2.0 ASSESSMENT OF ALTERNATIVES

2.1 Background

A major component of the environmental assessment (EA) process is the evaluation of alternative methods to carry out the Project. These alternatives include both “alternatives to” the Project and “alternative methods” to carry out the Project. This evaluation helps to guide the Project in a responsible manner with the assurance that any reasonable options have been considered. The assessment of alternatives has been prepared in accordance with the *Canadian Environmental Assessment Act* (CEAA, 2012) environmental impact statement (EIS) guidelines.

Alternatives will be carried forward through the assessment if they are likely to fulfill the following objectives:

- Does the alternative provide a reasonably viable solution to the problem?
- Is the technology both proven and has the necessary ability to operate at the Project scale?
- Is the alternative consistent with other Project objectives and/or company policies and procedures?
- Is the alternative consistent with Provincial government policy initiatives?
- Could they affect any sensitive environmental features or other valued components (VCs) when compared to other viable alternatives?
- Is the alternative reasonable to implement in a practical and economical fashion?
- Is the alternative within the scope of the company to implement?
- Is it possible to implement the alternative within the defined study area?

2.2 Assessment Methodology

2.2.1 Project Alternatives

Alternatives for the Project have been carefully considered, bearing in mind that all mining operations pose some unavoidable on-site safety risks, as do other industrial operations. Treasury Metals is aware of these risks and will put a priority on worker health and safety and training programs.

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

- Mining Method;
- Tailings Storage Facility and Minewater Pond;

- Waste Rock Management;
- Overburden Management;
- Processing Method;
- Cyanide Containing Effluent Management;
- Cyanide Destruction;
- Water Supply;
- Water Discharge Location;
- Watercourse Realignments;
- Plant and Infrastructure Location;
- Low-grade Ore Stockpile;
- Aggregate Supply;
- Non-hazardous Solid Waste Management;
- Hazardous Solid Waste Management;
- Domestic Sewage Management;
- Explosives Storage Facility;
- Electrical Power Supply;
- Open Pit Closure;
- Underground Closure;
- Waste Rock Storage Area Closure;
- Tailings Storage Facility Closure;
- Buildings and Equipment Closure;
- Infrastructure Closure; and
- Minewater Management and Drainage Closure.

2.2.2 Alternatives Assessment Approach

The approach to the assessment of alternative means for undertaking the Project is to uniformly apply a qualitative evaluation process for each of the alternative means considered in a way that identifies and eliminates unacceptable alternatives and highlights the preferred alternative Comparable methodologies have been followed in similar EAs for other regional mining projects.

2.2.3 Indigenous Engagement Regarding the Alternatives Assessment

Throughout the EA process, Treasury Metals has worked to engage with Indigenous communities that have a vested interest in the Project area to ensure that traditional knowledge, views and concerns that they have shared with Treasury Metals have been incorporated into the design of the Project and reflected in the EIS. To accomplish this, Treasury Metals has continuously provided updates to communities regarding the status and design of the Project to elicit feedback, and better understand how the Project may potentially affect their traditional uses of land and resources. This feedback has greatly influenced the Alternatives Assessment through the addition of alternatives to some assessments or changing the outcome of assessments. This is highlighted in the Information Relevant to Indigenous Communities sections of each alternatives assessment provided in Sections 2.4 and 2.5 to clearly illustrate how Treasury Metals have used Indigenous input has influence the results.

2.2.4 Evaluation Criteria

For each aforementioned objective measure, a series of specific criteria and data were used to quantify the alternative characterization:

- Technical reports created by Treasury Metals and its external consultants
- Input and concerns raised by Indigenous peoples;
- Baseline studies completed for the Project area;
- Federal, Provincial and Municipal guidelines and reports; and
- Input and concerns raised by local stakeholders and community members.

2.2.5 Performance Objectives

The alternatives assessment was completed with the information available at the time and is consistent with the stage of the Project. It compares alternative methods by first identifying and characterizing the advantages and disadvantages of each feasible alternative method, then assessing each against each other for a series of objective measures to arrive at a preferred alternative.

The objective measures used are features that are significant for the realization of the Project as a whole and offer a relative basis to evaluate the distinct alternatives. The following objective measures were used in the comparison of alternatives:

- Overall cost for the life of the Project;
- Technical feasibility and technical reliability;
- Effects to the human environment

- Effects to the physical and biological environments; and
- Potential ability for future closure/reclamation processes.

Overall Cost for the Life of the Project

The overall cost is the total sum of all costs to implement and operate an alternative including initial and sustaining capital expenditures, operating costs and closure/reclamation costs. The criteria used to evaluate the overall cost for each alternative is provided in Table 2.2.5-1.

Table 2.2.5-1: Financial Criteria for the Alternatives Assessment

Criteria	Assessment
Goliath Gold Project Financing	Investor desirability and/or risk
Return on Investment (ROI)	Provides a competitive and acceptable ROI
Financial Risk	Provides a manageable or acceptable financial risk

The performance of these criteria is defined as:

- Preferred: Carries an acceptable financial risk while making a competitive ROI.
- Acceptable: Carries an acceptable financial risk while making an acceptable ROI.
- Unacceptable: Carries an unacceptable financial risk or does not provide an acceptable ROI.

Technical Feasibility and Technical Reliability

Technical feasibility and reliability can be used in conjunction to describe the suitability of a specific alternative. The criteria used to evaluate the technical feasibility and technical reliability for each alternative is provided in Table 2.2.5-2.

Table 2.2.5-2: Technical Feasibility Criterion for the Alternatives Assessment

Criteria	Assessment
Readily Available Technology	Has been successfully implemented in similar mining projects and can be relied upon for sufficient performance over an extended period of time.
	New technologies must be supported by sufficient investigations and technical study to provide confidence in their performance abilities

The performance of these criteria is defined as:

- Preferred: Well understood technical capability of alternative with supporting contingency options.
- Acceptable: Possible technical capability based on theoretical study. Contingency options must be available as a substitute if the alternative fails to perform as expected.

- Unacceptable: No readily available technologies, or technologies that rely solely on unproven studies.

Effects on the Human Environment

For this assessment the term human environment refers to the potential for negative human environment effects. These include a wide range of Indigenous and non-indigenous land use, socio-economic, cultural and community factors. The criteria used to evaluate the effects on the human environment for each alternative is provided in Table 2.2.5-3.

Table 2.2.5-3: Human Environment Criteria for the Alternatives Assessment

Criteria	Assessment
Local Residents and Recreational Users	• Effect on property values • Effect on employment opportunities • Effect on local access points • Effect on noise levels • Effect on water supply for both well water and drinking water • Effect on visual disturbance • Potential for adverse health effects
Infrastructure	• Effect on local access • Effect on power supply systems
Public Health and Safety	• Attainment of air quality point of impingement standards or scientifically defensible alternatives • Effect on drinking water supply • Effect on local health services
Local Economy	• Effect on local businesses and economic opportunities • Effect on access for tourism operators and/or natural resource harvesters
Tourism	• Effect on local tourism
Regional Economy	• Effect on regional businesses and economic opportunities
Government Services	• Effect on local government services and capacities
Resource Management Objectives	• Effect on established resource management plans
Built and Cultural Heritage	• Effect on any built heritage resource or cultural heritage features • Alteration that is not sympathetic or is incompatible with the historic fabric and appearance of cultural heritage resources • Isolation of a built heritage resource or heritage attribute from its surrounding environment, context or a significant relationship • Direct or indirect obstruction of significant views or vistas within, from or of built heritage resources or cultural heritage landscapes • A change in land use • Avoidance of damage to built heritage resources or cultural heritage landscapes, or document cultural resources if damage or relocation cannot be reasonably avoided
Archaeological Resources	• Effect on land disturbances • Avoidance of archaeological sites or mitigation by excavation if avoidance is not possible, as per the standards and guidelines for Consultant Archaeologists
First Nation Reserves and Communities	• Effect on conditions of community on First Nation reserves
Spiritual and ceremonial sites	• Avoidance of damage or disturbance to known spiritual and/or ceremonial sites
Traditional Land use	• Effect on Traditional Land use as caused by the Project
Aboriginal and Treaty Rights	• Effect on Aboriginal and Treaty rights

The performance of these criteria is defined as:

- Preferred: Has no effect or manages to minimize adverse effects with no additional mitigation measures and has a positive overall effect.
- Acceptable: Has no effect or manages to minimize adverse effects with additional mitigation measures and has a positive overall effect.
- Unacceptable: Likely to cause significant adverse effects that cannot be reasonably mitigated.

Effects on the Physical and Biological Environments

The term physical and biological environments refer to a wide range of factors within water, air, rock, soil and/or overburden and physical plant or animal species. The criteria used to evaluate the effects on the physical and biological environments for each alternative is provided in Table 2.2.5-4.

Table 2.2.5-4: Physical and Biological Environment Criteria for the Alternatives Assessment

Criteria	Assessment
Effect on Air Quality and Climate	• Maintain air quality point of impingement standards or defensible alternatives • Emission rates of greenhouse gases (GHGs)
Effect on Aquatic Life and Habitat	• Fulfilment of water quality standards and guidelines for protection of aquatic life or ensuring no further degradation of water quality if current conditions do not match Provincial Water Quality Objectives (PWQO) • Management of water level in effected water bodies and streams to maintain aquatic life • Maintenance of fish population • Maintenance of groundwater levels for both flows and quality
Effect on Wetlands	• Fulfilment of water quality standards and guidelines for protection of aquatic life or ensuring no further degradation of water quality if current conditions do not match PWQO • Area, type and quality (functionality) of wetlands that would be displaced or altered • Maintenance of wetland connectivity
Effect on Terrestrial Species and Habitat	• Area, type and quality of terrestrial habitat that would be displaced or altered • Effects of noise disturbance generated by the Project • Maintenance of wildlife movement corridors and plant dispersion • Effect on overall wildlife population
Effect on Species at Risk (SAR)	• Sensitivity level of effected SAR (Endangered, Threatened, Special Concern) • Areal extent, type and quality of SAR that would be displaced or altered • Effects of noise disturbance generated by the Project • Maintenance of wildlife movement corridors and plant dispersion

The performance of these criteria is defined as:

- Preferred: Has no effect or manages to minimize adverse effects with no additional mitigation measures and has a positive overall effect.

- Acceptable: Has no effect or manages to minimize adverse effects with additional mitigation measures and has a positive overall effect.
- Unacceptable: Likely to cause significant adverse effects that cannot be reasonably mitigated.

Potential Ability for Future Closure/Reclamation Processes

The performance of this factor is the ability of the alternative to successfully be reclaimed and provide closure. The criteria used to evaluate the potential ability for future closure/reclamation processes for each alternative is provided in Table 2.2.5-5.

Table 2.2.5-5: Closure Criteria for the Alternatives Assessment

Criteria	Assessment
Public Safety and Security	• Effect on safety and security risks to the community and general public
Environmental Health and Long-term Sustainability	• Effect on long-term air quality and the ability to meet point of impingement standards • Effect on long-term water quality and the ability to meet water quality guidelines • Effect on long-term wildlife habitats including SARs
Land Use	• Effect on long-term land uses • Effect on long-term visual appearance of Project Site

The performance of these criteria is defined as follows:

- Preferred: Causes limited alteration to the Project site which will in turn create a reduced effort in reclamation activities.
- Acceptable: Causes alteration to the Project site that will require moderate or large reclamation efforts to meet regulatory requirements.
- Unacceptable: Causes alteration to the Project to which reclamation and closure is not technically or reasonably feasible.

Identification of Preferred Alternative

Each alternative has been given a classification to be preferred, acceptable or unacceptable to the aforementioned categories. The overall preferred alternative was then chosen using a holistic approach to how the specific alternative interacted with the Project as a greater whole.

2.3 Alternatives to the Project

As part of the greater Alternatives Assessment process and in compliance with the CEAA (2012) EIS guidelines, Treasury Metals has assessed three alternatives to the Project. These alternatives to the Project have been identified as:

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

This assessment was carried out to distinguish the relative merits of the different Project alternatives. An analysis of these three alternatives was carried out using the categories provided in the Ontario Ministry of Natural Resources and Forestry (MNRF) Class EA Environmental Screening Criteria (MNRF, 2003.

For each topic, considerations were expressed relative to potential environmental effects, associated mitigation measures and to the significance of the effect after mitigation. Significance was assessed from low to high levels using a numerical scale of from 1 to 4 for convenience of expression only:

- Level 1: The anticipated future change affects the environmental element in such a way that only a portion of the component is disturbed for a short period of time, or not at all. Level 1 effects are considered to be not significant and serve as the preferred alternative.
- Level 2: The anticipated future change affects the environmental element so as to bring about a disturbance, but does not threaten the distribution, operation, or abundance of the component. Short-term effects associated with construction and the operation of facilities also constitute a Level 2 effect.
- Level 3: The anticipated future change affects the environmental element so as to bring about a disturbance, and may threaten the distribution, operation, or abundance of the component. Short-term effects associated with construction and the operation of facilities also constitute a Level 3 effect.
- Level 4: The anticipated future change affects the environmental element so as to seriously disturb the distribution, operation, or abundance of the component. All components registering a Level 4 effect would be considered an unsuitable alternative.

