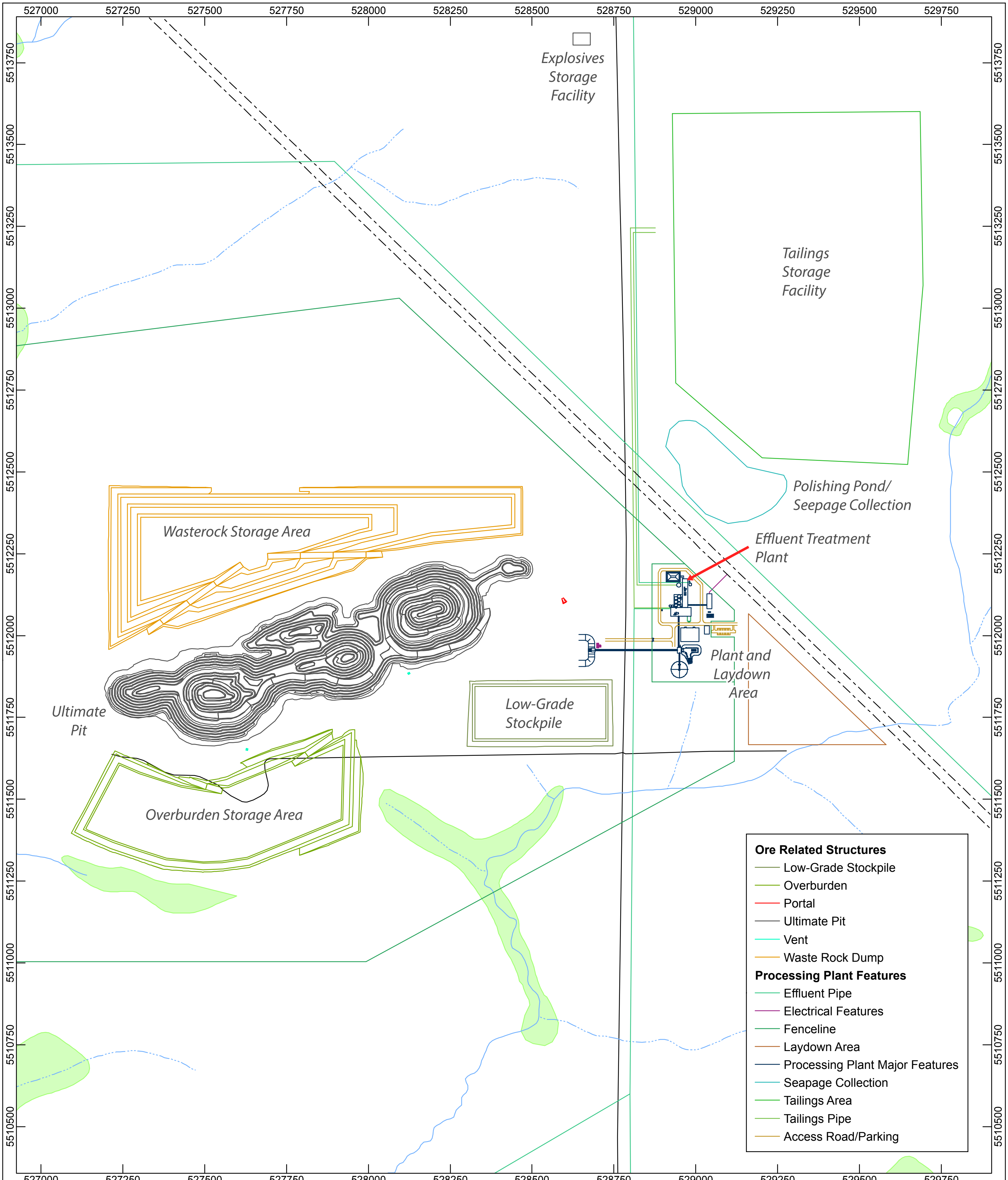
3.0 PROJECT DESCRIPTION

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 (Figure 3.0.1). The Project footprint will cover approximately 188 ha during the maximum of extent of operations with 133 ha or 71% of the footprint on Treasury private lands. This site plan shows the preferred alternatives for Project components as described in Section 2.

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.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	SCALE: 15 000 *TREASURY METALS INC.*		
GENERAL ARRANGEMENT OF PROJECT SITE DURING OPERATIONS PHASE	*DESIGN: AT 20 FEB. 2014* *GIS: AT 24 JUNE. 2014* *CHECK: AT 12 SEP. 2014*		
FIGURE: 3.0.1	REV.00		

Intermittent Watercourse
Permanent Watercourse
Roadway
Wetland
Waterbody
Utility Line

N

0 100 200 300
Meters

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

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 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 (OMNRF) established a tree nursery facility, located north of the mineral deposit, which was sold to Treasury in 2011 and houses the Project office (Figure 3.1.1).

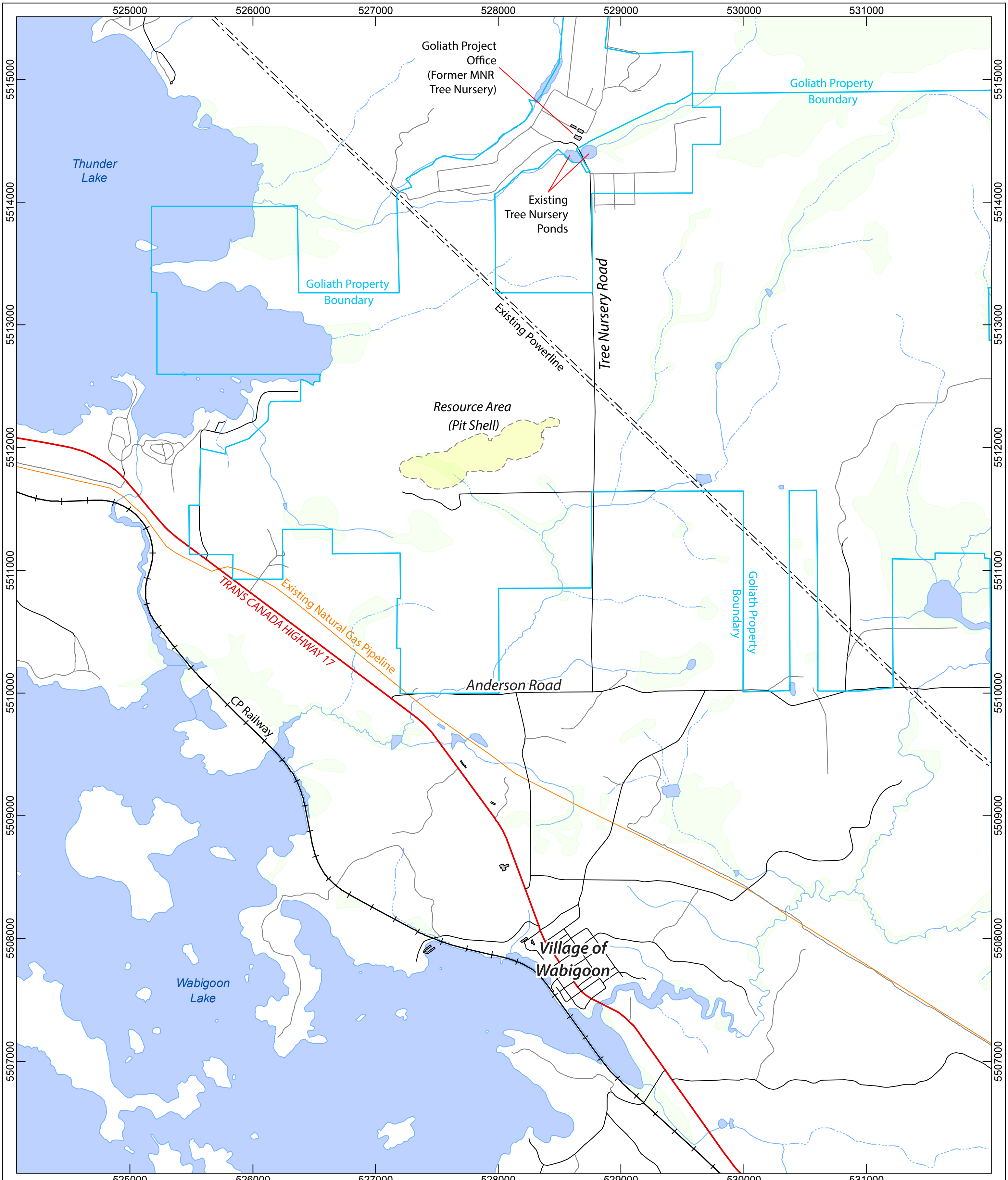
Figure 3.1. 1 Project Office

3.1.1 Roads

The Project site is accessed from Highway 17 via Anderson Road and Tree Nursery Road (Figure 3.1.2). 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 (Keewatin-Aksi, 2014). In addition to the municipal roads, there are a number of unpaved roads and trails associated with the former tree nursery that are in use by Treasury for access to drill targets and environmental sampling locations.

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. Current electrical power is supplied by a separate and smaller power line that runs parallel to the Tree Nursery Road (Figure 3.1.2). Treasury has been informed by Hydro One that this has no capacity and electrical power is better supplied by the aforementioned M2D line.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

EXISTING INFRASTRUCTURE

FIGURE: 3.1.2 REV.00

SCALE: 40 000

TREASURY METALS INC.

DESIGN: AT 20 FEB. 2014
GIS: AT 25 JUNE. 2014
CHECK: XX 12 SEP. 2014

Railway
Expressway / Highway
Local
Resource / Recreation
Existing Building
Hydro Line
Natural Gas Pipeline
Wetland
Waterbody
Intermittent Watercourse
Permanent Watercourse

N

0 250 500
Meters

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

3.1.3 Natural Gas

There is a main Trans-Canada natural gas (NG) pipeline that runs adjacent to and north of Highway 17. This pipeline provides natural gas for the Dryden area. Union Gas is the sole distributor of natural gas in the Dryden area (Figure 3.1.2). The main Trans-Canada line does not provide gas directly to the Project site, or local home owners in the immediate vicinity.

3.1.4 Railway

The Canadian Pacific Railway main line runs south of the Project site, along the north shore of Wabigoon Lake (Figure 3.1.2). 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.

3.1.5 Warehousing and Office Facilities

The former OMNRF tree nursery facility is owned by Treasury and operates as the Project office and as a warehousing facility (Figure 3.1.2).

3.1.6 Dams and Impoundments

The unnamed tributaries passing through the former tree nursery were historically impounded by OMNRF to provide water for the tree nursery (Figure 3.1.2). The structures and impoundments remain in place and functional.

3.2 PROJECT PHASES AND SCHEDULE

The total lifespan of the Project is approximately 17 years beginning with site preparation and ending with the completion of the closure activities (Figure 3.2.1; Table 3.2.1). Some of the phases and activities will overlap.

The estimated duration of each key Project phase is:

- Site Preparation Phase: 1 year;
- Construction Phase: 1 years;
- Operations Phase: 11 years;
- Closure and Post-Closure Phase: 6 years.

3.2.1 Site Preparation Phase

Before ore production can commence, a number of activities must occur:

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

The site preparation activities will be scheduled to minimize the potential disturbance of wildlife.

