimeter Ditching

An engineered perimeter runoff and seepage collection ditch will be constructed around the entire Operations Area (refer to Definition of Terms and Acronyms) prior to commencing earthworks for the Project and the collected water will be treated and discharged to Blackwater Creek. This perimeter structure will ensure compliance with the Metal Mining Effluent Regulations and prevent any direct releases of runoff to the environment once the site preparation commences.

3.16.2 Surface and Mine Water Management

The spoils from the perimeter ditch excavation will be windrowed, compacted in successive lifts, and erosion proofed immediately downstream of the ditch to serve as a containment berm. The berm will be designed to exclude non-contact water from the Operations Area. The ditch will provide additional freeboard for the perimeter collection ditches by way of compaction of the underlying overburden. This compaction process will also reduce the flow of ground water through overburden into the Operations Area due to open pit dewatering. This flow reduction will help reduce the zone of influence and potential drawdown of the overburden water table surrounding the pit. Generally, these berms will impound runoff so that flow decants to the open pit during an extreme flood event. However, engineered spillways would be incorporated into the perimeter berm where appropriate to prevent overtopping. These design elements will be integrated into the design basis going forward.

Surface runoff and seepage will be collected in perimeter ponds. Runoff will be retained in these ponds until it is required for use in the process plant. Surplus water in these ponds will be pumped to the effluent treatment system for treatment and discharge to Blackwater Creek. Adequate freeboard will be maintained in these ponds at all times to manage the Environmental Design Storm (EDS). There will be no direct release of runoff from the Operations Area to the environment.

A Minewater Pond (MWP) will be constructed south of the Tailings Storage Facility (TSF). Mine water from the pit and the underground mine workings will be pumped to the MWP. Suspended solids will be settled in this pond and biological oxidation of ammonia will be promoted through the use of in-pond aerators and the placement of media to provide increased surface area for ammonia oxidizing bacteria. Water from the MWP would be used in the underground mine, the Process Plant and for dust suppression within the Operations Area. Water that is used within the Operation Area that does not evaporate will be contained by the perimeter runoff and seepage collection ditch and subsequently treated within the effluent treatment system and discharged to Blackwater Creek. Surplus water in the MWP will be pumped to the effluent treatment system for treatment and discharge to Blackwater Creek. Adequate freeboard will be maintained in the MWP at all times to manage the EDS.

3.16.3 Stockpiles

The low grade ore stockpile is to be located at the Plant Site, resulting in a compact site footprint.

The overburden stockpile has been modified to avoid infilling the Blackwater Creek Tributary #1 south of the open pit.

The waste rock storage area (WRSA) has been modified to locate it primarily in the Blackwater Creek watershed and minimize the portion that extends into the Thunder Lake watershed. The WRSA will be constructed with an embankment slope that is adequate for long-term physical stability to avoid the need to re-contour the WRSA at closure. As embankments are removed from active fill placement, they will be covered with overburden and vegetated with ground cover species as well as tree species that are consistent with planting prescriptions in the Dryden Forest Management Plan (FMP). Priority will be given to finishing construction of the western perimeter of the WRSA so that this embankment can be prepared and planted to create a green barrier between the mining operations and the residences to the west.

3.16.4 Site Layout and Infrastructure

This section describes the updates to the site layout and infrastructure.

3.16.4.1 Watershed Approach

Treasury Metals has adopted a watershed approach to the site layout. The optimized general arrangement (GA) avoids the Thunder Lake watershed to the extent practical and situates the Project primarily within the sub-watershed of the two westernmost tributaries of Blackwater Creek.

The perimeter runoff and seepage collection ditch will be an engineered feature and will become the new watershed divide between Thunder Lake and Blackwater Creek. This effectively results in the Operations Area being entirely within the Blackwater Creek watershed.

3.16.4.2 Plant Site

Based on the feedback received during the EA process to date, there are impacts and concerns associated with the Plant site location presented in the EIS. Treasury has identified an alternative Plant site location west of Tree Nursery Road. This location is now considered the preferred location for the Plant site for the reasons listed below:

- No removal of fish habitat required and no diversion of Blackwater Creek around the Plant site would be required. This will reduce the impacts to the fish habitat in Blackwater Creek.
- Overburden depth is reduced and projected water table is not as shallow at this new preferred location. This facilitates the effective collection of runoff and seepage from the Plant site. This will reduce the impacts to surface water quality and ground water quality outside of the Operations Area.
- Shallower bedrock and preferable foundation conditions for Plant site infrastructure.

At this time, Treasury Metals continues to advance the federal environmental assessment using the location presented in the EIS as this is regarded as a conservative assessment of the Project effects. Should feedback during the EA and permitting process indicate a preference to re-locate the plant site to the new preferred location, Treasury Metals recognizes there could be the need to update the air and noise modelling required to support the Environmental Compliance Approval (ECA) process that would follow the EA.