As detailed in Section 2 of Appendix X to the revised EIS, the screening of the alternatives to the Project did not identify Level 4 effects, and therefore there was no reason identified not to proceed with the project development identified by Treasury Metals.

2.4 Project Alternatives – Construction and Operations

2.4.1 Mining Method

The choice of a mining method(s) is a function of the geometry and character of the mineralized deposit in relation to the surrounding geology and terrain, mineralization grade, and costs to mine the deposit relative to the mineral resource value (commodity prices), available technologies and environmental and socio-economic sensitivities.

The Goliath deposit is located very close to surface and the potentially mineable mineralized material extends to a depth of more than 400 m. The near surface resource contains potentially mineable mineralized material of just over 5 million tonnes with the deeper mineralization containing approximately 4 million tonnes. A portion of the near surface mineable mineralized material, just over 2 million tonnes, will be lower grade material that will be stockpiled during operations for processing in later years. The alternatives assessment completed for the mining method is Section 3 of Appendix X.

The available alternatives for mining the Goliath deposit are:

- Open pit mining;
- Underground mining; and
- A combination of open pit and underground mining.

2.4.1.1 Open Pit Mine Only (Alternative 1)

The top portion of the Goliath deposit is economically mineable using open pit methods down to a depth of 160 m below surface, which leaves deeper, higher grade portions of the deposit inaccessible. In addition to the mineralized material, the open pit mining will move approximately 6 million tonnes of overburden and 25 million tonnes of waste rock over a three-year period to expose the mineralized material for processing.

Land disturbances associated with open pit mining would include the pit area, together with areas required for the overburden stockpile and the WRSA. In addition, the mine rock is predicted to be potentially acid generating (PAG). This material will need to be managed over the short and longer-term after mine closure to prevent potential adverse environmental impacts to the natural environment. Potential adverse effects to the natural environment include; the risks associated with PAG material infiltrating and seeping into the Blackwater Creek watershed, potentially impacting water quality and aquatic life, the loss of terrestrial habitat due to the development of the open pit infrastructure (i.e., stockpiles), and the hydrological changes associated with site development that potentially impact terrestrial and aquatic life in addition to the physiological changes to hydrology.

Effects to the natural environment can be minimized by positioning overburden and mine rock stockpiles as close to the open pit as practical, and by developing higher stockpiles, thereby reducing the overall footprint. However, stockpile height has been limited to 30 m to minimize visual disturbance to the natural environment. Potential acid rock drainage (ARD) concerns can be mitigated through segregation of the majority of the PAG mine rock by encapsulation to limit the potential for ARD development, and where necessary to capture and manage any drainage in an effective manner. Hydrological impacts will be mitigated by capturing all surface water discharge from the site via perimeter containment ditching and delivering the excess captured water to treatment, and discharge via pipeline to Blackwater Creek. This discharge will ensure the continued viability of Blackwater Creek meeting hydrological needs, in addition to continued use by terrestrial and aquatic organisms.

Open pit mining typically generates more air and sound emissions compared to underground mining, and thus the potential intrusive effects of open pit mining on local residents are likely to be more substantive. Measures available to mitigate air and sound emission effects include: stockpile positioning, water sprays and other methods for dust suppression, choice and positioning of heavy equipment, operations scheduling (daytime and night time operations), and the use of sound barriers and setbacks.

The greater overall area required to construct and operate an open pit mine will also affect the land and resources available for Indigenous peoples to practice uses such as hunting, trapping and plant gathering.

2.4.1.2 Underground Mine Only (Alternative 2)

The geometry of the deposit does not allow for an underground mine to be economically viable without mining the near surface deposit via open pit. There are also much greater capital costs required for the development of an underground mine with higher unit cost for near surface mining production compared to open pit mining. Underground mining also generates a relatively small volume of waste rock to manage, which decreases the overall operational and closure costs of an underground mine.

Underground mining methods generate far less surface disturbance compared to open pit mining, and typically yield far smaller quantities of waste overburden and waste rock, and are preferred from an environmental viewpoint where the deposit is amenable to underground mining. There surface effects from underground mining are minimal with less terrestrial and aquatic habitat being lost or affected. Additionally, dust and noise emissions are mostly isolated underground. Underground mining methods are therefore rated as preferred from a natural environment perspective, and combined open pit / underground mining and open pit mining is rated as acceptable.

From a human environment perspective, there would be far less effects to Indigenous and non-indigenous land uses with a smaller overall effects footprint, less waste material left on the surface, and the reduction of noise and dust emissions compared to open pit mining. However, this alternative is not considered preferred as it is not economical to operate the mine using just underground mining methods. This would remove the economic benefits and jobs the mine would bring to the local communities.

During closure, the site would be remediated relatively quickly compared to open pit reclamation. Once the underground mine is closed the site would be made accessible to the local communities.

Unlike open pit mining that requires large waste rock storage areas to remain following mining, no permanent changes to the landscape would remain for an underground mine.

2.4.1.3 Combination of Open Pit and Underground Mining Methods (Alternative 3)

Based on results of open pit optimization studies, the optimal mining scenario is a combination of open pit and underground mining methods, with approximately 59% of the mineralized tonnage and 38% of the gold ounces to be mined by open pit methods, and the remained to be mined by underground operations via ramp access. This allows for less overall risk to financiers and maximizes the return on investment. It also delays capital spending on the development of the underground mine to the production phase of the Project. There are a number of Ontario mines where both open pit and underground mining has occurred, including the Dome Mine (Goldcorp), Musselwhite Mine (Goldcorp), Hemlo Mine (Barrick Gold) and Lac Des Isles (North American Palladium). This alternative is considered preferred from an economic perspective.

A combination of open pit and underground mining methods results in similar overall effects to the physical and biological environment as open pit and underground mining alone. There would be the need to stockpile large quantities of overburden and waste rock on the surface from the underground mine, increasing the overall effects to the terrestrial and aquatic environments. Noise and dust emissions from the open pit operation would also have effects to the surrounding environment. This alternative was considered to be acceptable from a physical and biological perspective.

The greater overall footprint of the operations area with the inclusion of an open pit mine would result in more potential affects to Indigenous and non-indigenous uses of the land. There would also be greater aesthetic effects of the Project with the increase noise and dust emissions from the open pit operation. However, a combination of open pit and underground mining methods is the optimal mining scenario resulting in the greatest mineralized tonnage of gold being mined. This allows for the greatest profitability and extends the Project life, increasing the workforce requirements and economic gain to the local community.

2.4.1.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of these alternatives.

Table 2.4.1.4-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response Influence on Assessment
TMI_378-AC(1)-52	Eagle Lake First Nation	Concerns over whether open pit or underground mining is safer	Both an open pit and underground mine can be operated safely. There is rigid legislation and associated regulations which the mine must comply with, that supports this assertion.

The advantages and disadvantages of each alternative on Indigenous communities are provided in Table X3-3 (Mining Method — Effects to the Human Environment) under the following criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Due to the larger Project footprint and overall environmental effects from open pit mining, the results of the assessment indicate that open pit mining will have the greatest potential negative effects on Indigenous communities. There will be more terrestrial habitat loss as a result of the open pit and the waste rock and overburden being stockpiled on surface. There will also be greater potential affects to the aquatic environment with potentially acid generating waste rock being stockpiled on surface that could cause seepage to migrate to surface watercourses. That stated, the Project is not economically feasible if underground mining is the only mining method used. Therefore, the benefits of the Project to the local economy (i.e., employment and business opportunities) would not be realised.

2.4.1.5 Selection of Preferred Alternative

A summary of the alternatives assessment for the mining method used for the Project has been provided in Table 2.4.1.5-1. Both the “open pit only” (Alternative 1) and the “combination of open pit mining and underground mining” (Alternative 3) were identified as acceptable options. Alternative 3 was identified as the preferred option on the basis of being the most economically viable strategy for developing the Goliath deposit. The “underground only” (Alternative 2) method was considered to be unacceptable as there is no way to economically mine the shallow portion of the deposit using underground mining methods. Alternative 3 will result in employment and business opportunities that will benefit both the local and regional economies, and should have a smaller environmental footprint than Alternative 1. With proper design and mitigation, Alternative 3 (combination of open pit and underground mine) can be advanced without causing significant impacts to terrestrial and aquatic ecosystems.

Table 2.4.1.5-1: Mining Method Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Open Pit Only	Underground Only	Combination of Open Pit and Underground Mining Methods
Cost Effectiveness	Acceptable	Unacceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Preferred	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Acceptable
Final Rating	Acceptable	Unacceptable	Preferred

2.4.2 Tailings Storage Facility and Minewater Pond

Two Project facilities (a TSF and a minewater pond) will overprint waters frequented by fish and are subject to a regulatory amendment of Schedule 2 of the Metal Mining Effluent Regulations (MMER). Assessment of potential alternatives for facilities that overprint waters frequented by fish is required under Environment and Climate Change Canada’s Guidelines for the Assessment of Alternatives for Mine Waste Disposal (Environment Canada 2013), pursuant to a Schedule 2 regulatory amendment. For the Project, this includes an assessment of tailings deposition technology and tailings storage facility locations.

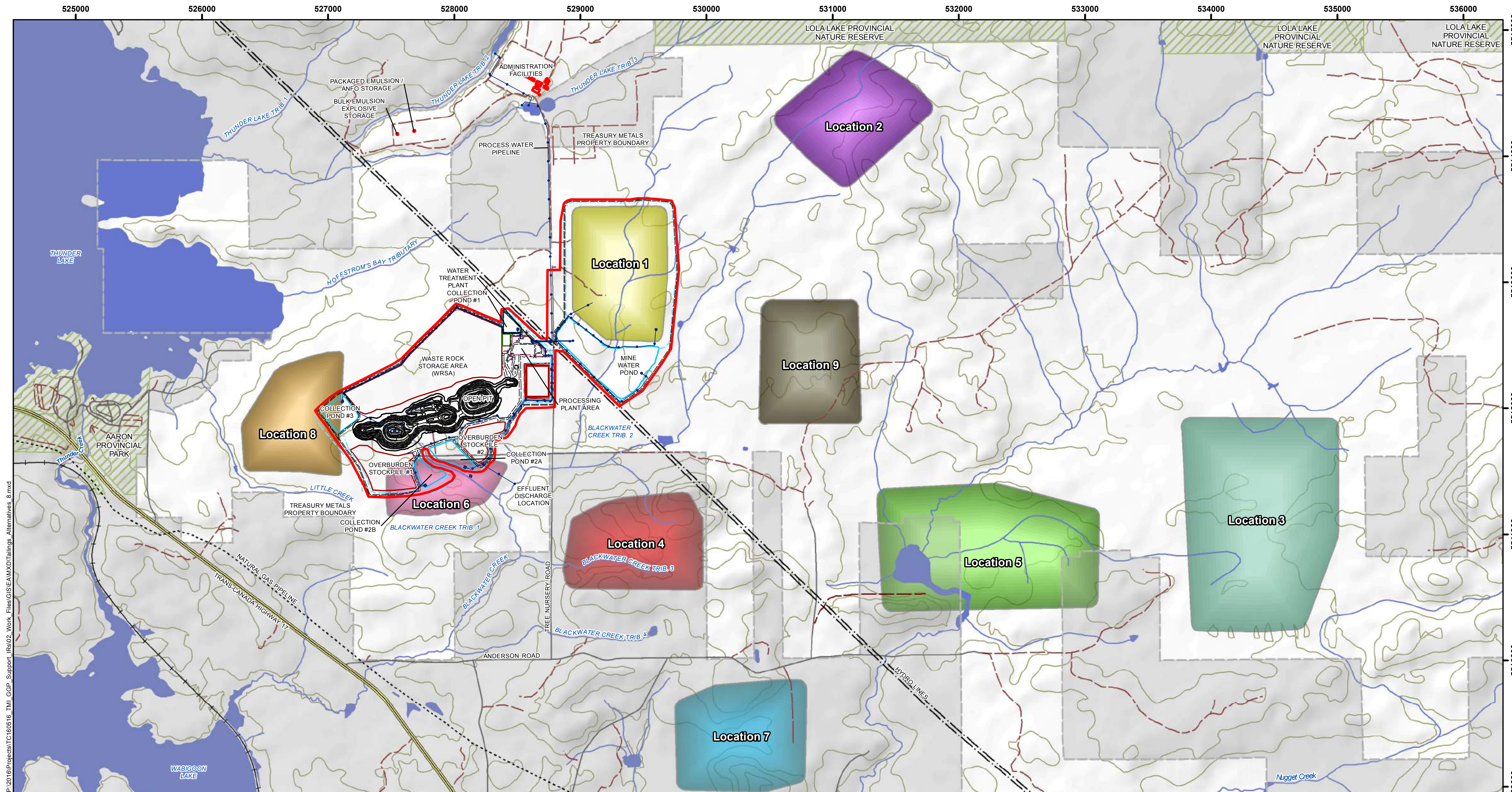
Because of the above requirements, and the requirements set out in Section 8.1 of the EIS Guidelines (Appendix Y), the alternatives assessment of the TSF and minewater pond was completed as a discrete document with differing methodologies to approach used for evaluating the other alternative means. This assessment and methodology is detailed in Appendix D-2 to the revised EIS. The evaluation of alternatives for the TSF supersedes much of the information presented in Appendix D to the original EIS; however, certain information from that appendix remains of use for the evaluation presented in Appendix D-2, and has therefore been included as Appendix D-1 to the revised EIS, with appropriate notes to explain how the information applies.