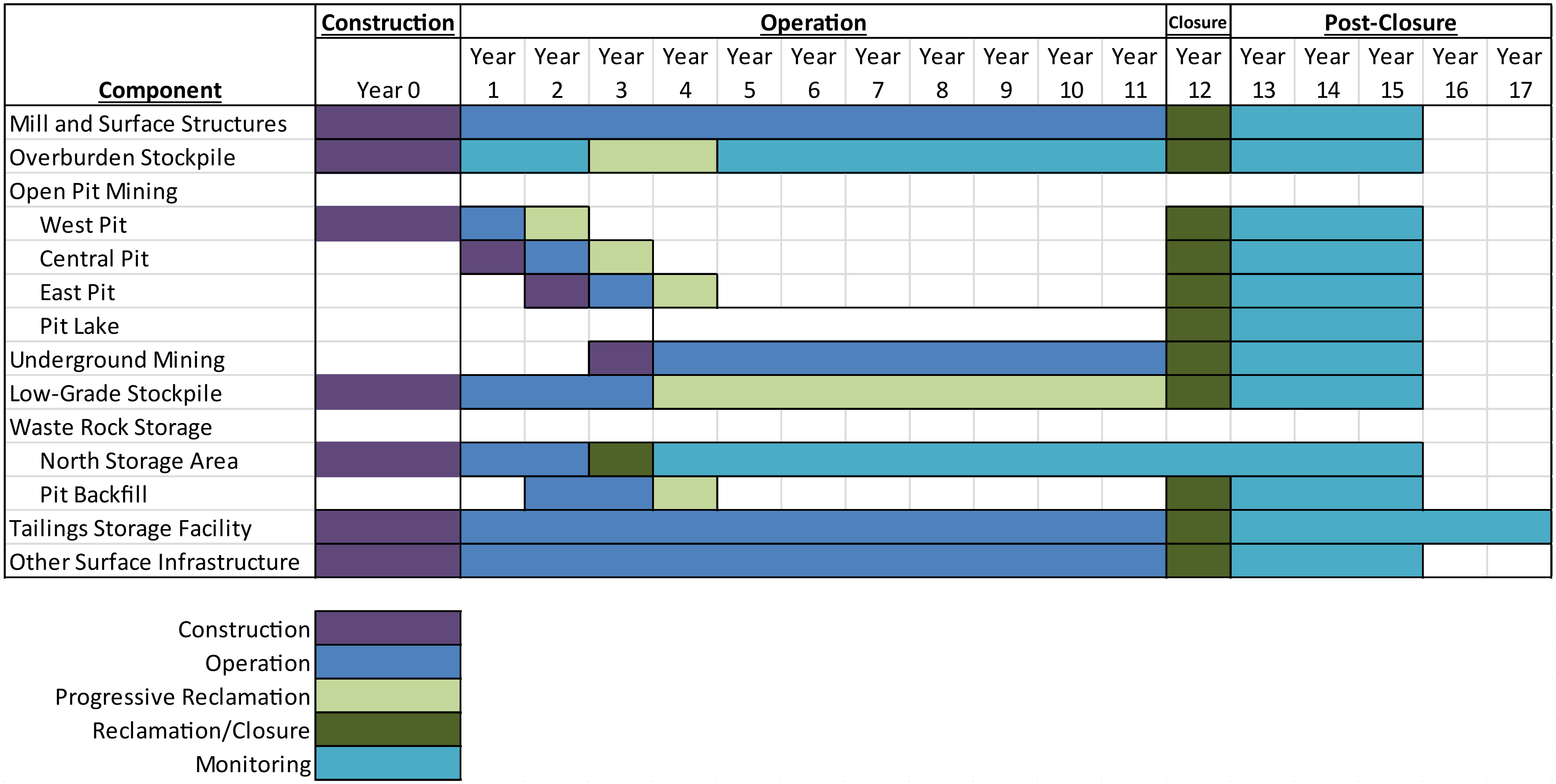


Figure 3.2.1 Goliath Gold Project Phases and Schedule.

Table 3.2.1 Key Project Components Listed by Phase

Project Phase	Duration	Key Components
Site Preparation Phase	1 year	- 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 Phase	1 year	- Additional site access roads and realignment of existing roads - Construction of the 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 electrical substation
Operations Phase	12 years	- Open pit - Underground development - Process plant - Waste Rock Storage - Overburden Storage - Low-Grade Stockpile
Closure Phase	2 years	- Project site area reclaimed to a naturalized and productive biological state - Site is without infrastructure

3.2.2 Construction Phase

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

Construction phase activities will include:

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

3.2.3 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 will be used to backfill the mined-out areas of the pit. The TSF capacity will be increased as required through dam raises.

Solid and liquid wastes/effluent will be managed to ensure regulatory compliance. 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.

3.2.4 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.

Treasury expects the active closure period of the Project will take approximately two years after operations cease. Until such time that the final pit is fully flooded, Treasury will hold the site in care and maintenance. 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. A conceptual closure plan is provided in Section 11, and described in Section 3.14.

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 m to 15 m. The stripped overburden material will be stockpiled south of the pit for use in site reclamation activities. Stripping will be completed using conventional technologies of bulldozers, excavators, and haul trucks. An aerial view of the proposed open pit area can be seen in Figure 3.3.1.

Figure 3.3. 1 Aerial View of Proposed Open Pit

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 by means of a small berm 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.

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

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

Benches will be drilled using conventional blasthole drills and blasted using conventional blasting technologies. A small fleet of 50 tonne to70 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 g 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 would occur five times per week. Treasury will work with blasting specialists to determine a maximum charge per delay to minimize both noise and vibration. Explosives will not be manufactured on site but delivered as required by a contractor. 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 mill process building and will provide space to accommodate the required male and female workforce.

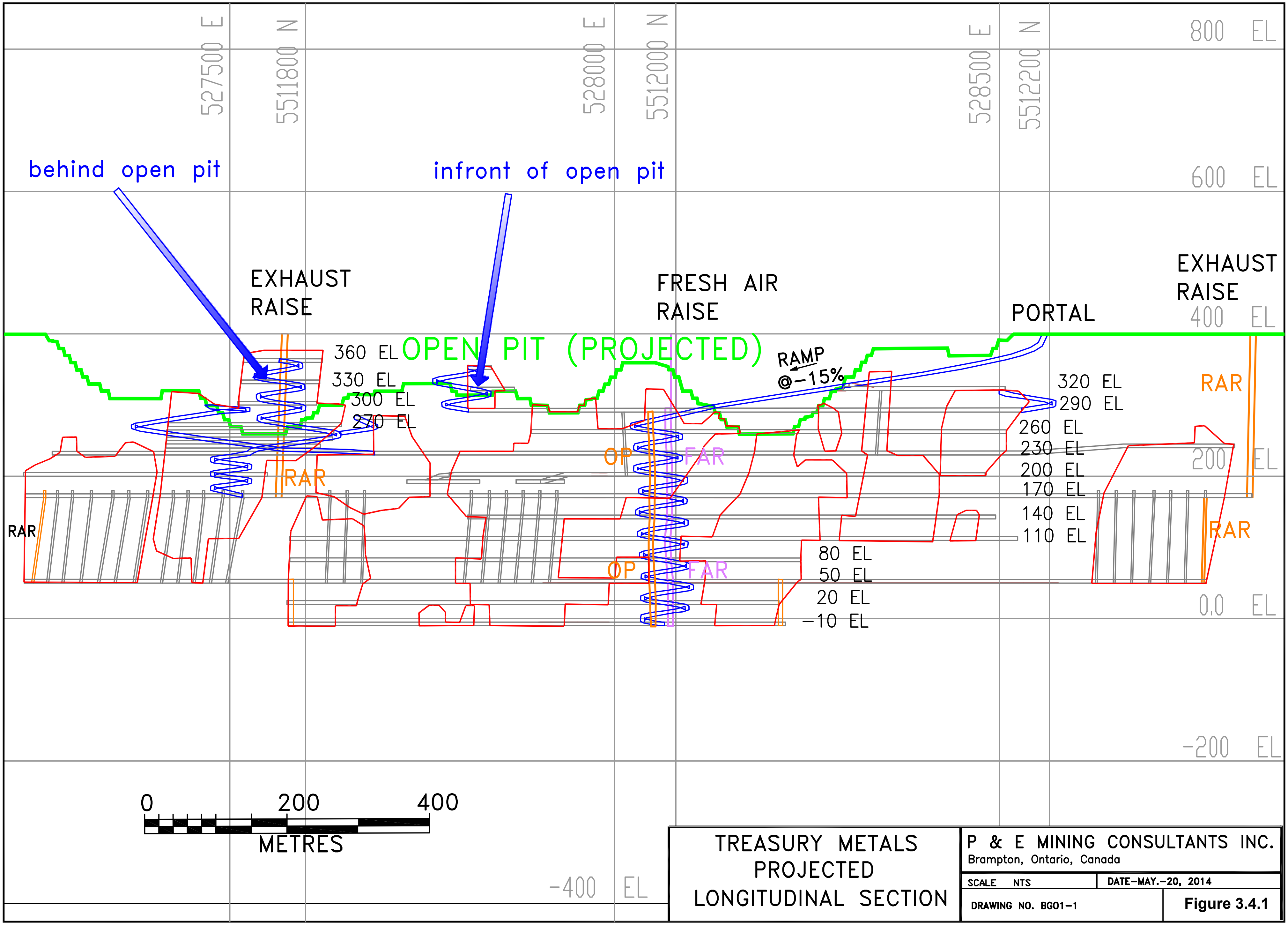
3.4 UNDERGROUND MINE

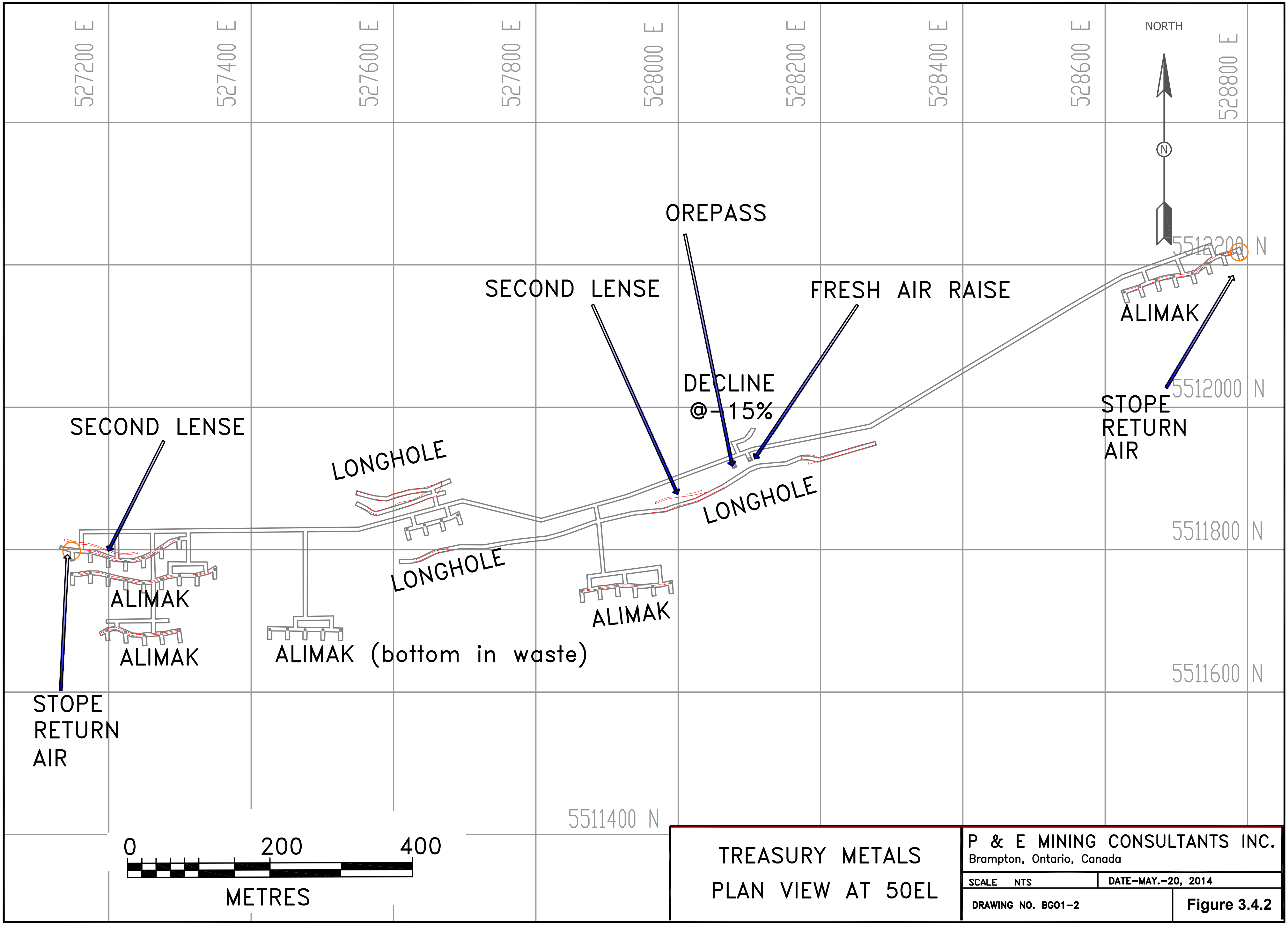
The underground mine will be used to extract ore that is either impractical or uneconomical to mine using open pit methods. Underground mining development will be scheduled so that a steady mill feed of 2,700 tpd is maintained while open pit production falls off and underground production is ramped up.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

The underground mine production will reach 1,800 tpd at full production. Current resource definition to allow for UG mine design has been completed to the proposed depth of 600 m (Figure 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.

The UG mine will be accessed with a ramp system from surface (Figure 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 UG mine.

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


527500 E
5511800 N
528000 E
5512000 N
528500 E
5512200 N
800 EL
600 EL
400 EL
200 EL
0.0 EL
-200 EL
-400 EL
behind open pit
infront of open pit
EXHAUST RAISE
FRESH AIR RAISE
PORTAL
EXHAUST RAISE
OPEN PIT (PROJECTED)
RAMP @-15%
360 EL
330 EL
300 EL
270 EL
320 EL
290 EL
260 EL
230 EL
200 EL
170 EL
140 EL
110 EL
80 EL
50 EL
20 EL
-10 EL
RAR
RAR
RAR
RAR
OP
FAR
OP
FAR
0
200
400
METRES
TREASURY METALS PROJECTED LONGITUDINAL SECTION
P & E MINING CONSULTANTS INC.
Brampton, Ontario, Canada
SCALE NTS
DATE-MAY.-20, 2014
DRAWING NO. BG01-1
Figure 3.4.1



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

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.