3.16.4.3 Pipelines

Pipelines between the TSF and the Plant site containing tailings and reclaim water will be positioned entirely within a lined swale so that potential spillage is contained. Furthermore, potential spillage would be contained by the perimeter runoff and collection system that encircles the Operations Area. Dam crests will be sloped towards the inside of their respective pond to keep spillage within the respective ponds.

3.16.5 Tailings Storage Facility

The floor of the TSF will be low-permeability. Where native soils do not provide a sufficiently thick low-permeability horizon beneath the TSF, the preferred alternative will be to use clay from open pit stripping and from beneath the WRSA where the clay needs to be removed to improve the WRSA foundation conditions. Any of the stripped clay that is not suitable due to its physical properties will be stockpiled with overburden. If the volume of clay is insufficient, a synthetic liner will be used to ensure a low-permeability floor for the TSF. Off-site clay borrow areas would not be developed.

A finger drain will be constructed in the existing creek channel that bisects the TSF. Collected drainage will be conveyed to a pump station at the downstream (south) end of the TSF, and used in the Plant.

The spillway will be positioned on the west side of the TSF so that overflow during an extreme flood event would drain to the open pit where it would be contained.

3.16.6 Water Management

Grey water (showers) will be pumped to the plant for use in the process.

The only freshwater withdrawals will be from the two existing pump house locations at the former Tree Nursery. The maximum withdrawal will be 5% of streamflow, as measured on a real-time basis.

The TSF will be managed as a discrete water pond. The only inputs to the TSF will be process water, direct precipitation and water from the TSF's perimeter seepage collection system. Water from the runoff collection ponds and dewatering will not be consolidated in the TSF as a normal operating practice, but these ponds will be used as sources of process water for the Plant.

As a future optimization, industrial evaporators could be deployed surrounding the TSF to evaporate surplus water from the TSF, thereby reducing the volume that requires treatment and discharge to Blackwater Creek. Evaporators would be enclosed within noise shrouds to contain noise from the fans.

In-pond aerators would be positioned within runoff collection ponds, the minewater pond and the TSF supernatant pond to minimize ice build-up and promote the oxidation of ammonia. Decreasing the ice cover would increase the volume of water that is available for use in the Plant during winter months.

3.16.7 Explosives Storage Facility

Minimum permissible distances from Natural Resources Canada have been reviewed and the proposed explosives storage facility will be located on land owned by Treasury Metals, which is removed from any known recreational trails. The facility would be self-contained with zero discharge.

3.16.8 Closure and Decommissioning

Closure strategies have been refined since the submission of the EIS in April 2015 and these are described below.

3.16.8.1 Watershed Approach

Post close out, the necessary segments of the perimeter runoff and seepage collection ditch will remain in place to ensure the Operations Area remains within the Blackwater Creek watershed. The majority of the Operations Area will drain to the open pit post close out. Once the pit is flooded to the spillway elevation, it will decant to the existing tributary of Blackwater Creek that will be restored at closure.

3.16.8.2 Strategy to Ensure Chemical Stability Post Close Out

For planning purposes, Treasury Metals is preparing to manage waste rock, ore and tailings as Potentially Acid Generating (PAG). Treasury Metals has refined the closure strategy to ensure long-term chemical stability and this is described in the following Sections.

Waste Rock Storage Area

Treasury Metals will further evaluate the geochemical properties of waste rock and the feasibility of a real-time characterization program to segregate non-acid generating (NAG) and PAG waste rock. Confirmed PAG rock would be placed beneath the static water level in the pit and/or underground mine to the extent practical, thereby minimizing the volume of PAG rock in the WRSA. If operational monitoring of the WRSA confirms that it is PAG, a low-permeability dry cover will be constructed over it at closure, in accordance with Section 59 of the Mine Rehabilitation Code of Ontario (O. Regulation 240/00). Clay would not be used in the dry cover over the WRSA due to potentially poor performance associated with desiccation, freezing and cracking.

Plant Site

The upper portion of the Plant site will be scarified, reclaimed and processed at the end of the mine life. This is anticipated to remove most PAG fines from the Plant site. Any PAG rock that remains at the Plant site would be managed using one of the below alternatives that is deemed most appropriate using empirical data that is gathered at close out.

- Re-location to the open pit and/or underground mine below the static water level;
- Placement on the WRSA prior to installation of the low-permeability dry cover; or
- Placement over the TSF prior to final rehabilitation (Section 2.9.2.3).

Tailings Storage Facility

Treasury Metals will optimize an engineered cover to mitigate chemical instability using empirical data that is gathered during the life of the Project, in general accordance with Peck, Advantages and limitations of the observational method in applied soil mechanics (Peck 1969). Examples of empirical data include embankment foundation conditions and performance (actual and modeled) of the low-permeability floor and embankments. Treasury Metals will optimize, design and install an engineered cover (either a dry or wet cover) to mitigate chemical stability issues in accordance with Section 59 of Schedule 2 of O. Regulation 240/00.