A multiple accounts analysis (MAA) has been prepared, which follows the methodology outlined in the Guidelines for the Assessment of Alternatives for Mine Waste Disposal (the Guidelines), prepared by ECCC. This analysis has been used to examine and compare different effects from mine waste storage alternatives, and to provide a decision-making tool, which is transparent and defensible. A sensitivity analysis is provided to allow for different weightings of key MAA components and to evaluate differing values on potential environmental, technical, economic and social impacts.

2.4.2.1 Pre-Screening Analysis and Identification of Alternatives

The assessment considered five candidate tailings storage methods, nine candidate tailings storage locations and nine candidate minewater pond locations. To focus the MAA on alternatives that are practicable, a pre-screening analysis was conducted to eliminate candidates with fatal flaws. Figure 2.4.2.1-1 shows the locations of each TSF candidate location. Figure 2.4.2.1-2 shows the location of each minewater pond candidate location. Tables 2.4.2.1-1 and 2.4.2.1-2 summarize TSF each location and methodology and give results of the pre-screening analysis. Nine potential minewater pond locations are described in Table 2.4.2.1-3 with a summary of the results of the pre-screening analysis.

A detailed description of the pre-screening results is provided in Appendix D-2.



LEGEND

- Railway
- Hydro Line
- Natural Gas Pipeline
- Highway
- Local Street
- Resource / Recreation Trail
- Provincial Park / Nature Reserve
- Watercourse
- Waterbody
- Contours (10 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Tailings Alternatives

- Location 1
- Location 2
- Location 3
- Location 4
- Location 5
- Location 6
- Location 7
- Location 8
- Location 9

Site Infrastructure

- Operations Area
- Processing Plant Site
- Access Haul Roads
- Pipeline
- Ditching
- Open Pit
- Security Fence
- Proposed Minewater and Collection Ponds
- Stockpile

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

0 0.5 1 2 3 4 5 Kilometres

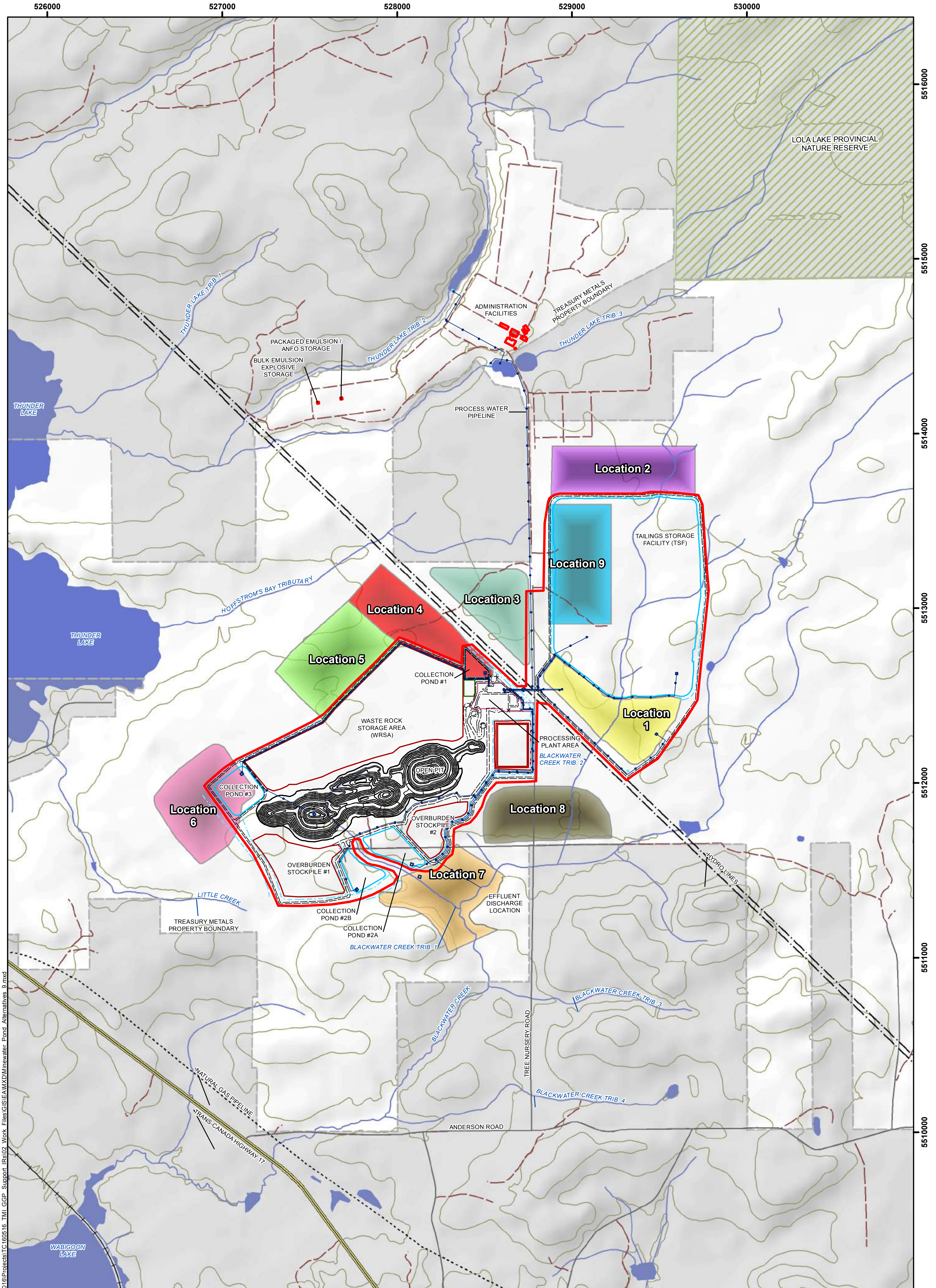
TREASURY METALS INC.

amec foster wheeler

GOLIATH GOLD PROJECT

Location of Tailings Storage Facility Candidate Alternatives

PROJECT Nº: TC160516	**FIGURE: 2.4.2.1-1**
SCALE: 1:28,500	DATE: April 2018



P:\2016\Projects\TC160516_TMI_GGP_Support_IRs\02_Work_Files\GIS\EA\MXD\Minewater_Pond_Alternatives_9.mxd

LEGEND

- Railway
- Hydro Line
- Natural Gas Pipeline
- Highway
- Local Street
- Resource / Recreation Trail
- Provincial Park / Nature Reserve
- Watercourse
- Waterbody
- Contours (10 m interval)

- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Minewater Pond Alternatives

- Location 1
- Location 2
- Location 3
- Location 4
- Location 5
- Location 6
- Location 7
- Location 8
- Location 9

Site Infrastructure

- Operations Area
- Processing Plant Site
- Access Haul Roads
- Pipeline
- Ditching
- Open Pit
- Security Fence
- Proposed Tailings Storage Facility and Collection Ponds
- Stockpile

0 0.25 0.5 1 1.5 Kilometres

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

TREASURY METALS Inc.
amec foster wheeler

GOLIATH GOLD PROJECT

Location of Minewater Pond Alternatives

PROJECT Nº: TC160516	FIGURE: 2.4.2.1-2
SCALE: 1:20,000	DATE: April 2018

Table 2.4.2.1-1: Identification of TSF Candidates and General Location

Project Aspect	Candidate Locations	General Location	Result of Pre-Screening
Tailings Management Facility Location	Location 1	Northeast of the proposed plant site	Carried Forward
	Location 2	Northeast of Location 1	Eliminated
	Location 3	Far east of the Project site	Eliminated
	Location 4	South of Location 1, east side of Tree Nursery Road and south of Normans Road	Eliminated
	Location 5	ESE of plant site between Location 4 and Location 3	Eliminated
	Location 6	South of proposed mine site and south of existing Normans Road	Carried Forward
	Location 7	SSE of plant site, south of the Project boundary, south of Anderson Road	Eliminated
	Location 8	West of open pit area	Eliminated
	Location 9	Directly east of processing plant	Carried Forward

Table 2.4.2.1-2: Identification of TSF Methodology of Tailings Disposal

Tailings Storage Method	Pre-Screening Result	Description
Underground Storage	Eliminated	Insufficient volumes for life of mine storage.
Open Pit Storage	Eliminated	Insufficient volume for life of mine storage, planned storage of waste rock within mined out open pit
Filtered Tailings	Carried Forward	Eliminates dam breach potential, no fatal flaws
Thickened Tailings	Eliminated	No significant advantages over conventional tailings due to site topography
Conventional Slurry Tailings	Carried Forward	Proven methodology, no fatal flaws

Table 2.4.2.1-3: Identification of Minewater Pond Candidates and General Location

Project Aspect	Candidate Locations	General Location	Result of Pre-Screening
Minewater Pond	Location 1	Directly south of TSF Location 1	Carried Forward
	Location 2	Directly north of TS Location 1	Eliminated
	Location 3	North of processing plant, west of Tree Nursery Road	Carried Forward
	Location 4	Northeast of waste rock storage area	Eliminated
	Location 5	North of waste rock storage area	Eliminated
	Location 6	West of waste rock storage area	Carried Forward
	Location 7	South of open pit within Blackwater Creek Tributary #1	Eliminated
	Location 8	Southeast of processing plant	Eliminated
	Location 9	Northeast of plant site, east of Tree Nursery Road within footprint of TSF Location 1	Carried Forward

Following a pre-screening (fatal flaw) analysis, two of the tailings storage methods, three tailings storage locations and four minewater pond locations were retained for further consideration through the MAA. In the interest of having a focused and manageable MAA rather than assessing every possible combination, alternatives which make the most sense from a mine development perspective have been developed for consideration in the MAA. All candidates not eliminated in the pre-screening step are considered through the alternatives carried forward to the MAA.

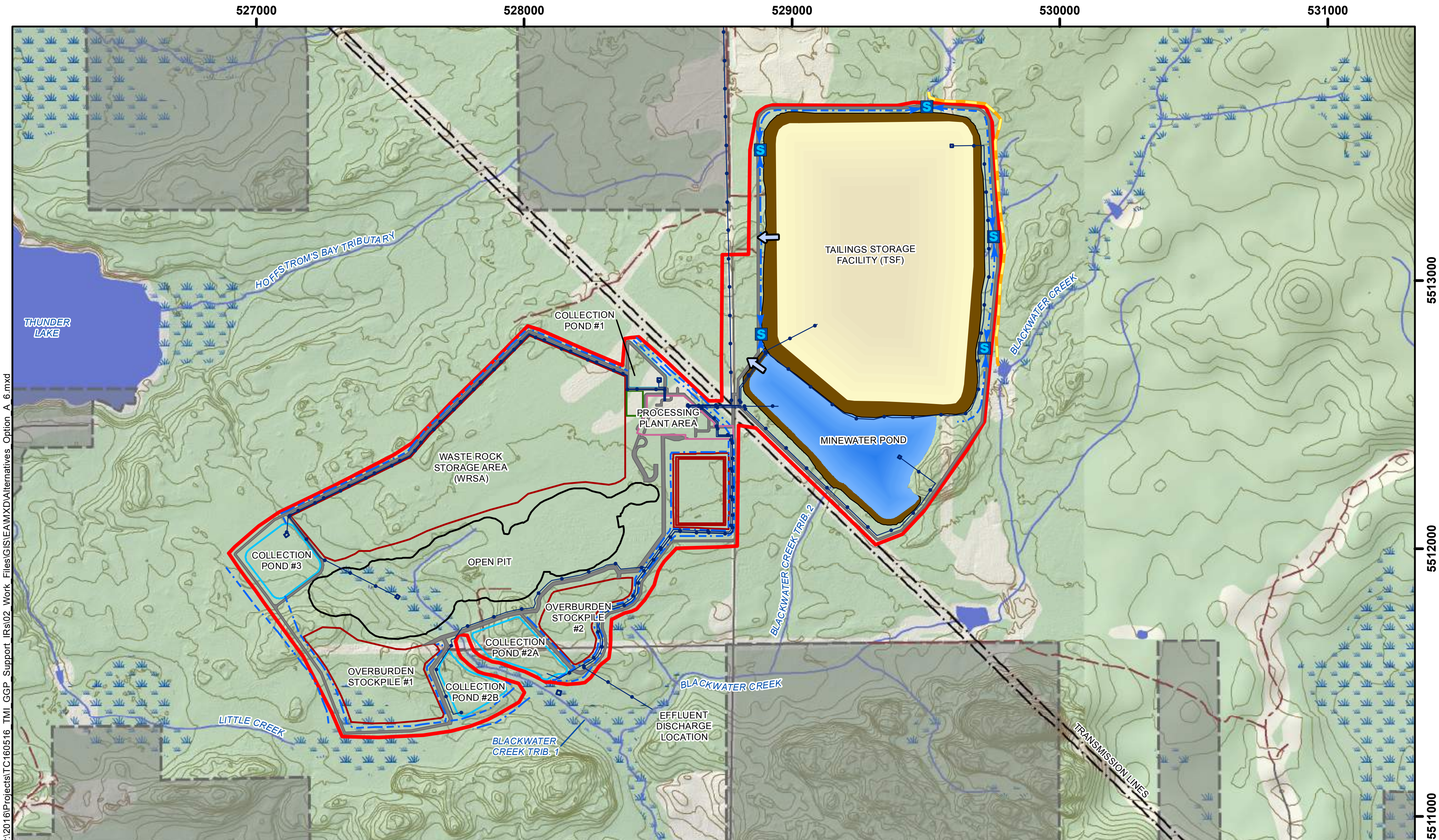
Four alternatives were developed using each of the candidate tailing storage methods and various locations, as summarized below.