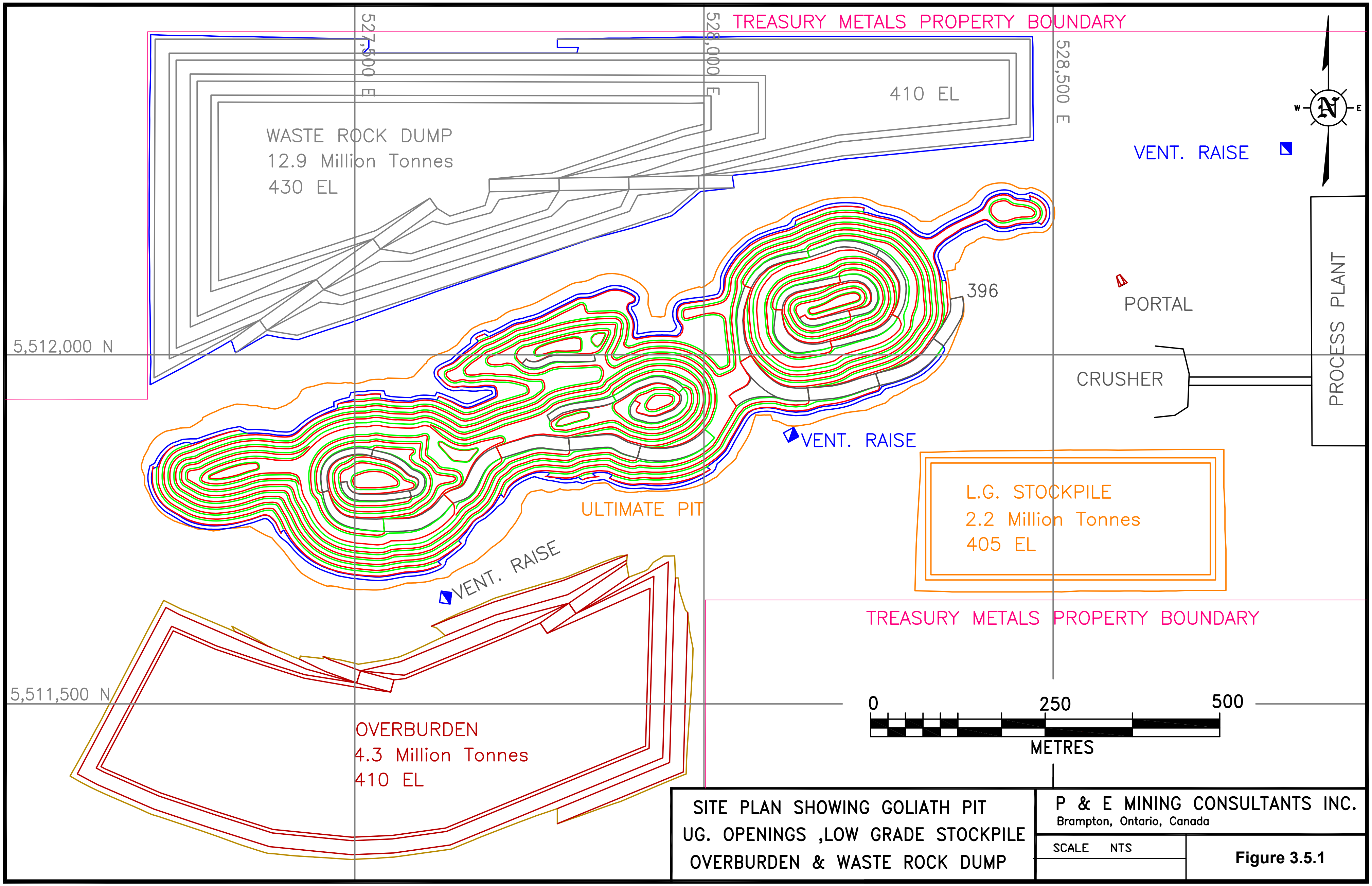
3.5 STOCKPILES

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

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

3.5.1 Mine Rock Stockpile

Approximately 23 million tonnes of waste rock will be produced during the open pit mine life with an additional 2 million tonnes being generated and stored on surface from underground mining. The area surrounding the open pit has relatively little in the way of topographical relief which facilitates the placement of this rock directly to the north of the proposed open pit (Figure 3.5.1). 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 can be used to backfill the pits and minimize the volume and footprint of the waste rock stockpile north of the pit (Figure 3.5.2). The waste rock stockpile will have a footprint of 37 ha, a height of 30 m above grade, and side slopes with a final overall grade of 3 horizontal width to 1 vertical height (3H:1V). The waste rock stockpile will be wholly within property owned by Treasury.Due to the conservative design factors placed on the mine rock 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.

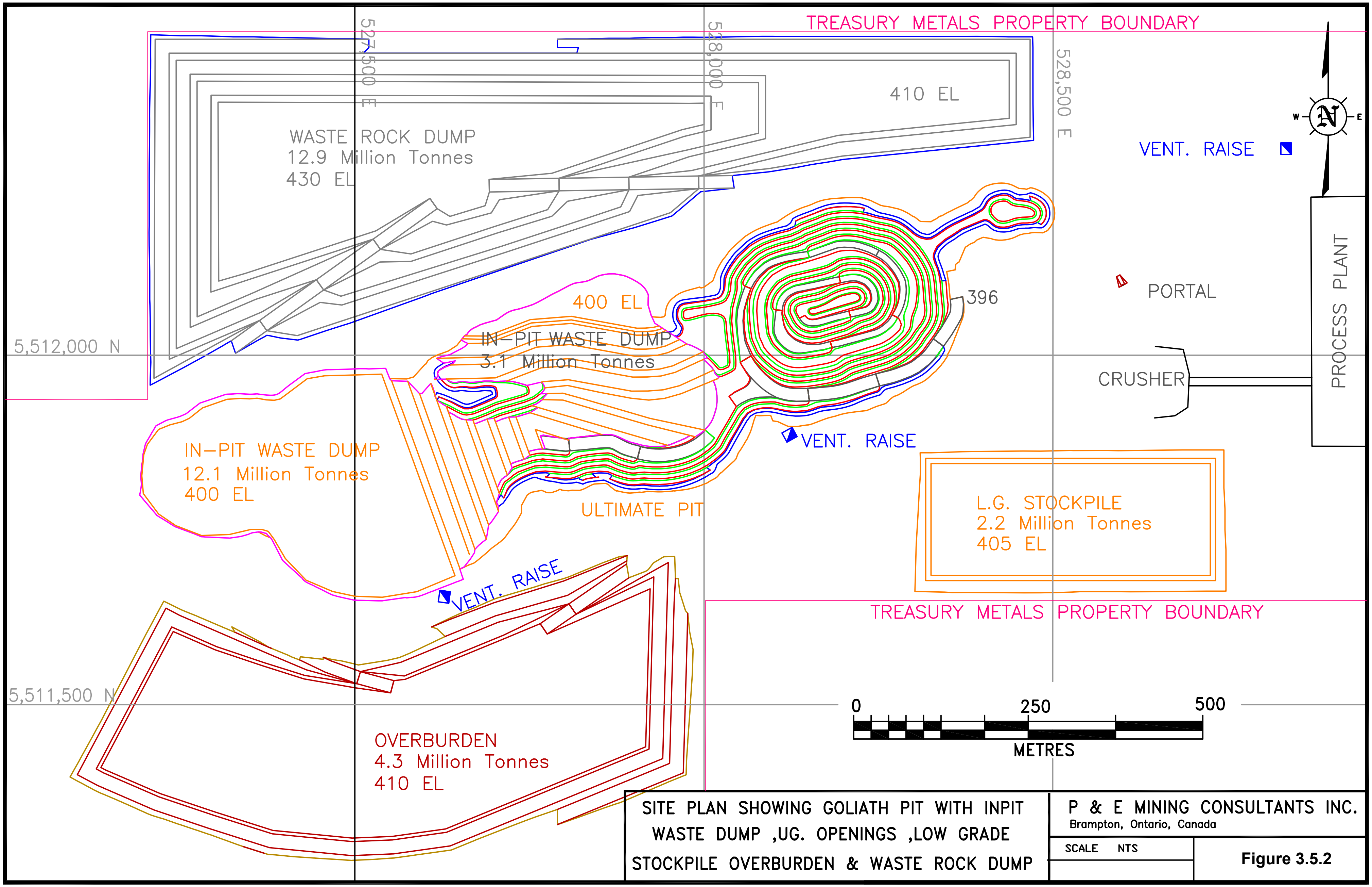


SITE PLAN SHOWING GOLIATH PIT
UG. OPENINGS ,LOW GRADE STOCKPILE
OVERBURDEN & WASTE ROCK DUMP

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

SCALE NTS

Figure 3.5.1


TREASURY METALS PROPERTY BOUNDARY
527,500 E
528,000 E
528,500 E
410 EL
WASTE ROCK DUMP
12.9 Million Tonnes
430 EL
VENT. RAISE
PORTAL
400 EL
IN-PIT WASTE DUMP
3.1 Million Tonnes
396
5,512,000 N
CRUSHER
PROCESS PLANT
IN-PIT WASTE DUMP
12.1 Million Tonnes
400 EL
VENT. RAISE
ULTIMATE PIT
L.G. STOCKPILE
2.2 Million Tonnes
405 EL
VENT. RAISE
TREASURY METALS PROPERTY BOUNDARY
5,511,500 N
0
250
500
METRES
OVERBURDEN
4.3 Million Tonnes
410 EL
SITE PLAN SHOWING GOLIATH PIT WITH INPIT WASTE DUMP ,UG. OPENINGS ,LOW GRADE STOCKPILE OVERBURDEN & WASTE ROCK DUMP
P & E MINING CONSULTANTS INC.
Brampton, Ontario, Canada
SCALE NTS
Figure 3.5.2

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

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

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 (Figure 3.5.2). The overburden stockpile will have a footprint of approximately 26 hectares, a maximum height of 20 m above grade, and a total capacity of 4.3 million tonnes. Slopes will generally follow similar to the mine rock stockpile at a grade of 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. This stockpile will be temporary as the materials will be used during progressive reclamation of the mine site.

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

3.5.3 Low-Grade Ore and Other Stockpiles

A low-grade ore stockpile will be constructed during the open pit phase of mining (Figure 3.5.2). This will be a temporary stockpile to allow the low-grade ore to be blended with the higher grade underground ore to provide a consistent grade and rate of feed to the mill during the underground mining phase. By the end of the mine life this stockpile will be fully exhausted. Ditching and seepage collection will surround this stockpile to collect any surface water runoff or seepage. This water will be collected and directed towards the overall water management system for possible treatment or recycling within the milling process which will be detailed in a specific water management plan.

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

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

3.6 PROCESSING

The processing plant at the Project site will consist of a standard gravity/carbon-in-leach (CIL) circuit with cyanide destruction of CIL tails (Figure 3.6.2). 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%.

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.

3.6.1 General

The process plant site will be located to the east of the mining pits, and just east of the Tree Nursery Road (Figure 3.6.3). The road will be diverted to the east side of the process plant. The plant security gate and car park access will be from this new section of Tree Nursery Road. The process plant and ancillary buildings will be located outside a 500 m radius blast zone from the edge of the open pit and on property owned by Treasury. The crushing facility will have a tentative clearance of 300 m from the edge of the pit. 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

3.6.2 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

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

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

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

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 meter 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 will 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 and the supplier.

3.6.4 Crushing, Ore Storage and Mill Feed

The crushing circuit will consist of a static grizzly over a 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.

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 and dead stockpile 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 (Figures 3.6.2 and 3.6.3). The ore will be primary crushed with a jaw crusher and then ground to the target leaching P_{80} using a single stage SAG mill and classifying cyclones. 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 prior to disposal into the TSF.