Alternative A (Figure 2.4.2.1-3) is the tailings and minewater pond approach presented through the revised EIS. It utilizes conventional slurry tailings, deposited at TSF Location 1. Minewater would be managed in a pond adjacent to the TSF at minewater pond Location 1. Both the TSF and minewater pond would require a MMER Schedule 2 regulatory amendment.

A variant of Alternative A, Alternative B (Figure 2.4.2.1-4) uses the same conventional slurry tailings approach, deposited at TSF Location 1. Minewater pond Location 3 was selected, as it is situated near TSF Location 1, and avoids the need for a MMER Schedule 2 regulatory amendment for the minewater pond. The TSF would require a MMER Schedule 2 regulatory amendment.

Filtered stack tailings was one of the deposition methods carried forward from the pre-screening assessment. The previous assessment of alternatives report (WSP 2014, included as Appendix D-1 to the revised EIS) found that the highest rated filtered stack location was at TSF Location 6. Accordingly, Alternative C (Figure 2.4.2.1-5) utilizes filtered stack tailings deposition at TSF Location 6. Minewater pond Location 6 has been identified as the best minewater pond location for a filtered stack at TSF Location 6, as it maintains a compact site footprint by not placing mine wastes to the east of Tree Nursery Road. Alternative C will require a MMER Schedule 2 regulatory amendment for the TSF, but not for the minewater pond.

Alternative D (Figure 2.4.2.1-6) was selected as the optimal configuration for an alternative that avoids placing mine waste over waters frequented by fish, and accordingly has no MMER Schedule 2 requirements. It utilizes conventional slurry tailings, deposited subaerially at TSF Location 9. A minewater pond at Location 9 was selected as it does not overprint water frequented by fish, has favorable terrain for a pond, and is located near TSF Location 9.



LEGEND

- Transmission Line
- Local Street
- Resource / Recreation Trail
- Wetland
- Watercourse
- Waterbody
- Contours (2 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Components of Alternative A

- Emergency Spillway
- Sumps (Not to scale)
- Dam
- Minewater Pond
- Tailings
- Watercourse Diversion

Site Infrastructure

- Operations Area
- Processing Plant Site
- Access Haul Roads
- Pipeline
- Ditching
- Open Pit
- Collection Ponds
- Stockpile

0 0.25 0.5 1 1.5 Kilometres

NOTES:
- Contours created from a combination Land Information Ontario (LIO) data and LiDAR data.
- Watercourses represent pre-development conditions based on LIO database, as modified by KBM.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

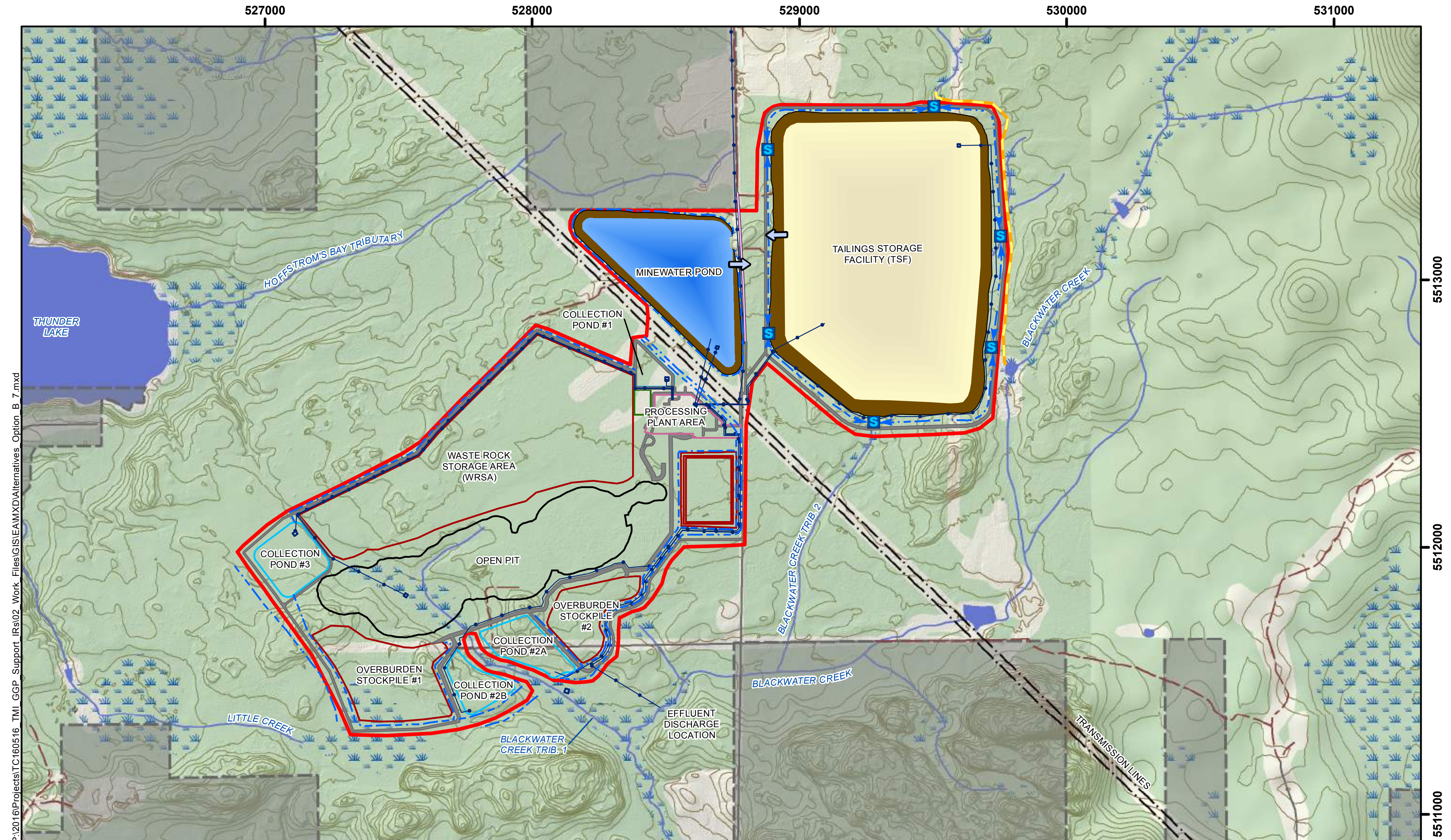
Alternative A Configuration

PROJECT N°: TC160516

FIGURE: 2..4.2.1-3

SCALE: 1:20,000

DATE: April 2018



LEGEND

- Transmission Line
- Local Street
- Resource / Recreation Trail
- Wetland
- Watercourse
- Waterbody
- Contours (2 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Components of Alternative B

- Emergency Spillway
- Sumps (Not to scale)
- Dam
- Minewater Pond
- Tailings
- Watercourse Diversion
- Road Realignment

Site Infrastructure

- Operations Area
- Processing Plant Site
- Access Haul Roads
- Pipeline
- Ditching
- Open Pit
- Collection Ponds
- Stockpile

NOTES:
- Contours created from a combination Land Information Ontario (LIO) data and LiDAR data.
- Watercourses represent pre-development conditions based on LIO database, as modified by KBM.

Datum: NAD83
Projection: UTM Zone 15N

0 0.25 0.5 1 1.5 Kilometres

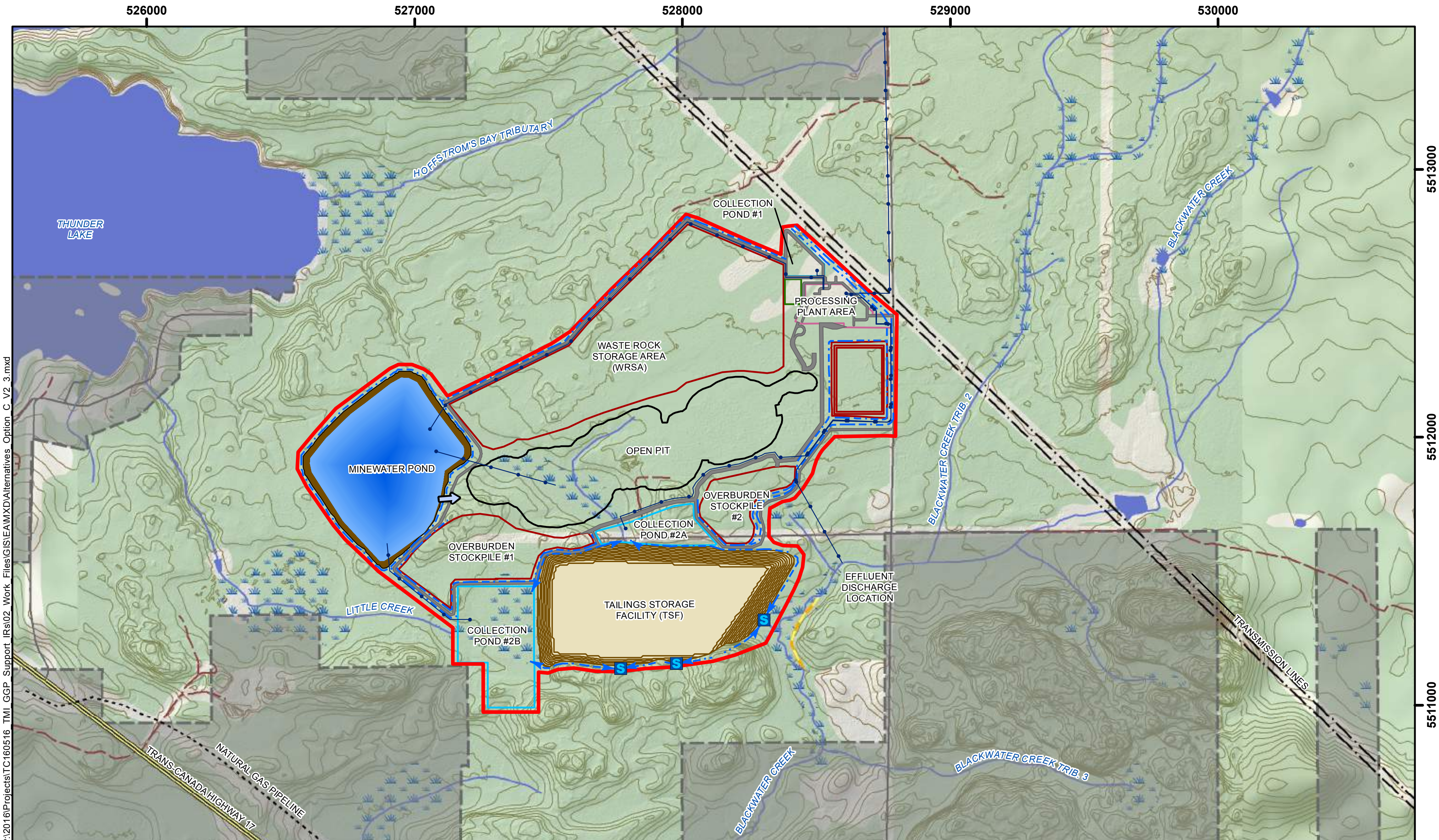
TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Alternative B Configuration

PROJECT N°: TC160516	**FIGURE: 2.4.2.1-4**
SCALE: 1:20,000	DATE: April 2018



LEGEND

- Transmission Line
- Natural Gas Pipeline
- Highway
- Local Street
- Resource / Recreation Trail
- Wetland
- Watercourse
- Waterbody
- Contours (2 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Components of Alternative C

- Emergency Spillway
- Sumps (Not to scale)
- TSF Contours (2 m interval)
- Dam
- Minewater Pond
- Tailings
- Potential Watercourse Diversion

Site Infrastructure

- Operations Area
- Processing Plant Site
- Access Haul Roads
- Pipeline
- Ditching
- Open Pit
- Collection Ponds
- Stockpile

0 0.25 0.5 1 1.5 Kilometres

NOTES:
- Contours created from a combination Land Information Ontario (LIO) data and LiDAR data.
- Watercourses represent pre-development conditions based on LIO database, as modified by KBM.

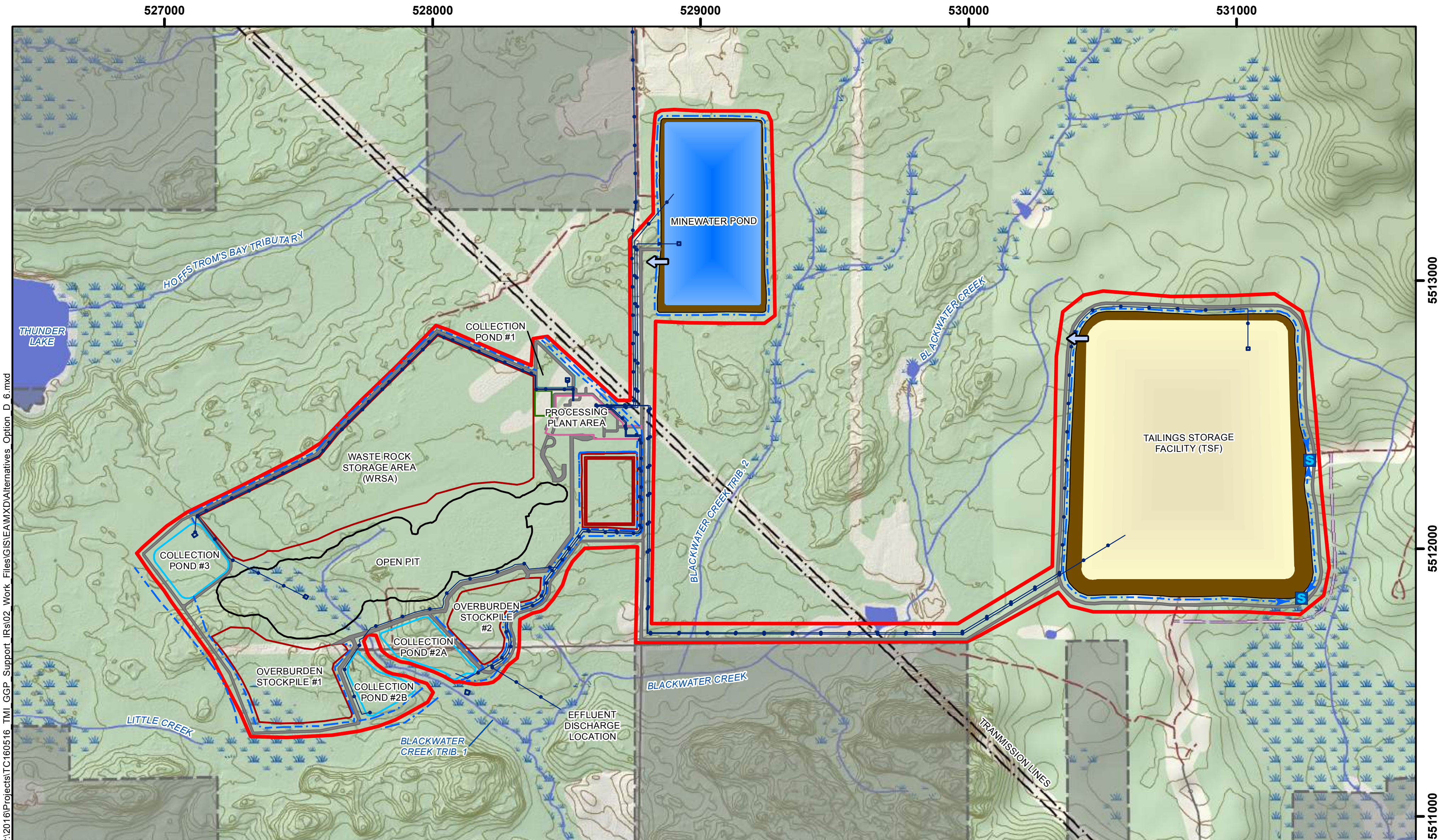
Datum: NAD83
Projection: UTM Zone 15N

TREASURY METALS Inc.
amec foster wheeler

GOLIATH GOLD PROJECT

Alternative C Configuration

PROJECT N°: TC160516 | **FIGURE: 2.4.2.1-5**
SCALE: 1:20,000 | DATE: April 2018



P:\2016\Projects\TC160516_TMI_GGP_Support_IRs\02_Work_Files\GIS\EA\MXD\Alternatives_Option_D_6.mxd

LEGEND

- Transmission Line
- Local Street
- Resource / Recreation Trail
- Wetland
- Watercourse
- Waterbody
- Contours (2 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Components of Alternative D

- Emergency Spillway
- Sumps (Not to scale)
- Dam
- Minewater Pond
- Tailings
- Trail Realignment

Site Infrastructure

- Operations Area
- Processing Plant Site
- Access Haul Roads
- Pipeline
- Ditching
- Open Pit
- Collection Ponds
- Stockpile

0 0.25 0.5 1 1.5 Kilometres

NOTES:
- Contours created from a combination Land Information Ontario (LIO) data and LiDAR data.
- Watercourses represent pre-development conditions based on LIO database, as modified by KBM.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Alternative D Configuration

PROJECT Nº: TC160516

FIGURE: 2.4.2.1-6

SCALE: 1:20,000

DATE: April 2018

2.4.2.2 Alternative Characterization

2.4.2.2.1 Alternative A

Alternative A utilizes conventional slurry tailings technology with a TSF located to the northeast of the open pit, within the Blackwater Creek Tributary 2 basin. The minewater pond is located adjacent to the TSF, sharing the south dam of the TSF. The focus in designing this alternative was to contain effects from the Project to within the Blackwater Creek watershed and avoid effects to Thunder Lake. As both the TSF and minewater pond overprint Blackwater Creek Tributary 2, both structures would require an MMER Schedule 2 regulatory amendment.

Environmental Characterization - The focus of designing the TSF and minewater pond for Alternative A from an environmental perspective was to contain effects from the Project to within the Blackwater Creek watershed. This design approach is largely successful, as Alternative A has the least amount of area that is outside the Blackwater Creek watershed (5.0 ha) compared to the other alternatives assessed. Alternative A will overprint more fish habitat in minor tributaries than the other alternatives (2,300 m of Blackwater Creek Tributary 2). This alternative does not overprint any main stem / river watercourse fish habitat and does not require new roadway watercourse crossings. A fish habitat compensation plan will likely need to be developed for the tributary fish habitat loss associated with Alternative A.

Alternative A will overprint 85.3 ha and 12.6 ha of forest and wetlands, respectively. The amount of overprinted forest is comparable to Alternative B (92.9 ha), higher than Alternative C (37.6 ha) and lower than Alternative D (117.3 ha). Alternative A will overprint the largest area of wetland (12.6 ha overprinted), compared to Alternatives B, C and D (10.9, 9.4 and 1.8, respectively).

During baseline studies of the LSA, a small number of SAR were identified as potentially inhabiting the Project area: Common Nighthawk, Barn Swallow, Little Brown Myotis and Northern Myotis. Of these species, the Little Brown Myotis and Northern Myotis are the only species that are classified as Endangered both Provincially (Endangered Species Act, MOECC 2007) and Federally (Species at Risk Act, Parks Canada Agency 2002), and may require habitat compensation. Alternative A was assessed with bat surveys, which identified that there is 5.1 ha of habitat that could potentially support bat maternity roosts.

There are three areas that have been assigned Provincial protection in relatively close proximity to the Project. Alternative A (and B) is situated the same distance to Lola Lake Provincial Nature Reserve and Aaron Provincial Park (1.2 km and 3.3 km, respectively). Additionally, Alternative A is located outside the Nugget / Hughes Creek watershed and will not affect the Provincial Fish Sanctuary in Barrett Bay.

Technical Characterization - Alternatives A and B share a TSF design with differing minewater pond designs. The location suitability of the TSF for Alternative A is very good with a storage volume to dam ratio of 3.6, higher than the other conventional slurry alternative with a ratio of 2.8 (Alternative D). The maximum TSF dam height of 23 m would occur on the south dam of the TSF, and is shorter than the maximum dam height of the other conventional slurry alternative at 31 m (Alternative D). The ground foundation at Alternatives A and B is the most suitable out of the four alternatives, as the conditions provide free draining materials with good foundation shear strength.

The hazard potential of the TSF is greatest for Alternative A (and B) out of the four alternatives, as there is infrastructure in the form of Tree Nursery Road and Normans Road downgradient of the TSF, which are occasionally used by local residents. The hazard potential of the minewater pond is fair for Alternative A, and has the potential to affect the same infrastructure as the TSF in the event of a dam failure.

Alternative A was designed with the minewater pond adjacent to the TSF to allow for the best flexibility of water management between the two structures out of the four alternatives. The alternative has the shortest length of perimeter ditching required (4.1 km). In additional to seepage capture infrastructure required by the MMER, Alternative A is almost entirely located within the 2 m groundwater drawdown zone created by mine dewatering, which will result in seepage draining to the mine during operations and closure, until the water table has risen to pre-development levels.

Alternative A has moderate expansion capabilities as TSF dams are partially constrained by the minewater pond to the south, Tree Nursery Road to the west and Blackwater Creek to the east. However, Alternative A has good economics for potential future dam expansions should they be required if additional resources are mineable, compared to the other alternatives due to favorable topography that lowers dam raise costs.

Project Economics Characterization - Alternative A is projected to have the lowest overall costs out of the four alternatives.

For the conventional slurry alternatives, the cost of building the TSF dams is greatest contributor to capital costs. Alternatives A and B will have the lowest TSF dam construction costs due to favorable topography, which reduces the dam requirements.

The operational costs of conventional slurry tailings deposition are significantly less than that of filtered stack construction. The TSF and minewater pond of Alternative A, based on the short distance from the process plant to the TSF and the open pit to the minewater pond, have very low costs of tailings pumping and deposition compared to the other alternatives. Alternative A also has reduced water management costs as it has low dam heights that decreases the cost of pumping seepage back to the TSF and is situated close to the process plant for water recycle.

Closure costs and post-closure costs are not major contributors to overall costs for Alternative A (dominated by capital costs). Alternative A will impose additional costs for fish habitat compensation. Alternative A along with Alternative B, are believed to have the least financial risk to Treasury Metals, due to overall lower costs of tailings management and have a lower risk of Project delays, compared to Alternatives C and D.

Socio-economic Characterization - Although no specific heritage sites were identified in the Project operations area to date by Aboriginal peoples, the intrinsic value of traditional uses of the land is understood by Treasury Metals. The configuration of Alternative A is anticipated to result in a lower reduction to traditional land access (743 ha of land). For the purposes of the alternatives assessment, this area is defined as the combination of areas where access will be restricted due to safety and security reasons (i.e., the operations area) and those areas where access would be controlled. Treasury Metals is open to allowing Indigenous peoples access to the portions of their properties outside of the operations area (e.g., portions of the former MNRF tree nursery) for traditional purposes with prior consent and notification. For safety reasons, Treasury Metals would need to escort interested Indigenous peoples to those areas, allowing them controlled access. Additionally, only those practices that do not require the use of firearms would be allowed in these areas in order to ensure the safety of workers. This area is comparable to Alternatives B (702 ha) and C (782 ha), and less than Alternative D (1,254 ha). Potential effects to wildlife abundance will be reduced as the TSF and minewater pond of Alternative A are contiguous with the mine site, maintaining a fairly compact Project site. Thunder Lake was identified by First Nations as culturally important and this alternative limits potential effects to Thunder Lake watershed as Alternative A has the smallest TSF / minewater pond footprint in the watershed (5.0 ha).

The Project is located in a populated area with nearby residents. The Alternative A TSF and minewater pond is situated approximately 4.0 km away from the Village of Wabigoon, 2.5 km away from the residents and cottagers on Thunder Lake, 0.8 km away from nearby rural residents and 3.2 km away from Aaron Provincial Park. These distances are comparable to Alternative B and D with slight distance variations between the individual operations area and the four receptors. Alternative C was significantly closer to each of the four receptors compared to Alternative A as described in Section 2.4.2.2.3, and has a much greater probability of leading to operational effects.

2.4.2.2.2 Alternative B

Alternative B utilizes conventional slurry tailings technology and has a TSF to the northeast of the open pit, within the Blackwater Creek Tributary 2 basin. The minewater pond is located to the west of the TSF, between the existing transmission line and Tree Nursery Road. The focus in designing this alternative was to contain effects from the TSF to within the Blackwater Creek watershed as much as practicable, while ensuring the minewater pond does not overprint watercourses frequented by fish. For this alternative, only the TSF overprints Blackwater Creek Tributary 2 and would require an MMER Schedule 2 regulatory amendment.