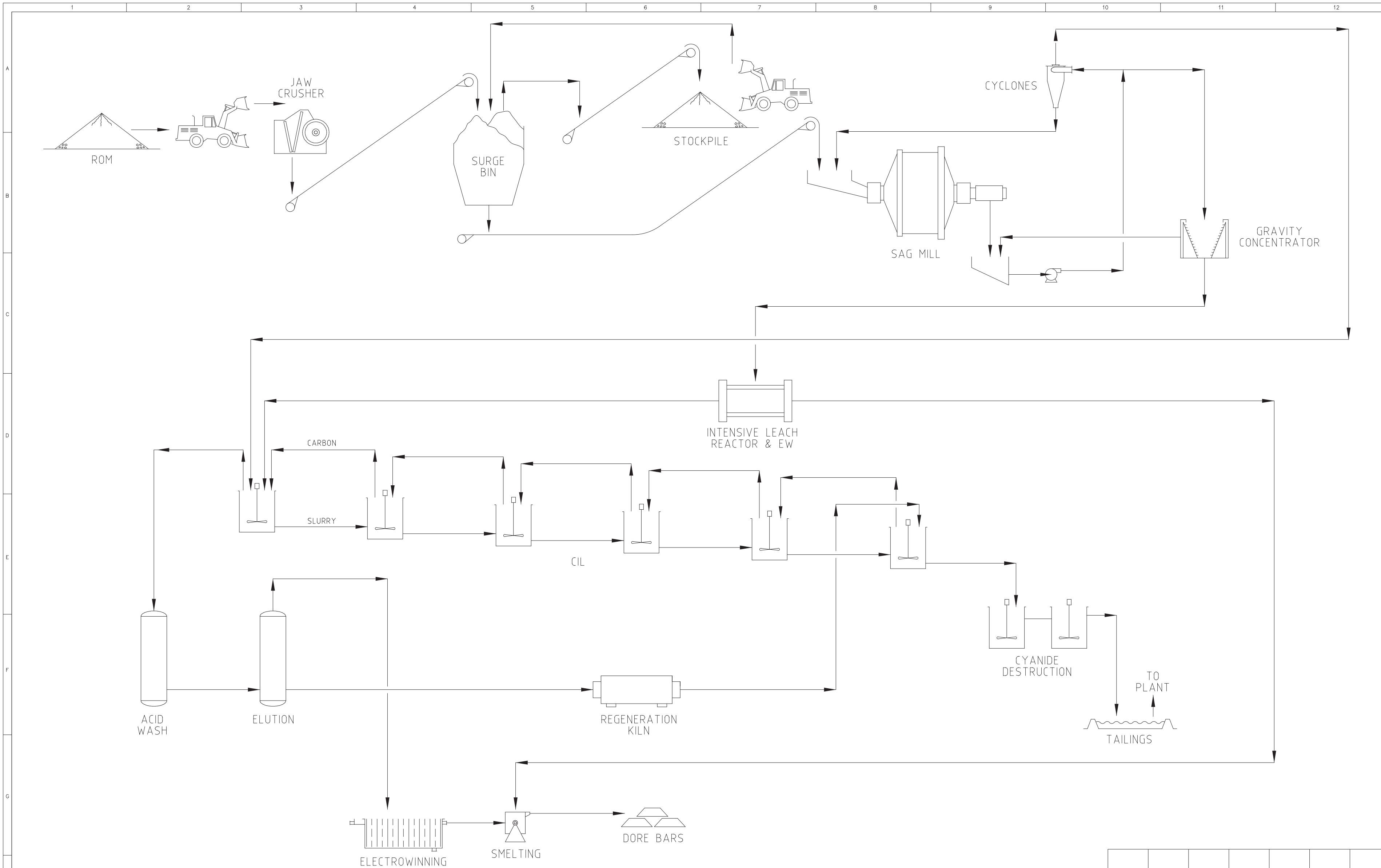
3.6.6.1 Gravity Recovery Circuit

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.



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

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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

Figure 3.6.2

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

Figure 3.6.3

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

CLIENT: TREASURY METALS INC.

PROJECT: GOLIATH GOLD

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

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

A1

3.6.6.3 Cyanide Detoxification

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

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.

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.

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

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

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

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 and the natural ground topography has been used to align the dam embankments to maximise storage capacity while minimizing embankment fill volumes (Figure 3.7.2). 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% will be routed to the underground mine workings from Year 6 to end of the operations in Year 12. An estimated 4,139,600 dry tonnes will be routed to the TSF from Year 6 to end of Year 12 of the operations for a total of approximately 9,066,600 dry tonnes requiring storage within the TSF. The actual fraction of tailings solids that can be directed to the underground mine workings as well as the schedule will be confirmed as the mine design is advanced.

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 3.7.3). 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.

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 OMNRF 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 3.7.4) with subsequent embankment raises during the life of mine to accommodate tailings solids storage, operational and storm water management (Figure 3.7.5). 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 NAG 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 3.7.6). 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.

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

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

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

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 NAG mine waste rock from the mining operations in the downstream shell of the dam. An additional transition zone may be required after Stage 1, between the transition zone and the mine waste rock; this will be determined once mine waste rock gradations have been established.

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 NAG rock and will be provided from the mining operations or off-site aggregate suppliers. The mine waste 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 sorting of NAG and PAG to ensure that only NAG material is used in the construction of the TSF. NAG waste rock volumes available for construction will be determined as the project is advanced with the mine design.
- 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.

3.7.2.2.1 Internal Drain System

The presence of the upstream clay zone 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 consisting of Zone E material or NAG waste rock. All water that is collected in the seepage collection ditch will be contained, collected and transferred back into the TSF utilizing a sump, pump and pipeline system. The design of the TSF ditch will include consideration of all potential water inputs as well as seepage estimates, and location, determined from the embankment seepage analysis.

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 3.7.1).

Table 3.7.1 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 OMNRF Best Management Practices (Appendix D).

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.

3.7.5 Tailings Management

The Stage 1 TSF embankment will be stabilised at the pre-production stage and will be raised over the operational life of the facility to provide containment of tailings solid, operational and storm water management (Figures 3.7.2 to 3.7.6). 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 (1) spigot and opening one (1) spigot at the other end of the series. This is repeated on a daily or on an as required basis in order to maximise the tailings densities and to ensure a uniform tailings elevation across the storage.

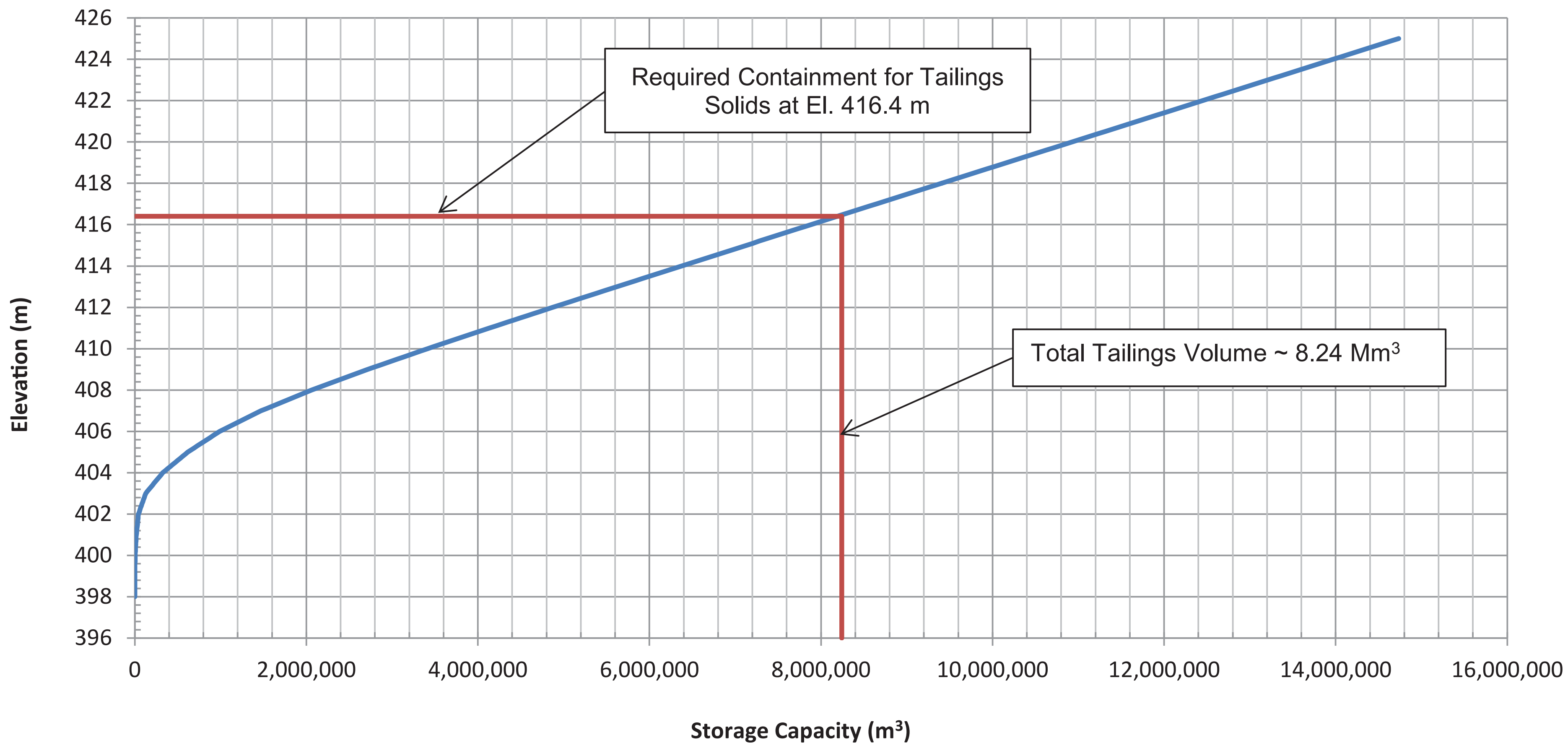
The tailings deposition system will consist of a high density polyethylene (HDPE) delivery pipeline and an HDPE deposition pipeline for routing tailings to the TSF. The deliver pipeline will be aligned from the plant to the crest of the TSF embankment. The tailings deposition line will be aligned along 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 m to 50 m centres along the pipeline. The spigot off takes will be comprised of tees, flexible hose and Spigot clamps.

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.



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

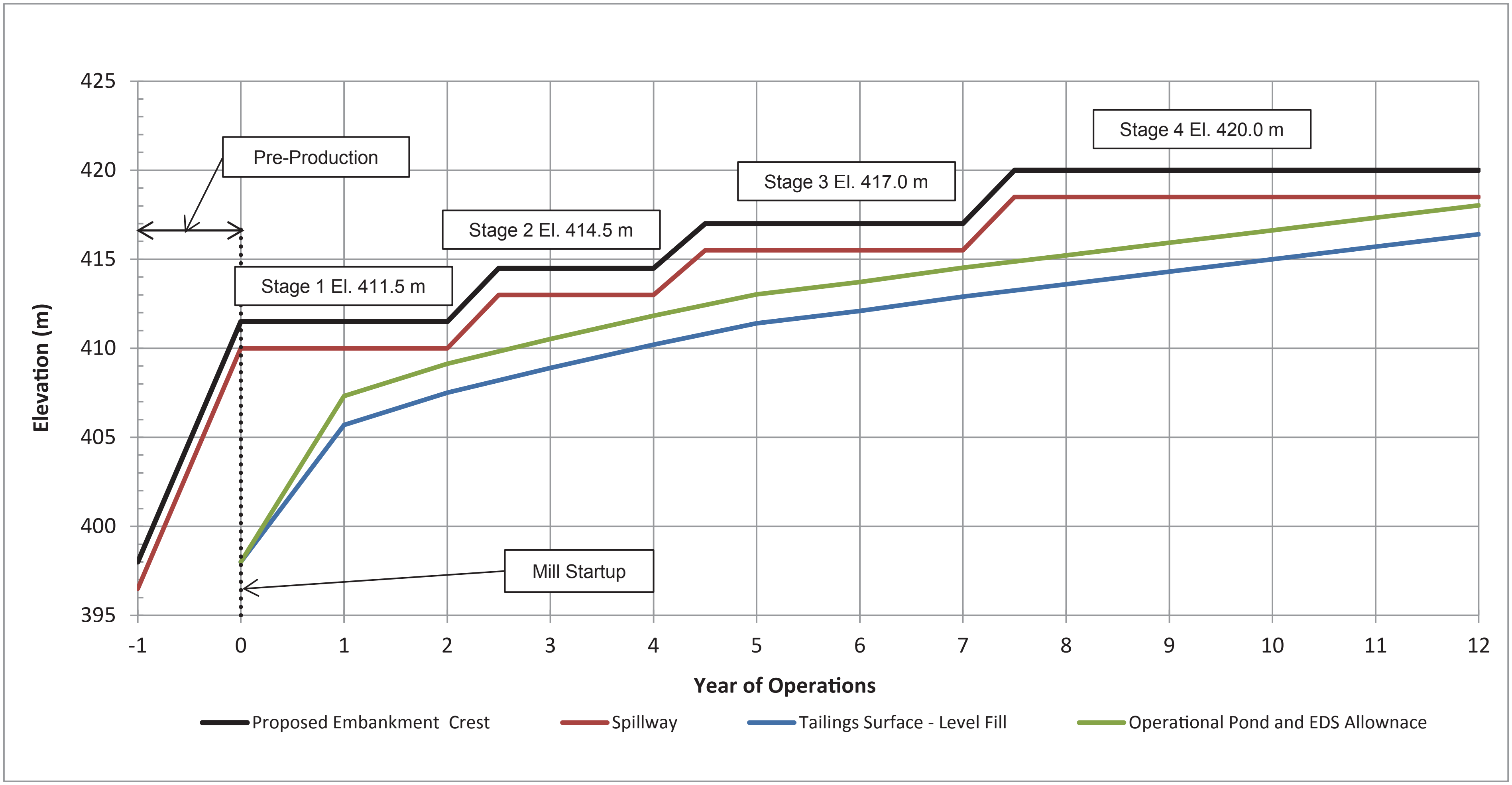
Prepared By:	BRP	Checked By:	HBW	Approved By:	HBW

TREASURY METALS INC.