Environmental Characterization - The Alternative B design results in 16.8 ha of the TSF and minewater pond outside of the Blackwater Creek watershed. The greatest anticipated flow reductions are to Hoffstrom's Bay Tributary. Alternative B will overprint a shorter length of Blackwater Creek Tributary 2 (2 km) compared to Alternative A (2.3 km), as the minewater pond does not overprint the watercourse. This alternative does not overprint any main stem / river fish habitat and does not require road watercourse crossings. A fish habitat compensation plan is expected to be required to offset and compensate for fish habitat losses.

Alternative B will overprint 92.9 ha and 10.9 ha of forest and wetlands respectively. The amount of overprinted forest is comparable to Alternative A (85.3 ha), higher than Alternative C (37.6 ha) and lower than Alternative D (117.3 ha). Alternative B will overprint the second largest area of wetland at 10.9 ha compared to Alternatives A, C and D (12.6, 9.4 and 1.8 respectively).

During baseline studies of the LSA, a small number of SAR species were identified as potentially inhabiting the Project area: Common Nighthawk, Barn Swallow, Little Brown Myotis, and Northern Myotis). Of these species, the Little Brown Myotis and Northern Myotis are the only species that are classified as Endangered both Provincially (ESA) and Federally (SARA). It was identified during bat surveys that Alternative B would overprint 5.1 ha of habitat that could potentially support bat maternity roosts.

Alternative B (and A) is situated the same distance to Lola Lake Provincial Nature Reserve and Aaron Provincial Park at 1.3 km and 3.3 km, respectively. Additionally, Alternative B is located outside the Nugget / Hughes Creek watershed and accordingly, will not affect the Provincial Fish Sanctuary in Barrett Bay.

Technical Characterization - Alternatives A and B share a TSF design with differing minewater pond designs. The location suitability of the TSF for Alternative B is very good with a storage volume to dam ratio of 3.6, higher than the other conventional slurry alternative with a ratio of 2.8 (Alternative D). The maximum TSF dam height of 23 m (south dam) is shorter than the maximum dam height of Alternative D (31 m). The dam foundations of Alternative B (and A) is the most suitable out of the four alternatives as the conditions provide free draining materials with good foundation shear strength. The minewater pond dam height would be significantly shorter than the TSF, but the minewater pond dam for Alternative B is the second tallest (12.0 m) of all the alternatives.

The hazard potential of the TSF is greatest for Alternative B (and A) of the four alternatives assessed, as there is infrastructure in the form of Tree Nursery Road and Normans Road downgradient of the TSF, which are occasionally used by local residents. Additionally, the hazard potential of the minewater pond is fair for Alternative B, and has the potential to affect the same infrastructure as the TSF in the of a dam failure, and could also fail towards a property not owned by Treasury Metals located adjacent to the minewater pond.

Alternative B was designed with the minewater pond in close proximity to the TSF while not overprinting water frequented by fish. The close proximity of these two structures allows for good flexibility of water management, but it is not as flexible as Alternative A. Additionally, as Alternative B does not have a shared TSF and minewater pond dam, a longer (5.8 km) perimeter ditch would be required to capture runoff (as opposed to 4.1 km for Alternative A). In additional to seepage capture infrastructure required by the MMER, Alternative B is almost entirely located within the 2 m groundwater drawdown zone created by mine dewatering, which will result in seepage draining to the mine during operations and closure, until the water table has risen to pre-development levels.

The Alternative B TSF has a large capacity for expansion should it be needed, and has good economics for expansion due to topographic conditions at the TSF.

Project Economics Characterization - Alternative B is projected to have the second lowest overall costs out of the four alternatives after Alternative A.

For conventional slurry alternatives, the capital cost of building the TSF dams is the greatest cost of the alternative. Alternative B (and A) will have the lowest TSF dam construction costs due to favorable topography, although Alternative C will not require TSF dams. Alternative B will have higher minewater pond dam construction costs compared to Alternative A due to less favorable topography and the presence of high ground in the proposed minewater pond area.

The operational costs of conventional slurry tailings deposition are significantly less than that of filtered stack construction. The TSF and minewater pond of Alternative B, based on the short distance from the process plant to the TSF and the open pit to the minewater pond, have very low costs of tailings pumping and deposition compared to the other alternatives. Additionally, Alternative B has reduced water management costs, as it has low dam heights that reduce the cost of pumping seepage back to the TSF and is situated close to the process plant for water recycle.

Closure costs and post-closure costs are not major contributors to overall costs for Alternative A (dominated by capital costs). Alternative B assumes additional costs for fish habitat compensation and a realignment of Tree Nursery Road. Alternative B along with Alternative A, are believed to have the least financial risk to Treasury Metals, due to overall lower costs of tailings management and have a lower risk of Project delays, compared to Alternatives C and D.

Socio-economic Characterization - Although no specific heritage sites were identified in the Project operations area to date by Aboriginal peoples, the intrinsic value of traditional uses of the land is understood by Treasury Metals. The configuration of Alternative B is anticipated to result in limited traditional access to approximately 702 ha of land, which is slightly less than Alternatives A (743 ha) and C (782 ha), and considerably less than Alternative D (1,254 ha). Potential effects to wildlife abundance will be reduced as the TSF and minewater pond of Alternative B are generally contiguous with the mine site, maintaining a fairly compact Project site. Alternative B has a notable TSF and minewater pond footprint within the Thunder Lake watershed (16.8 ha). Thunder Lake was identified by First Nations as culturally important and effects from the Project should be limited at this lake.

The Project is located in a populated area where nearby residents could experience potential effects (air, noise and aesthetics) from some of the alternative configurations. The Alternative B TSF and minewater pond is situated approximately 4.4 km away from the Village of Wabigoon, 1.9 km away from the residents and cottagers on Thunder Lake, 1.1 km away from nearby rural residents and 2.7 km away from Aaron Provincial Park. These distances are comparable to Alternative A and D with slight distance variations between the individual operations area and the four receptors. Alternative C was significantly closer to each of the four receptors compared to Alternative A, and has a much greater probability of leading to operational effects due.

2.4.2.2.3 Alternative C

Alternative C utilizes filtered stack tailings with the TSF located south of the open pit, within the basin of both Blackwater Creek and Blackwater Creek Tributary 1. The minewater pond is located to the west of the open pit and provides a contiguous site footprint that minimizes the Project footprint. The focus in designing this alternative was to place the TSF in close proximity to the process plant and maintain a compact site footprint, while utilizing a TSF without a tailings pond located over impounded tailings. As the TSF overprints two watercourses frequented by fish, Alternative C would require an MMER Schedule 2 regulatory amendment.

Environmental Characterization - The focus of designing the TSF and minewater pond for Alternative C from an environmental perspective was to maintain a compact site footprint. Although the TSF is located win the Blackwater Creek watershed, modifications to the site layout result in other aspects of the Project (overburden stockpile and runoff collection pond) being located in the Thunder Lake watershed. Alternative C results in larger flow reductions to nearby watercourses compared to the other alternatives and Little Creek will experience approximately 23% flow reductions. Although Alternative C will overprint significantly less tributary fish habitat than Alternatives A and B at 750 m of Blackwater Creek Tributary 1, it may require realignment of 415 m of the Blackwater Creek main stem, depending on size requirements of the TSF runoff collection ponds. A fish habitat compensation plan would need to be developed for the tributary and main stem fish habitat loss for Alternative C.

The alternatives vary significantly between the amount of terrestrial resources that each overprint. Alternative C will overprint 37.6 ha and 9.4 ha of forest and wetlands respectively. The amount of overprinted forest is considerably less than all the other alternatives with the second least overprinting 85.3 ha (Alternative A). Alternative C will overprint the third largest area of wetland at 9.4 ha compared to Alternatives A, B and D with 12.6 ha, 10.9 ha and 1.8 ha respectively.

During baseline studies of the LSA, a small number of SAR were identified as potentially inhabiting the Project area including: Common Nighthawk, Barn Swallow, Little Brown Myotis and Northern Myotis. Of these species, the Little Brown Myotis and Northern Myotis are the only species that are classified as Endangered both Provincially (ESA) and Federally (SARA) and may require habitat compensation. Alternative C was the only alternative that was found to not overprint habitat supporting potential bat maternity roosts.

Alternative C is situated the greatest distance away from Lola Lake Provincial Park (3.5 km) but the closest alternative to Aaron Provincial Park (1.9 km). Alternative C is located outside the Nugget / Hughes Creek watershed and will not have any effect on the Provincial Fish Sanctuary in Barrett Bay.

Technical Characterization - Alternative C utilizes a filtered stack approach to tailings management, such that there is no tailings pond. The location suitability of the TSF for Alternative C is good, although a moderate length haul route from the dewatering plant to the filtered stack will be required. The foundation of Alternative C is the least suitable of the four alternatives, as the conditions provide low permeable material with only fair foundation shear strength. The minewater pond storage volume to dam volume ratio for Alternative C is the same as Alternative A of 3.9, greater than Alternative B (2.5) and less than Alternative D (5.1).

As Alternative C uses filtered stack technology, large containment dams would not be required around the TSF. As such, the potential of the dry stack failure is generally limited to slope failure, or collection pond failure. Potential risks to public safety are reduced compared to the other alternatives. The hazard potential of the minewater pond is higher, as it is situated on high ground near residents along Thunder Lake, which could be affected by a failure.

Alternative C has the least flexibility to manage water of the alternatives, as the filtered stack option has less available water storage capacity to manage upset conditions, such as higher than anticipated sediments, or during periodic maintenance on the water treatment plant. Also, the minewater pond overprints a waste rock storage area collection pond and the design requires mixing of waste rock runoff with mine water. As filtered stack construction requires extensive dewatering of the tailings slurry from the process plant, the maximized water recycle will increase the amount of water on site requiring treatment before discharge. This may require Treasury Metals to increase the size of the treatment plant to accommodate the excess water. In additional to seepage capture infrastructure required by the MMER, Alternative C is located entirely within the 2 m groundwater drawdown zone created by mine dewatering, which will result in seepage draining to the mine during operations and closure, until the water table has risen to pre-development levels.

The location of the TSF will require realignment of Blackwater Creek Tributary 1 as part of closure, and the realignment of the Blackwater Creek main stem; during site preparation and construction. A relatively short perimeter ditch (4.4 m) would need to be built around the TSF, which is slight longer than Alternative A (4.1 m), which has the shortest perimeter ditch requirements.

Alternative C has large expansion capabilities with good economics and is comparable with Alternative B as the best alternatives for expansion. Using filtered stack tailings deposition does not require the raising of dams, and allows for the tailings pile to be built higher without having to increase the land area overprinted.

Alternative C will utilize filtered stack technology, which has a much greater potential to generate fugitive dust emissions compared to conventional slurry technology. Additionally, the TSF will be located near the property boundary, which does not provide a buffer to reduce effects from dust emissions outside the property. That stated, it is unlikely that Alternative C will be able to meet the regulatory requirements for air quality at the property boundary, and may not be possible to obtain the necessary environmental approvals.

Project Economics Characterization - Alternative C is projected to have the highest overall costs out of the four alternatives.

Capital costs for Alternative C are lower than the conventional slurry alternatives, as costly embankment dams for the TSF are not required. A filtration plant capable of dewatering the tailings to an unsaturated state will be required at a lower cost than the dams.

Operational costs for Alternative C are much higher than the other alternatives as a result of several factors including: tailings dewatering at the filtration plant, transportation of filtered tailings by truck, spreading tailings and constructing the stockpile, and treating excess water.

Although relatively minor compared to capital and operational costs, Alternative C has the highest closure costs of the four alternatives. Alternative C is the only alternative that requires a dry TSF cover, which will require more material movement compared to the other alternatives. Alternative C will have additional costs associated with fish habitat compensation.

Due to the high overall costs associated with Alternative C, there is an increased risk that fluctuations in the price of gold could result in Project delays, entering a care and maintenance phase, or forced early shutdown. Alternative C also has the greatest risk of EA or environmental approval delays or rejection due to potential compliance issues with fugitive dust emissions from the TSF. Additionally, Alternative C has the greatest risk of displacing nearby rural residents due to exceedances in health guidelines for fugitive dust at sensitive receptors. Treasury Metals may have to buy the land, or go through lengthy court battles that could take years to acquire the land, resulting in Project delays.

Socio-economic Characterization - Although no specific heritage sites were identified in the Project operations area to date by Aboriginal peoples, the intrinsic value of traditional uses of the land is understood by Treasury Metals. The configuration of Alternative C is anticipated to result in limited traditional access to approximately 782 ha of land. Effects to wildlife abundance will be reduced as the TSF and minewater pond of Alternative C allow for the most compact Project site of the alternatives. Alternative C has the largest TSF / minewater pond footprint in the Thunder Lake watershed, and also moves other mine infrastructure (overburden stockpile and a runoff collection pond) into the Thunder Lake watershed (37.8 ha). Thunder Lake was identified by First Nations as culturally important and effects from the Project should be limited at this lake.

The Project is located in a populated area where nearby residents could experience potential effects (air, noise and aesthetics) if approvals for the alternative could be obtained. As Alternative C utilizes a filtered stack for TSF storage, the drier tailings will result in greater fugitive dust emissions, resulting in increased air quality and aesthetic effects. The drier tailings are also expected to result in increased particulate matter concentrations in the air, in excess of guidelines for the protection of human health, likely requiring the relocation of two nearby residents if approvals could be obtained. TSF construction will also be continuous, resulting in continuous noise emissions associated with TSF construction, unlike the conventional slurry alternatives, which will require occasional dam raises, predominately during daytime hours.

The Alternative C TSF and minewater pond are closer to nearby dwellings compared to the other alternatives; situated approximately 3.1 km away from the Village of Wabigoon, 0.5 km away from the residents and cottagers on Thunder Lake, 0.5 km away from nearby rural residents and 3.2 km away from Aaron Provincial Park.

2.4.2.2.4 Alternative D

Alternative D utilizes conventional slurry tailings technology with the TSF to the east of the open pit and the minewater pond to the northeast of the open pit. It has the largest site footprint with both the TSF and minewater pond located the furthest away from the centroid of the open pit of all the alternatives. The focus in designing Alternative D was to have an alternative that does not overprint any waters frequented by fish.

Environmental Characterization - The main focus of designing the TSF and minewater pond for Alternative D was to not overprint waters frequented by fish. To avoid these waters however, there is 91.1 ha of the Alternative D TSF and minewater pond outside the Blackwater Creek watershed and the alternative affects multiple watersheds in the area including Hoffstrom's Bay Tributary, Blackwater Creek and the Hughes Creek / Nugget Creek system. Two haul road watercourse crossings will also be required over Blackwater Creek and Blackwater Creek Tributary 2, which could result in an increased effect to the aquatic environment at the crossings.

Alternative D will overprint 117.3 ha of forest and 1.3 ha of wetlands. The amount of overprinted forest is the largest of the alternatives, but Alternative D will overprint the smallest area of wetland (1.8 ha compared to Alternatives A, B and C with 12.6, 10.9 and 9.4 respectively).

During baseline studies of the LSA, a small number of SAR species were identified as potentially inhabiting the Project area including: Common Nighthawk, Barn Swallow, Little Brown Myotis and Northern Myotis. Of these species, the Little Brown Myotis and Northern Myotis are the only species that are classified as Endangered both Provincially (Engangered Species Act, MOECC 2007)) and Federally (Species at Risk Act, Parks Canada Agency 2002) and may require habitat compensation. The Alternative D minewater pond will overprint 2.9 ha of habitat that could potentially support bat maternity roosts. The TSF is located in a forested area that was not assessed during bat surveys.

Alternative D will have the greatest greenhouse gas emissions of the alternatives based on diesel fuel use associated with haul truck traffic for TSF construction. Over the projected life of the mine, Alternative D will have an estimated 1,330,000 km of total haul distance, compared to 181,000 km for Alternatives A and B and 877,000 km for Alternative C.

There are three areas that have been assigned Provincial protection in relatively close proximity to the Project. Alternative D is situated 1.9 km away from Lola Lake Provincial Park and is the furthest alternative to Aaron Provincial Park (4.7 km). However, a portion of Alternative D is located within the Nugget / Hughes Creek watershed and it could potentially affect the Provincial Fish Sanctuary in Barret Bay.

Technical Characterization - As a requirement of the Schedule 2 process, Alternative D was designed to not overprint any water frequented by fish. This design approach significantly impacts the technical aspects of the alternative. This alternative has the worst location suitability of the TSF alternative considered, with a storage volume to dam ratio of 2.8, which is lower than the other conventional slurry alternatives with a ratio of 3.6 (Alternatives A and B). The maximum TSF dam height of 31 m would be built on the south dam of the TSF and is the largest dam that would be built out of the four alternatives. The foundation of Alternative D is rated fair as conditions provide moderately free draining material with moderate foundation shear strength. The minewater pond dam height would however, be the shortest of the alternatives with a maximum height at 8.0 m.

The hazard potential of the TSF for Alternative D is better than the other conventional slurry alternatives (Alternatives A and B), as a dam failure would only affect a forestry road seldom used by local residents. Additionally, the hazard potential of the minewater pond is poor for Alternative D, as a dam break has the potential to affect local infrastructure occasionally used by local residents (Tree Nursery Road and Normans Road).

As Alternative D was designed to not overprint water, a location could not be found which allowed the TSF and minewater pond to be situated in close proximity to each other. Alternative D has the least flexibility of water management of the conventional slurry alternatives (Alternative A and B), as there is a considerably greater distance for water to be pumped between the TSF and processing plant / minewater pond area. Although seepage capture infrastructure required by the MMER, unlike the other alternatives, Alternative C is located entirely outside of the 2 m groundwater drawdown zone created by mine dewatering, and seepage that bypasses the seepage collection system would report to the Nugget Creek / Hughes Creek system.

The overall size of the TSF for Alternative D requires the longest perimeter ditch system (6.0 km) to capture runoff. However, the benefit of Alternative D is that it does not overprint water, and it is also the only alternative that does not require a watercourse realignment.

Alternative D has large expansion capabilities with poor economics and is a slightly worse alternative compared to Alternatives B and C for expansion. The TSF dams can be raised on all sides without affecting existing mine infrastructure and is much less likely to require a second TSF in the event more ore was viable for processing. However, to cost to raise the dams would be significant primarily because of the large southern dam.

Alternative D will utilize conventional slurry technology, which has a lower potential to generate fugitive dust emissions compared to filtered stack technology. Additionally, the TSF will be located away from the property boundary, which provides a large buffer from dust emissions affecting outside the property. As such, Alternative D has the greatest likelihood of meeting all regulatory requirements for air quality at the property boundary and complying with environmental approvals.

Project Economics Characterization - Alternative D is projected to have the second highest overall costs out of the four alternatives.

For conventional slurry alternatives, the capital cost of building the TSF dams is the greatest cost of the alternative. Due to the selection of less favorable topography, which is required to avoid overprinting watercourses, Alternative D will have larger and more costly dams than the other conventional slurry alternatives. Alternative D is also further from the ore processing plant, requiring longer haul roads and pipeline infrastructure compared to the other alternatives, further increasing capital costs.

The operational costs of conventional slurry tailings deposition are significantly less than that of filtered stack construction. The TSF and minewater pond of Alternative D, based on the long distance from the process plant to the TSF and the open pit to the minewater pond, have higher costs of tailings deposition and pumping compared to the other conventional slurry alternatives.

Closure costs and post-closure costs are not major contributors to overall costs for Alternative D (dominated by capital costs). However, Alternative D will have relatively high closure costs in comparison to the other conventional slurry alternatives, primarily due to the larger TSF and minewater pond footprints, and additional haul road and pipeline infrastructure to be reclaimed.

Due to the high overall costs associated with Alternative D, there is an increased risk that fluctuations in the price of gold could result in Project delays, entering a care and maintenance phase, or forced early shutdown.

Socio-economic Characterization - Although no specific heritage sites were identified in the Project operations area to date by Aboriginal peoples, the intrinsic value of traditional uses of the land is understood by Treasury Metals. Due to the spread out nature of Alternative D, it is anticipated to result in greater areas where traditional access could be limited or restricted (1,254 ha) compared to the other alternatives, which range from 702 to 782 ha. Effects to wildlife abundance will be greater than the other alternatives, as the Project site will be larger and less compact, resulting in greater habitat loss and extending Project related effects into a relatively undisturbed area.

Alternative D is more remote from nearby residents than several of the other alternatives, as it is situated in a relatively undeveloped area, approximately 4.1 km away from the Village of Wabigoon, 2.5 km away from the residents and cottagers on Thunder Lake, 1.5 km away from nearby rural residents and 3.3 km away from Aaron Provincial Park.

Alternative D will require a minor realignment of a forest access road, and will require Normans Road to be closed to public traffic, in addition to Tree Nursery Road.

2.4.2.3 MAA Ledger

The alternative characterization above provides a detailed description of the alternatives to ensure that every aspect of an alternative is properly considered and to allow for direct comparison within the remaining alternative set.

Site-specific characterization criteria were developed for the Project by a multidisciplinary team and are categorized into four categories or "accounts" as defined by Environment and Climate Change Canada (Guidelines for the Assessment of Alternatives for Mine Waste, September, 2013), that reflect the entire project life cycle. A multiple accounts ledger includes a three-level hierarchy comprised of accounts, sub-accounts and indicators. Accounts identify the general area of consideration and include:

- Environmental;
- Technical;
- Project economics; and
- Socio-economic.

The four "accounts" are summarized below.

Environmental Account

Characterize the local and regional environment surrounding the proposed TIA. These include elements such as climate, geology, hydrology, hydrogeology, water quality and potential impacts on aquatic, terrestrial and bird life.

Technical Account

Characterization of the engineered elements of each alternatives such as storage capacity, dam size and volume, diversion channel size and capacity, dumping techniques (if applicable), haul distances (if applicable), sedimentation and pollution control, dam requirements, tailings discharge methods, pipeline grades and routes, closure design, discharge and/or water treatment infrastructure and supporting infrastructure such as access roads.

Economic Account

Characterizes the project life economics, all aspects of the Tailings Management Plan (TMP) needs to be considered including investigation, design, construction (inclusive of borrow development and royalties where applicable), operation, closure, post-closure care and maintenance, water management, associated infrastructure (including transport and deposition systems), compensation payments and land use or lease fees.

Socio-economic Account

Identifies how a proposed TIA may influence local and regional land users. Elements that are considered here include characterization and valuation of land use, cultural significance, presence of archaeological sites and employment and/or training opportunities.

Each account is split into evaluation criteria (sub-accounts) that are used to determine the level of impact to the account. For example, an environmental account could contain sub-accounts that include terrestrial ecosystem impacts, aquatic ecosystem impacts, impacts to groundwater and impacts to air quality. Sub-accounts should conform to the following criteria detailed by Environment Canada (2013):

- Sub-accounts need to be impact driven;
- The sub-account must differentiate one alternative from another;
- The sub-account must be relevant to the account;
- The sub-account must be understandable, and unambiguously defined for clarity;
- Sub-accounts must not be redundant; and
- Sub-accounts should be judgmentally independent (one sub-account cannot depend on the value of another sub-account).

While sub-accounts measure impacts between the alternatives, they are often not easy to quantify and rank in a transparent manner. Measurement criteria (indicators) allow qualitative or quantitative measurement of the impact associated with each sub-account.

For the purposes of this MAA, each indicator has a six-point scale established that details how an alternative is valued, as suggested in the guidance document, "*Guidelines for the assessment of alternatives for mine waste disposal: chapter 2*" (Environment Canada 2013). Based on consultant experience with other recent assessments of alternatives, for indicators measured by quantitative data, the six-point scale is set up to reflect and maximize the relative differences between each alternative. Typically, this results in one alternative with the best indicator value of six, one alternative with the lowest indicator value of one, while the remaining alternatives are somewhere in the middle of the scale depending on their relative characteristics.

Qualitative scales are set up to cover a wider range of scenarios for added clarity and to ensure that an independent reviewer would also assign the same values. Typically, this results in the alternatives tending to have values towards the middle of the scale.

Deliverables for the multiple accounts ledger include a comprehensive list of accounts, sub-accounts and indicators, including rational for selection, and six-point value scales for each of the indicators.

2.4.2.4 Values Based Decision Process and Sensitivity Analysis

A value-based decision process is applied for each of the site alternatives upon conclusion of providing the scoring matrix for each of the indicators and accounts. This process entails taking the list of accounts, sub-accounts and indicators and assessing the combined impacts for each of the alternatives under review. This entails valuing of all indicators and also weighting of all indicators, sub-account and accounts and quantitatively determining merit ratings for each alternative. There are three steps to this process (Valuing, Weighting and Quantitative Analysis; Appendix D-2).

An experienced multidisciplinary team with representatives from Treasury Metals and Amec Foster Wheeler held a workshop to determine appropriate weightings for the sub-accounts and indicators. Where possible, views of external stakeholders as identified during engagement were incorporated when determining weights.

Weights were applied to each sub-account and indicator on a scale of one to six based on the relative importance of each sub-account and indicator. A weight of two is considered twice as important as a weight of one, likewise, a weight of four is twice as important as a weight of two. By design of the scale, no sub-account or indicator can be weighted more than six times above another sub-account or indicator.

The base case account weights as suggested by Environment and Climate Change Canada (Environment Canada 2011, Section 2.6.2 therein) are as follows:

- Environment – 6;
- Technical – 3;
- Socio-economic – 3; and
- Project economics – 1.5.

As provided in the Guidelines, the base case includes weighting the environment account twice as important as the technical and socio-economic accounts, which in turn are weighted twice as important as the Project economics account.