GOLIATH PROJECT

LOCATION 1
STAGE-STORAGE CURVE

FIGURE 3.7.2	Project No.: 141-12598-00	Ref. No.: A



Notes:

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

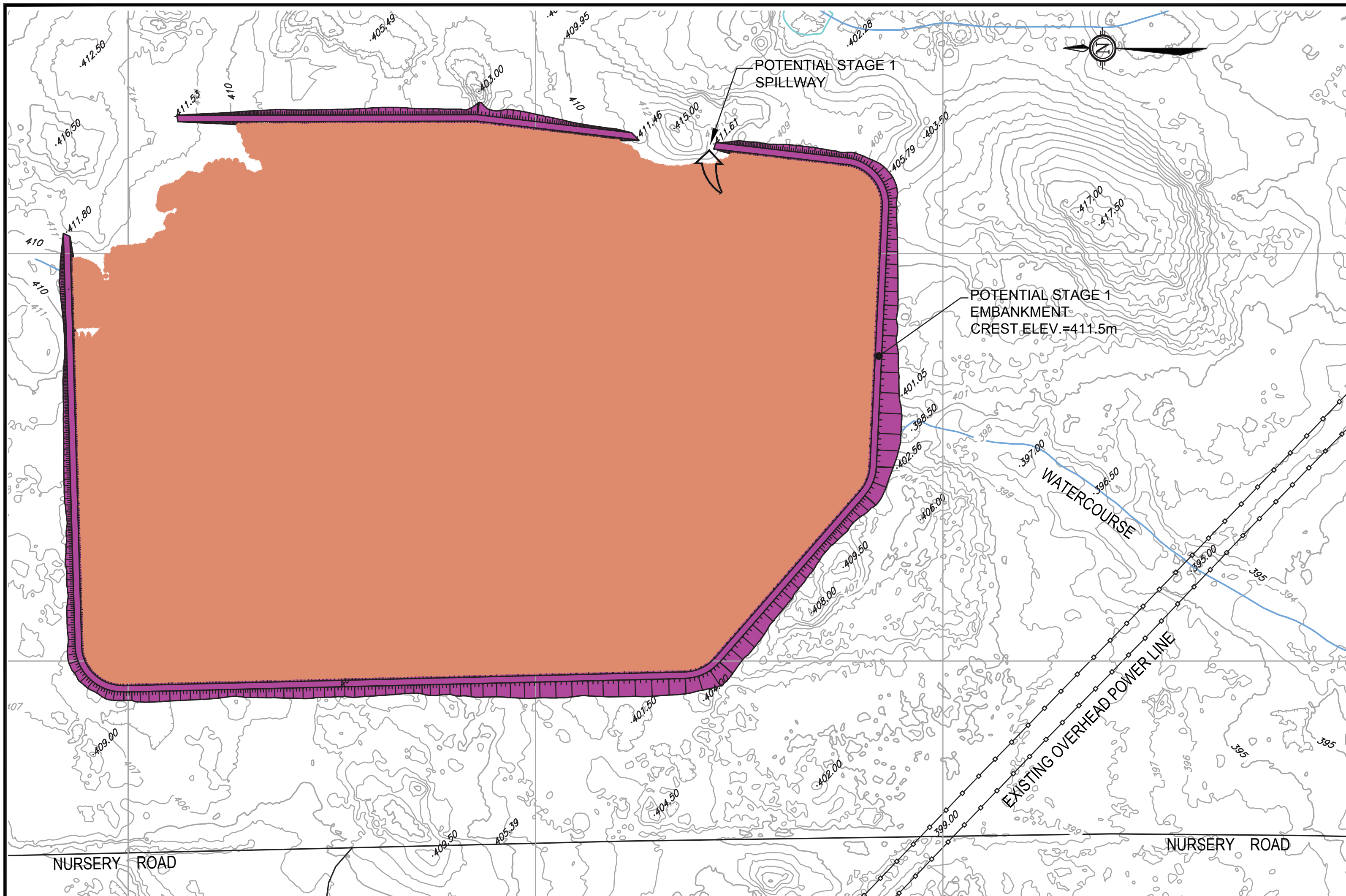
Prepared By:	BRP
Checked By:	HBW
Approved By:	HBW

TREASURY METALS INC.

GOLIATH PROJECT
ALTERNATIVES ASSESSMENT

LOCATION 1
EMBANKMENT STAGING

FIGURE 3.7.3	Project No.: 141-12598-00	Ref. No.: A



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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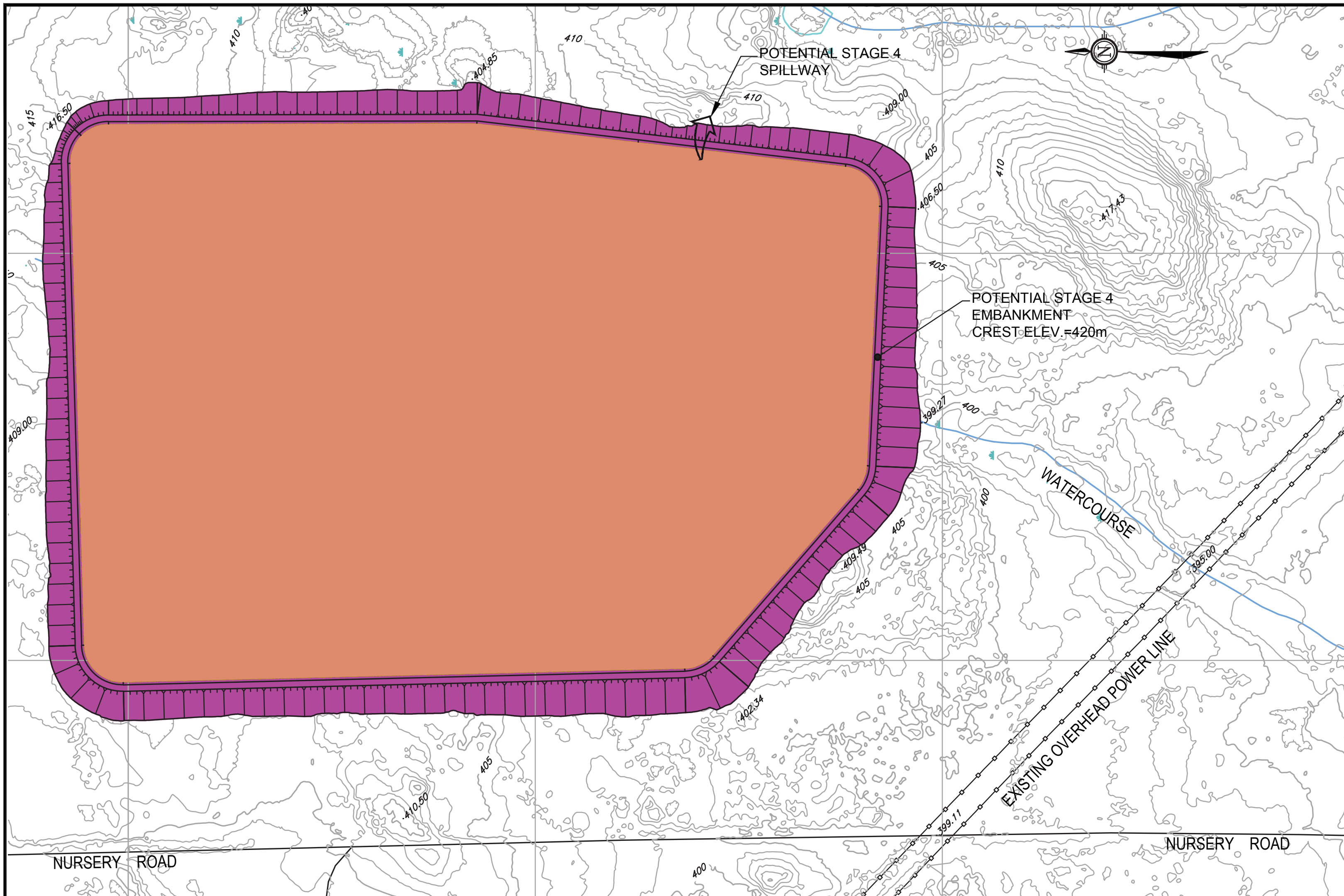
PROJECT:	TREASURY METALS - GOLIATH PROJECT TAILINGS STORAGE FACILITY ALTERNATIVES ASSESSMENT
TITLE:	LOCATION 1, STAGE 1 PLAN
PROJECT NO:	141-12598-00
SCALE:	1:5000
DRAWN BY:	G. HOOGWERF
CHECKED BY:	B. PLUMRIDGE
ISSUE/REVISION:	INTERNAL ISSUE — A
ISSUE DATE:	MARCH 28, 2014
FIGURE NO:	**Figure 3.7.4**



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

TITLE: LOCATION 1, STAGE 4 PLAN

PROJECT NO: 141-12598-00

SCALE: 1:5000

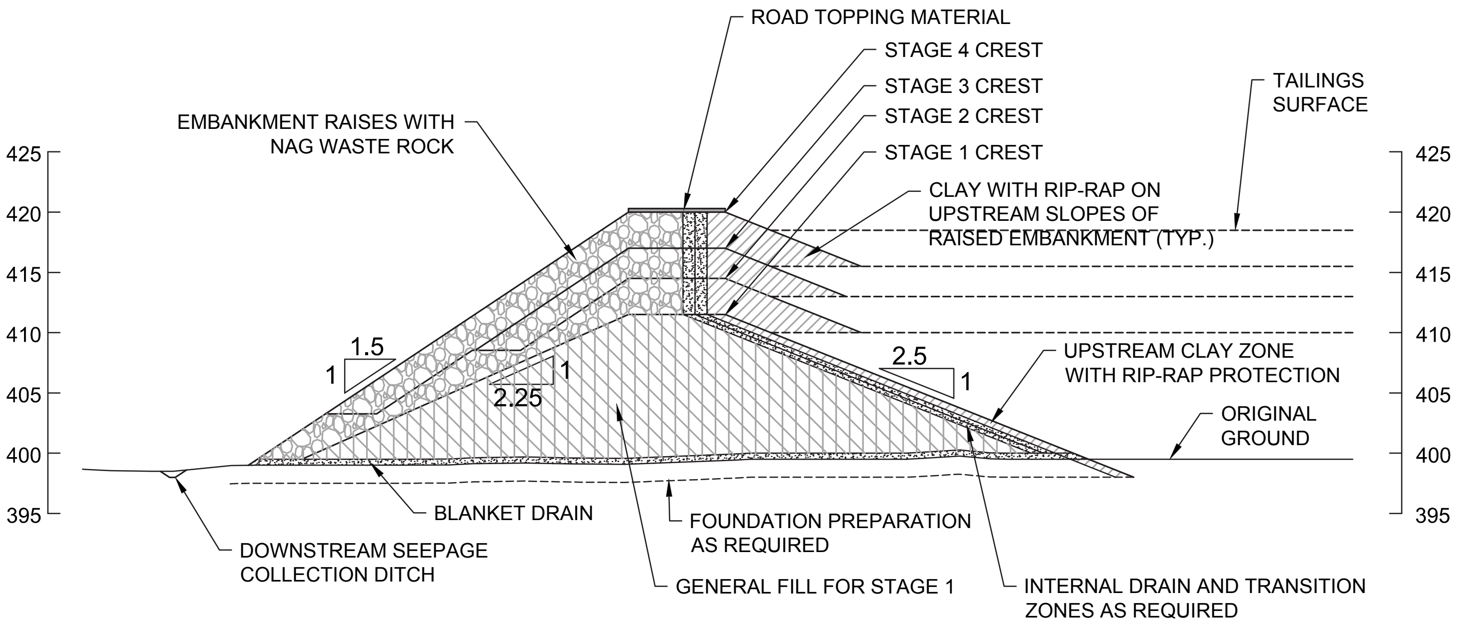
DRAWN BY: G. HOOGWERF

CHECKED BY: B. PLUMRIDGE

ISSUE/REVISION: INTERNAL ISSUE A

ISSUE DATE: MARCH 28, 2014

FIGURE NO: **Figure 3.7.5**



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 3.7.6

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.

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;

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; and
- Provide appropriate effluent discharge characteristics for release into the natural environment.

The main components of the water management system are:

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

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

3.8.2 Mine Water Management

Mining dewatering requirements have been estimated by AMEC to be 1,320 m^3/d (base case scenario). No surface water inflows or precipitation were included in this number. It is assumed that all surface water will be diverted around the open pit and away from the underground portal. Net precipitation is calculated considering evaporation of 250 mm per year and the end of life pit surface area, and is estimated to be:

0.475 m net precipitation x 350,000 m^2/365 = 455 m^3/d

Therefore, total mine water is calculated as:

455 m^3/d + 1,320 m^3/d = 1775 m^3/d

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.

3.8.3 Water Supply for Process Plant Operations

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

Once operations are sufficiently advanced to provide recycled water, fresh water will still be required in the processing plant for consumption as potable water, pump gland water, reagent makeup, carbon elution, and firefighting water reserve. The fresh water demand will be met by either ground wells, surface water drawn from the former tree nursery irrigation ponds (Figure 3.8.1). The total fresh water requirement is estimated to be 600 m^3/d.

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

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

Figure 3.8. 1 Tree Nursery Irrigation Ponds for Water Intake

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 600 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.

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 supplemental mine water runoff that does not require further treatment for use.

3.8.5 Tailings Storage Facility Water Management

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

Water collected in the TSF will consist of runoff from the catchment created by the perimeter embankments as well as operational water delivered to the TSF in the tailings stream that is not locked in the settled tailings. The water inputs into the TSF in addition to tailings have been identified at this stage of the project as consisting of mine dewatering. Other potential inputs may become apparent as the Project is advanced and these will be included with the water management design. Surplus water collected in the TSF can be stored and directed to a treatment facility prior to being released. 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. 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.

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 transfer to treatment rates, as well as timelines during the year, 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 12 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 Rate of Rise

Tailings deposition into the facility will result in development of a tailings beach 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 12 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 m^3 of tailings from the embankment crest by spigotting.

The yearly rate of tailings flow is not consistent over the life of the operations as tailings will be deposited initially into the TSF followed by a portion of the tailings solids being directed to the underground mine workings for disposal (Table 3.8.1, Figure 3.8.2).

Table 3.8.1 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/m^3. The rate of rise in Year 1 will be approximately 10 m as the lower areas of the basin are filled in. The average rate of rise from Years 2 to 5 is approximately 1.4 m per year. A reduction in the tailings rate of rise 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 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

Water inputs and outputs for the TSF will be confirmed as the project is advanced with the completion of design work for other aspects of the Project, consisting of the mine design, waste rock stockpile design, plant site design, etc. The following identifies the water inputs and outputs that have been identified at this stage of the project for the TSF. The values shown below represent the Year 1 to Year 5 operations prior to the start of co-disposal of tailings solids into the underground mine:

TSF Inputs:

- Paste tailings solids (2,700 dtpd);
- TSF catchment runoff (determined with the analysis);
- Direct pond precipitation (dependent on the area of the pond as it varies during the year);
- Water in tailings stream (3,579 m^3/day);
- Mine dewatering (1,600 m^3/day); and
- Seepage reclaim (determined with analysis).

TSF Outputs:

- Water retained in tailings voids (1,455 m^3/day);

- Evaporation from pond (dependent on the area of the pond as it varies during the year);
- Water reclaim to the plant site for processing (3,360 m^3/day);
- Water transfer to treatment (determined with analysis); and
- Embankment Seepage (determined with analysis).

A water/solids balance schematic showing the current water inputs and outputs for the TSF is provided as Figure 3.8.2. The results of the water/solids balance will identify the transfer rates from the TSF to water treatment. The following is a discussion of the water input and output constraints that have been applied to the water/solids balance to identify the required pond levels and also the required water transfer rates.

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.

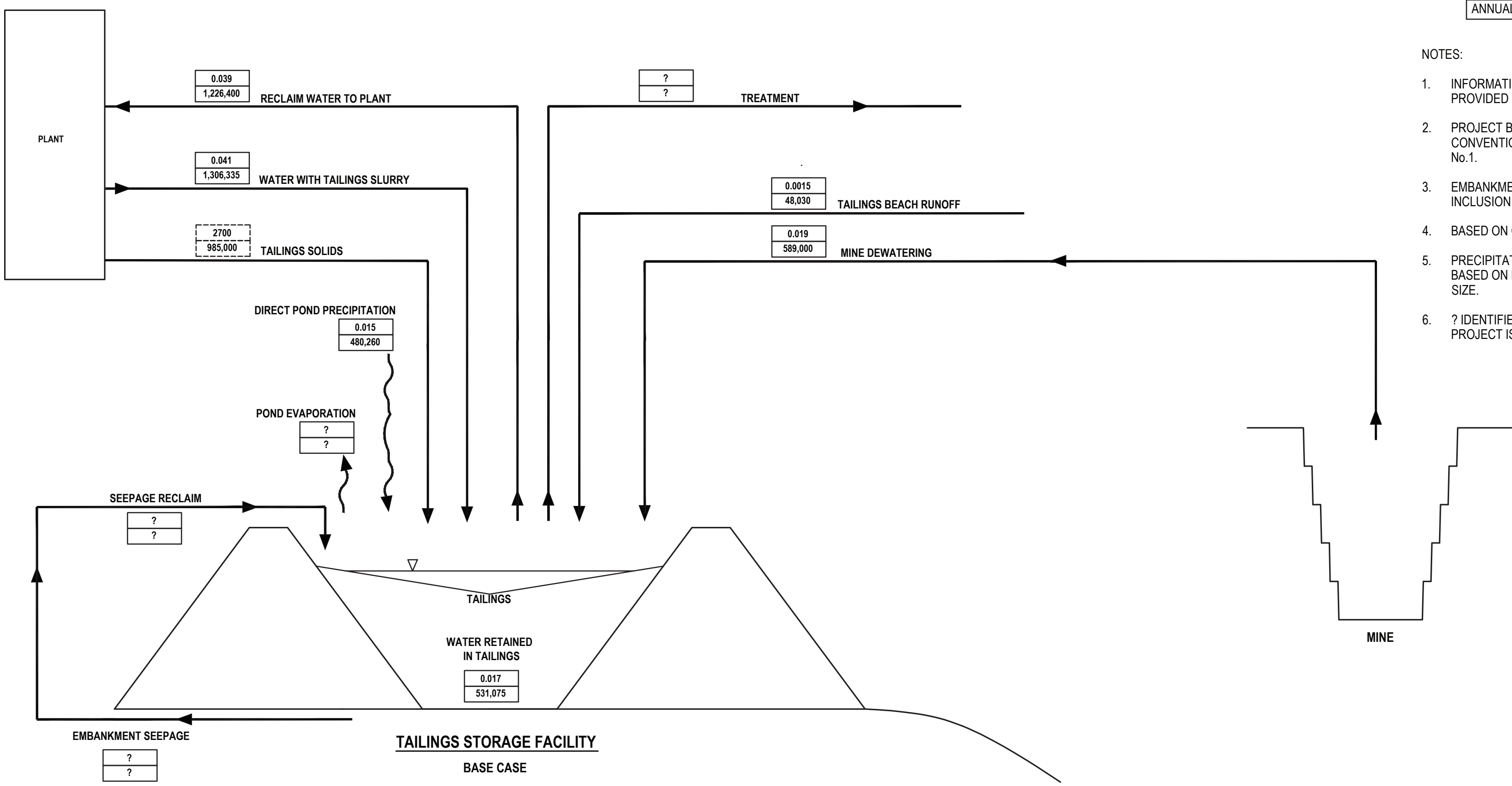
Runoff into the pond will be from the contributing drainage basin areas and estimates of the runoff coefficients for each. Snowmelt parameters will be included within the model to account for the effects of snowpack and spring melt. Accumulated snow up to the months of March, April and May can be assigned 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. 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 OMNRF Best Management Practices is provided in Appendix D, inclusively. The required IDF based on the HPC is provided in Appendix D for the CDA guidelines and OMNRF 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 runup. Freeboards for the facility will be determined utilizing the Lakes and Rivers Improvement Act and the CDA guidelines.



LEGEND

FLOW RATE	m³/s
ANNUAL VOLUME	m³

DTPD
DTPA

NOTES:

1. INFORMATION SHOWN IS PRELIMINARY AND IS PROVIDED FOR DISCUSSION AND CONFIRMATION.
2. PROJECT BASE CASE SHOWN CONSISTING OF CONVENTIONAL TAILINGS DEPOSTION TO LOCATION No.1.
3. EMBANKMENT SEEPAGE WILL BE DEPENDENT ON INCLUSION OF A LINER CONTAINMENT SYSTEM.
4. BASED ON OPERATION 365 DAYS PER YEAR.
5. PRECIPITATION INTO TAILINGS STORAGE FACILITY IS BASED ON PRELIMINARY ESTIMATES OF LAYOUT AND SIZE.
6. ? IDENTIFIES VALUES TO BE DETERMINED AS THE PROJECT IS ADVANCED.

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

TITLE: WATER/SOLIDS BALANCE SCHEMATIC

PROJECT NO:	141-12598-00
SCALE:	NOT TO SCALE
DRAWN BY:	G. HOOGWERF
CHECKED BY:	B. PLUMRIDGE
ISSUE/REVISION:	DRAFT REPORT A
ISSUE DATE:	MARCH 28, 2014
FIGURE NO:	Figure 3.8.2

3.8.6 Water Balance

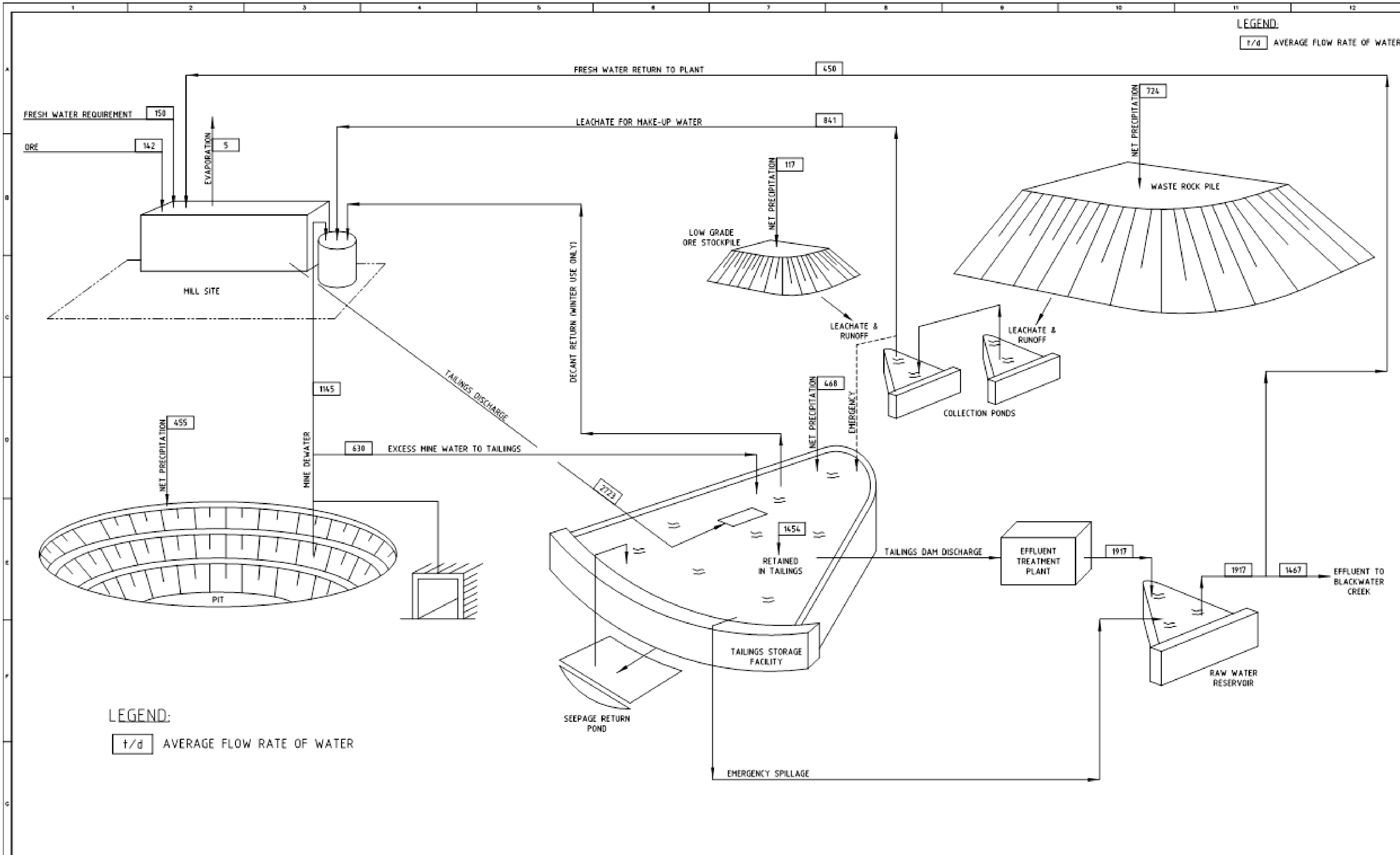
Metallurgical assays of the Goliath deposit indicate a relatively clean ore with low levels of substances deleterious to both gold recovery and the environment. Some metals were below the limits of detection of the testing method used, for example mercury. Additional testing has been requested at the lowest limit of detection possible to determine any potential impact of mercury. The water balance conditions are outlined in Table 3.8.2.

Table 3.8.2 Water Balance Conditions

Processing Plant Throughput	2,700	t/d
Average Surface Area of TSF Over LOM	760,000	m^2
Average Annual Precipitation	725	mm
Average Annual Lake Evaporation	500	mm
Waste Rock Storage Catchment Area	556,748	m^2
Low Grade Stock Pile Catchment Area	89,760	m^2
Processing Plant Site Surface Area	65,000	m^2
Ore Moisture	5	%
Open Pit & Underground Mine Dewater (excluding rainfall)	1,210 – 1,600	m^3/d
Open Pit Rainfall Area	350,000	m^2
Overburden Pile	0	m^3/d
Fresh Water Requirement	600	m^3/d

Using the basis of design presented in Table 3.8.2 and a preliminary steady state simulation of the processing circuit and tailings facility, the overall site water balance and final effluent composition was predicted. No probabilistic modelling or estimating was conducted and probable maximum precipitation events were not considered. With the exception of potentially high values of total suspended solids, high rainfall events should not negatively influence the effluent water quality. The water and chemical balance is preliminary in nature and does not take into account seasonal variations in water flow.

Sources and destinations of water at the Project site have been examined and the overall net water balance is presented in Figure 3.8.3.



CLIENT: TREASURY METALS INC.

PROJECT: GOLIATH GOLD

Lycopodium

DRAWING TITLE: OVERALL SITE PROCESS WATER BALANCE DIAGRAM

SCALE	JOB No.	DWG No.	REV.
NTS	5027	000-F-050	A

DRAWN: SdM DATE: 09JUN14

Figure 3.8.3

3.8.7 Final Effluent Discharge

Contaminated water will be treated in the cyanide destruction circuit with subsequent attenuation in the tailings storage facility (Table 3.8.3). By destroying cyanide prior to discharging the tailings to the storage facility, potential cyanide contamination situations such as dam seepage or tailings facility overflow during extreme storm events late in the project life are eliminated. By design, the cyanide treatment circuit will destroy cyanide to a level acceptable for direct discharge to the environment and reduce the environmental safety requirements placed on the TSF. This method ensures that wildlife, including waterfowl and aquatic life, are protected, that cyanide consumption is minimized, and that contingency is in place to prevent the inadvertent release of cyanide into the environment. It also provides for the smallest tailings storage facility footprint.

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

Table 3.8.3 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	
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	0.04	1
Iron	0.358	
Lead	0.082	0.2
Lithium	0.024	
Magnesium	1.44	

Table 3.8.3 Discharge Qualities

Parameter	Predicted Tailings Supernatant (mg/L)	MMER Max Monthly Mean (mg/L)
Manganese	0.063	
Mercury	0.0018	
Molybdenum	0.001	
Nickel	0.021	0.5
Nitrate (as N)	7.07	
pH	6.16	
Phosphorus	0.06	
Potassium	1.78	
Selenium	0.0005	
Silicon	0.099	
Silver	0.00005	
Sodium	1.16	
Strontium	0.032	
Sulphates	68.67	
Sulphur	22.94	
Thallium	0.642	
Tin	0.0005	
Titanium	0.003	
Uranium	0.005	
Vanadium	0.004	
Zinc	0.04	0.5

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

Tailings storage facility decants will be pumped to the effluent treatment plant for treatment prior to discharge to the polishing pond and ultimately Blackwater Creek.

In the effluent treatment plant, tailings pond decant water will be treated in three distinct process steps including an advanced oxidation process for residual cyanide destruction, multimedia filtration, and reverse osmosis membrane filtration.

TSF decant 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 utilised 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 following 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 reverse osmosis system to remove any residual solids and prevent membrane damage.

The resulting impact 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.

RO permeate is stored in the permeate storage tank, from where it is returned to the process or discharged to the environment via the polishing pond. 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 heavy metals will be precipitated. The treated reject stream will then return to the TSF.

The effluent treatment plant will ensure that water discharged meets (or exceeds) the provincial water quality objectives.

3.8.8 Water Management Structures

Effluent water will be pumped to the selected location in Blackwater Creek via a pipeline and discharged from the end of pipe. In order to minimize risks of erosion due to the potentially high flow at the end of the pipe, the treated water will be directly discharged into a small constructed structure that will dissipate the flow velocities. This structure will be confirmed as part of the detailed design prior to construction with the likely design to incorporate a small rock fill dam that will integrate the discharge into the natural flows of Blackwater Creek. The quantity of effluent used for pipeline sizing is based on the 1981 – 2010 Environment Canada station 6032117 highest monthly precipitation (July) of 127.6 mm. This amount precipitation was applied to the catchment area of the tailings storage facility, mine rock piles, and open pit. No evaporation was considered, and a suitable flow rate of effluent was determined to be 158 m^3/h; to which a 20% equipment design margin was applied. The 20% equipment design margin also accounts for precipitation in the polishing pond. Additional effluent capacity requirements are assumed to be held in inventory in the tailings storage facility freeboard for subsequent discharge at the design flow rate.

All existing surface drainage ways coinciding with site infrastructure will be diverted around the infrastructure to prevent potential contamination of fresh water and to minimize the quantity of water being processed through the site (Section 3.8.9 Water Course Realignment). Site infrastructure (ore pad, waste rock storage, and processing plant) will be located on sites contoured such that surface run-off can be captured independently of surrounding surface water and processed through the mill or be sent directly to the tailings pond if non-ARD. Any contaminated surface water will be collected in a minimum number of collection ponds and be pumped to mill via a lift station.

Surface water runoff from the processing plant site is not expected to require treatment. In the future, provision could be made for containment and pumping of the contaminated surface water to the tailings storage facility using a portable pump. However, this water is not expected to be contaminated. It is envisioned that all processing plant equipment will be inside containment bunds and all containment bunds will be under cover and not collect rainfall. By design, plant site surface water will drain into the surrounding terrain and ultimately into Blackwater Creek, which will also receive the plant effluent and, therefore, will be monitored and reported on an ongoing basis.

Surface water runoff from topography surrounding the TSF is not expected to require treatment and will diverted around the infrastructure to prevent potential contamination of fresh water and to minimize the quantity of water stored within the TSF infrastructure. Diagram of proposed water management structures are presented in Figure 3.8.4.

3.8.9 Water Course Realignment

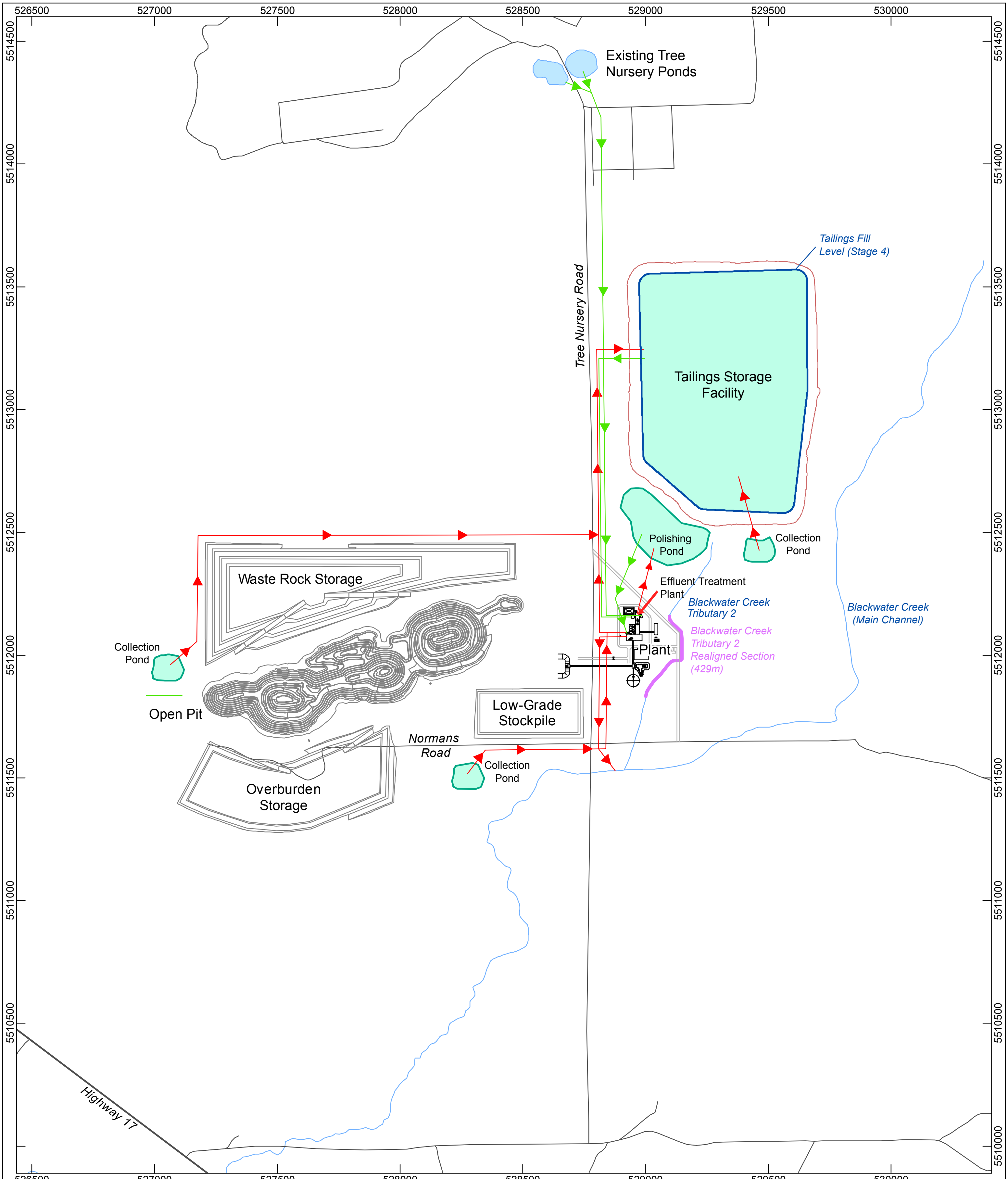
Only one minor watercourse realignment will be needed to carry out the Project, being a realignment of Blackwater Creek Tributary #2 to by-pass the process plant area. The realignment of this tributary will be to the eastern edge of the plant site area and will include approximately 400 m of channel construction to create the appropriate routing for this Creek Tributary and drainage. In general, flows will be limited in this channel as the headwaters of the Tributary are located in the area where it is anticipate that the TSF will be placed. A portion of these flows will be managed as part of the TSF and water will be part of the reclaim water that is used for processing operations. This diversion will consist of a small trapezoidal channel that would provide like-for-like fish habitat in the process (Figure 3.8.5).

3.8.10 Aquatic Habitat Rehabilitation

Treasury Metals has engaged OMNRF to determine the most suitable option for aquatic habitat compensation associated with the Project. As per personal communication with OMNRF (D. Brunner, OMNRF Dryden) it has been determined that bank stabilization on Wabigoon Lake is the preferred method of aquatic habitat rehabilitation. Additional options will be determined though engagement with public and First Nation stakeholders. Total rehabilitation and compensation efforts will be determined though negotiations with provincial regulatory officials.

3.9 FUEL AND CHEMICAL MANAGEMENT

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



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Existing and Proposed Water Structures

FIGURE: 3.8.4 REV.03

NOT FOR CONSTRUCTION

TREASURY METALS INC.

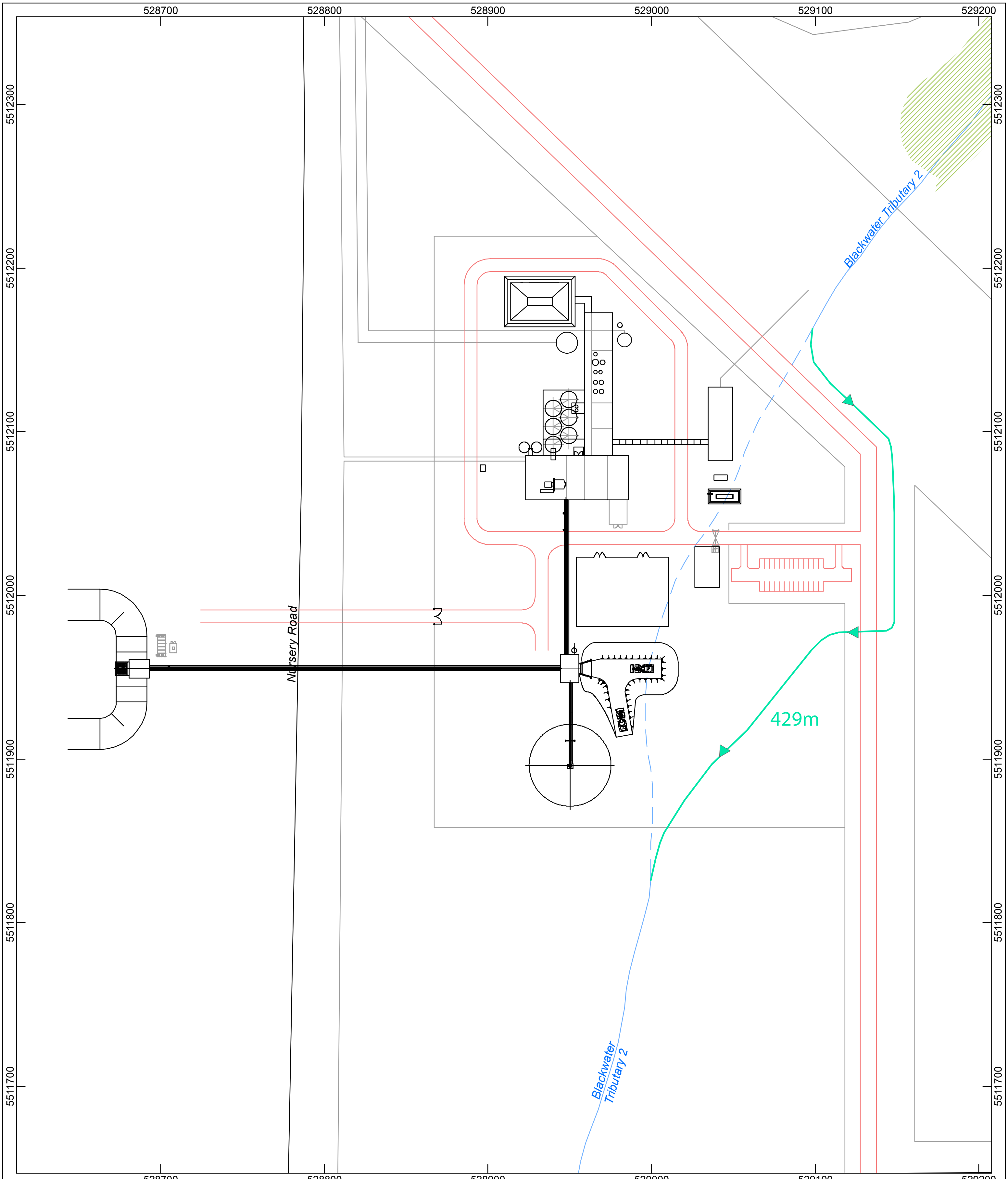
DESIGN: AT 06 FEB. 2014
GIS: AT 21 AUG. 2014
CHECK AT 12 SEP. 2014

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

0 100 200 300
Meters

N

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



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Blackwater Creek Tributary #2 Water Course Realignment

FIGURE: 3.8.5 | REV.02

NOT FOR CONSTRUCTION

TREASURY METALS INC.

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

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

0 25 50
Meters

N

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

3.10 DOMESTIC AND INDUSTRIAL WASTE

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

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

All sanitary waste will be sent to an off-site contractor and 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.

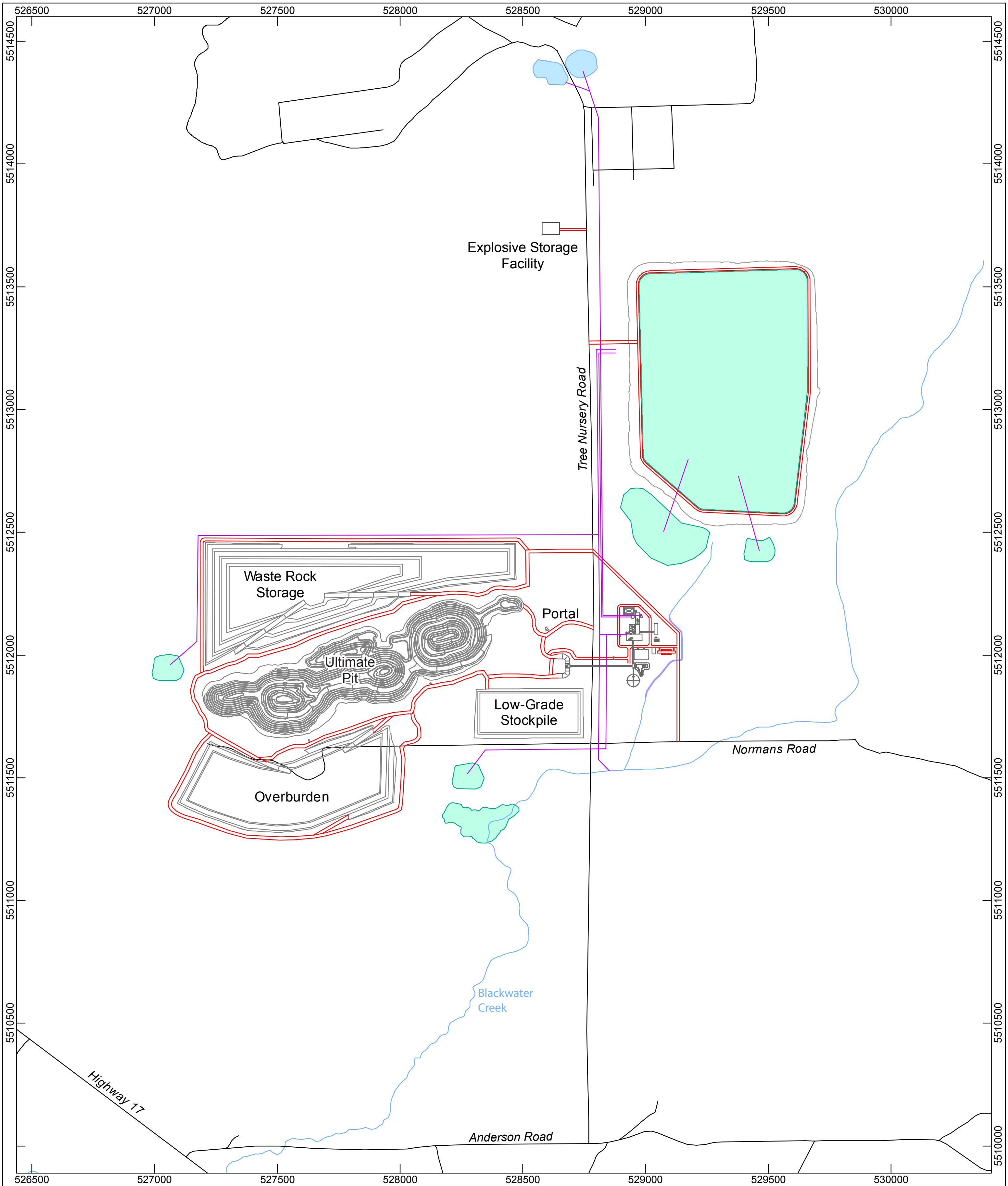
Outlying facilities may be serviced by septic tile fields or holding tanks for treatment in the on-site plant. The Tree Nursery facility will continue to use its current septic system and investigation on capacity in support of the Project will be assessed.

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 defined in Section 3.8. Consequently, neither parking nor the internal site circulation road network is expected to impact Highway 17 operation.

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

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



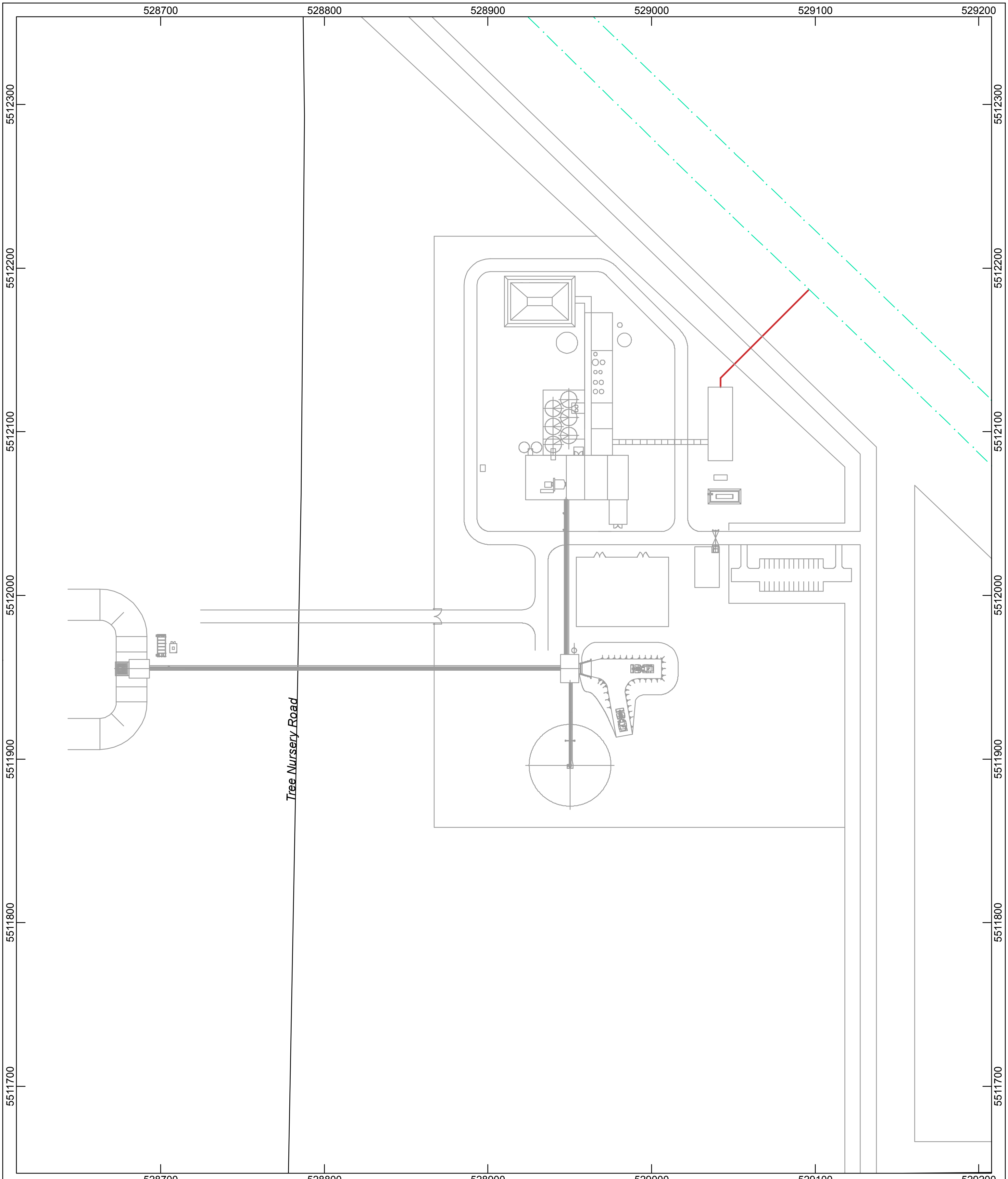
GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	*NOT FOR CONSTRUCTION* *TREASURY METALS INC.*
Access Routes, Pipeline Access, and Stream Crossings	*DESIGN: AT 06 FEB. 2014* *GIS: AT 14 NOV. 2014* *CHECK: AT 14 NOV. 2014*
FIGURE: 3.11.1 REV.01	

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

0 100 200 300
Meters

N

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



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	*NOT FOR CONSTRUCTION* *TREASURY METALS INC.*	
Plant Power Supply	*DESIGN: AT 06 FEB. 2014* *GIS: AT 21 AUG. 2014* *CHECK: AT 21 SEP. 2014*	
FIGURE: 3.12.1	REV.02	

Existing Powerline
Plant Structures
Power Supply
Local Road

0 25 50
Meters

N

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

3.12 POWER SUPPLY

The plant 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. Aerial view of power lines can be seen in Figure 3.12.2.

Figure 3.12. 2 Power Line Infrastructure

3.12.1 Plant Distribution Services and Transformer

The electrical service will include a number of components:

- The 4.16 kV facilities including switchgear and two 600 kVAR shunt capacitor banks together with station services, protection and control;
- 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;
- Allowable Frequency Variation: 60 Hz +2.5, -0.5.

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. Two preliminary locations have been identified to date. The first location is situated to the east on the edge of Tree Nursery Road. Currently, this location is the preferred option. The second option is located to the north of the Project Office, on the Company’s Tree Nursery land package. Location will be determined though consultation with appropriate regulatory authorities and suppliers.

3.13.2 Additional Facilities

No other Goliath facilities are proposed other than those described above, with the exception of the current infrastructure contained within the former OMNRF Tree Nursery. Treasury currently has offices location within the Tree Nursery facility, and Toronto. Other space and lands may be leased as needed to support operations at Goliath.

No camp accommodation will be provided for contractors during the construction, operations, or closure phase. Sufficient housing and accommodation is available in the local area communities.

3.14 CLOSURE AND DECOMMISSIONING

3.14.1 Open Pit Mine

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

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

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

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

3.14.2 Underground Mine

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

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

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

3.14.3 Stockpiles

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

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

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

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

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

3.14.4 Tailings Storage Facility (TSF)

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

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

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

Section 35 and 36 of the Code state:

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

Section 72 of the Code states:

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

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

3.14.5 Aggregate Sources

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

3.14.6 Buildings, Machinery, Equipment, and Infrastructure

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

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

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

3.14.7 Petroleum Products, Chemicals, and Explosives

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

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

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

3.14.8 Roads, Pipelines, and Power Distribution

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

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

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

3.14.9 Site Drainage and Water Structures

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

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

3.14.10 Dewatering Infrastructure

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

3.14.11 Waste Management

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

3.14.12 Other Facilities and Infrastructure

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

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

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

3.15 IN-DESIGN MITIGATION

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

3.15.1 Private Land Use

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

3.15.2 Use of Existing Infrastructure

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

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

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

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

3.15.3 Air Quality and Noise Mitigation

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

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

3.15.4 Domestic Waste

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

3.15.5 Cyanide Detoxification Circuit

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

3.15.6 Waste Rock Storage Area

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

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

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

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