A sensitivity analysis is recommended for completion as part of the Assessment of Alternatives. The sensitivity analysis is completed by adjusting the weights of accounts, sub-accounts and indicators to determine the range of variances within the alternatives and the sensitivity to various scenarios. This part of the analysis is completed to eliminate bias and subjectivity and to consider other scenarios beyond Environment and Climate Change Canada's base case (e.g., increasing the weight of the socio-economic account).

2.4.2.5 Selection of Preferred Alternative

Overall results of the MAA base case scenario, and calculation of alternative merit ratings, are provided in Table 2.4.2.5-1. Supporting steps in the MAA quantitative analysis are provided as follows; MAA Values in Table 2.4.2.5-2; the analysis of indicators in Tables 2.4.2.5-3, 2.4.2.5-4, 2.4.2.5-5, and 2.4.2.5-6, and the analysis of sub-accounts in Tables 2.4.2.5-7, 2.4.2.5-8, 2.4.2.5-9, and 2.4.2.5-10.

The MAA found that Alternative A is the preferred alternative with an alternative merit rating of 4.3 out of a maximum of 6.0. The runner-up alternative (Alternative B) received an alternative merit rating of 4.2. Alternatives A and B are very similar, differentiated only by minewater pond location, and the closeness of account merit ratings is reflective of their many similarities.

In all sensitivity analysis scenarios Alternative A was found to be the preferred alternative. This leads to a high confidence that the MAA has come to the appropriate conclusion.

The characterization of each Alternative is presented in the following pages. A full description of the multiple accounts ledger, quantitative analysis and sensitivity analysis can be found in Sections 8, 9 and 10 of Appendix D-2, respectively.

Table 2.4.2.5-1: Multiple Accounts Analysis Base Case Results

Account	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
		Rating	Score	Rating	Score	Rating	Score	Rating	Score
Environment	6	4.2	25.0	4.2	25.1	3.8	22.6	3.5	21.1
Technical	3	4.3	12.9	4.1	12.4	3.2	9.6	4.0	11.9
Project Economics	1.5	5.2	7.8	5.0	7.5	3.0	4.5	3.1	4.7
Socio Economic	3	4.0	12.0	3.9	11.7	3.8	11.5	3.4	10.2
Alternative Merit Score		57.8		56.7		48.3		47.9	
Alternative Merit Rating		4.3		4.2		3.6		3.5	

Table 2.4.2.5-2: Multiple Accounts Values

Account	Sub-Account	Indicator	Indicator Value			
			Alternative A	Alternative B	Alternative C	Alternative D
Environmental	Surface and Groundwater Quantity and Quality	Flow Loss	3	3	1	5
		Flow Reductions Outside Blackwater Creek	6	5	4	1
		Seepage Capture During Operations	6	6	6	1
	Aquatic Resources	Tributary Fish Habitat Losses	1	2	4	6
		Mainstem Watercourse Fish Habitat Losses	6	6	1	6
		Watercourse Crossings	6	6	6	4
	Terrestrial Resources	Forest Loss	3	3	6	1
		Wetland Loss	1	2	3	6
		Use of Recently Disturbed Land	5	4	6	1
	SAR	Common Nighthawk	2	3	1	6
		Barn Swallow	6	6	2	1
		Bats	4	4	6	2
	Atmospheric Emissions	Fugitive Dust	6	6	2	5
		Noise Emissions	6	4	6	2
		Greenhouse Gas (GHG) Emissions	6	6	2	1
		Light Trespass	5	5	3	4

Table 2.4.2.5-2: Multiple Accounts Values (continued)

Account	Sub-Account	Indicator	Indicator Value			
			Alternative A	Alternative B	Alternative C	Alternative D
Environmental (cont'd)	Protected Areas	Distance to Nature Reserve	1	1	6	3
		Distance to Provincial Park	3	3	1	6
		Provincial Fish Sanctuary	6	6	6	4
	Closure / Post-Closure	Potential for Seepage to Report to Thunder Lake	3	3	1	6
		Surface Water Discharges	5	5	3	2
Technical	Design Factors	TSF Location Suitability	5	5	4	3
		Minewater Pond Location Suitability	3	1	3	6
		Foundation Suitability	4	4	2	3
	Safety Factors	TSF Hazard Potential	3	3	5	4
		Minewater Pond Hazard Potential	3	2	1	3
		Maximum TSF Dam Height	5	5	6	1
		Maximum Minewater Pond Dam Height	1	2	5	6
		Worker Health	5	5	1	6
	Water Management	Seepage During Operations	5	5	6	1
		Runoff Management	6	2	5	1
		Watercourse Realignment	3	3	2	6
		Excess Water Management	5	5	1	5
		Flexibility for Water Management	5	4	1	2
	Expansion Capacity	Expansion Capacity	4	6	6	5
	Compliance with Environmental Approvals	Dust Management	5	5	1	6

Table 2.4.2.5-2: Multiple Accounts Values (continued)

Account	Sub-Account	Indicator	Indicator Value			
			Alternative A	Alternative B	Alternative C	Alternative D
Project Economics	Capital Cost	Clearing / Site Preparation	2	2	6	1
		TSF Dam Construction	5	5	6	1
		Tailings Dewatering Infrastructure	6	6	2	6
		Minewater Pond Construction	4	1	3	6
		Roads	6	6	3	1
		Pumping Infrastructure	4	5	6	1
		Seepage Collection Infrastructure	6	2	5	1
	Operational Costs	Tailings Deposition	6	6	2	4
		TSF Water Management	6	6	1	3
		Minewater Pond Pumping	2	5	6	1
	Closure Costs	TSF Cover	6	6	1	5
		Minewater Pond Reclamation	6	4	2	1
		Road Reclamation	6	6	3	1
	Post Closure Costs	Inspection / Maintenance / Monitoring	5	5	6	1
		Risk of Additional Treatment Facilities	6	6	4	1
	Ancillary Costs	Fish Habitat Compensation	1	2	3	6
		SAR Compensation	1	1	6	3
		Road Realignment	6	3	6	1
		Haul Distances for Overburden Stockpiles	6	6	1	6
	Risk	Risk of EA or Environmental Approval Delays or Rejection	5	5	1	5
		Risk Arising from TSF Costs	4	4	1	3
		Delays from Displacing Local Residents	6	6	4	6

Table 2.4.2.5-2: Multiple Accounts Values (continued)

Account	Sub-Account	Indicator	Indicator Value			
			Alternative A	Alternative B	Alternative C	Alternative D
Socio-economic	Aboriginal Land Use and Heritage Value	Access Effected Areas	5	6	5	1
		Wildlife Abundance	4	4	5	2
	Aboriginal Land Use and Heritage Value (cont'd)	Loss of Undisturbed Habitat	3	2	6	1
		Avoidance of Thunder Lake Watershed	6	4	1	5
	Land Use	Loss of Tree Stands	2	2	6	1
		Access Along Transmission Line	5	5	6	4
		Area with Air Quality Above Health Based Guidelines	6	6	1	6
	Operational	Village of Wabigoon	5	6	1	5
		Residents and Cottagers Around Thunder Lake	6	4	1	6
		Nearby Rural Residents	2	4	1	6
		Aaron Provincial Park	6	5	1	6
		Fugitive Dust	6	6	2	5
		TSF Elevation	1	1	6	1
		Frequency and Duration of Construction	4	4	1	3
	Local Infrastructure	Access Along Tree Nursery Road	3	3	6	2
	Drinking Water Quality	Potential for Seepage to Affect Drinking Water Wells	2	2	6	1
	Public Safety	Hazard Potential of TSF	3	3	5	4
		Hazard Potential of Minewater Pond	3	2	1	3
	Local Employment / Business	Risk to Local Economy	4	4	1	3
	Displacement of Residents	Potential for Displacing Local Residents	6	6	4	6

Table 2.4.2.5-3: Environmental Indicator Analysis

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Surface and Groundwater Quantity and Quality	Flow Loss	2	3	6	3	6	1	2	5	10
	Flow Reductions Outside Blackwater Creek	3	6	18	5	15	4	12	1	3
	Seepage Capture During Operations	5	6	30	6	30	6	30	1	5
	Sub Account Merit Score		54		51		44		18	
	Sub Account Merit Rating		5.4		5.1		4.4		1.8	
Aquatic Resources	Tributary Fish Habitat Losses	3	1	3	2	6	4	12	6	18
	Mainstem Watercourse Fish Habitat Losses	4	6	24	6	24	1	4	6	24
	Watercourse Crossings	2	6	12	6	12	6	12	4	8
	Sub Account Merit Score		39		42		28		50	
	Sub Account Merit Rating		4.3		4.7		3.1		5.6	
Terrestrial Resources	Forest Loss	3	3	9	3	9	6	18	1	3
	Wetland Loss	4	1	4	2	8	3	12	6	24
	Use of Recently Disturbed Land	2	5	10	4	8	6	12	1	2
	Sub Account Merit Score		23		25		42		29	
	Sub Account Merit Rating		2.6		2.8		4.7		3.2	
SAR	Common Nighthawk	2	2	4	3	6	1	2	6	12
	Barn Swallow	3	6	18	6	18	2	6	1	3
	Bats	6	4	24	4	24	6	36	2	12
	Sub Account Merit Score		46		48		44		27	
	Sub Account Merit Rating		4.2		4.4		4.0		2.5	
Atmospheric Emissions	Fugitive Dust	3	6	18	6	18	2	6	5	15
	Noise Emissions	4	6	24	4	16	6	24	2	8
	Greenhouse Gas Emissions	5	6	30	6	30	2	10	1	5
	Light Trespass	1	5	5	5	5	3	3	4	4
	Sub Account Merit Score		77		69		43		32	
	Sub Account Merit Rating		5.9		5.3		3.3		2.5	
Protected Areas	Distance to Nature Reserve	5	1	5	1	5	6	30	3	15
	Distance to Provincial Park	2	3	6	3	6	1	2	6	12
	Provincial Fish Sanctuary	4	6	24	6	24	6	24	4	16
	Sub Account Merit Score		35		35		56		43	
	Sub Account Merit Rating		3.2		3.2		5.1		3.9	

Table 2.4.2.5-3: Environmental Indicator Analysis (continued)

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Closure / Post-Closure	Potential for Seepage to Report to Thunder Lake	5	3	15	3	15	1	5	6	30
	Surface Water Discharge	4	5	20	5	20	3	12	2	8
	Sub Account Merit Score		35		35		17		38	
	Sub Account Merit Rating		3.9		3.9		1.9		4.2	

Table 2.4.2.5-4: Technical Indicator Analysis

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Design Factors	TSF Location Suitability	6	5	30	5	30	4	24	3	18
	Minewater Pond Location Suitability	3	3	9	1	3	3	9	6	18
	Foundation Suitability	4	4	16	4	16	2	8	3	12
	Sub Account Merit Score		55		49		41		48	
	Sub Account Merit Rating		4.2		3.8		3.2		3.7	
Safety Factors	TSF Hazard Potential	6	3	18	3	18	5	30	4	24
	Minewater Pond Hazard Potential	4	3	12	2	8	1	4	3	12
	Maximum TSF Dam Height	2	5	10	5	10	6	12	1	2
	Maximum Minewater Pond Dam Height	1	1	1	2	2	5	5	6	6
	Worker Health	3	5	15	5	15	1	3	6	18
	Sub Account Merit Score		56		53		54		62	
	Sub Account Merit Rating		3.5		3.3		3.4		3.9	
Water Management	Seepage During Operations	5	5	25	5	25	6	30	1	5
	Runoff Management	3	6	18	2	6	5	15	1	3
	Watercourse Realignment	2	3	6	3	6	2	4	6	12
	Excess Water Management	4	5	20	5	20	1	4	5	20
	Flexibility of Water Management	3	5	15	4	12	1	3	2	6
	Sub Account Merit Score		84		69		56		46	
	Sub Account Merit Rating		4.9		4.1		3.3		2.7	
Expansion Capacity	Expansion Capacity	1	4	4	6	6	6	6	5	5
	Sub Account Merit Score		4		6		6		5	
	Sub Account Merit Rating		4.0		6.0		6.0		5.0	

Table 2.4.2.5-4: Technical Indicator Analysis (continued)

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Compliance with Environmental Approvals	Dust Management	1	5	5	5	5	1	1	6	6
	Sub Account Merit Score		5		5		1		6	
	Sub Account Merit Rating		5.0		5.0		1.0		6.0	

Table 2.4.2.5-5: Project Economics Indicator Analysis

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Capital Cost	Clearing / Site Preparation	1	2	2	2	2	6	6	1	1
	TSF Dam Construction	6	5	30	5	30	6	36	1	6
	Tailings Dewatering Infrastructure	3	6	18	6	18	2	6	6	18
	Minewater Pond Construction	2	4	8	1	2	3	6	6	12
	Roads	2	6	12	6	12	3	6	1	2
	Pumping Infrastructure	1	4	4	5	5	6	6	1	1
	Seepage Collection Infrastructure	1	6	6	2	2	5	5	1	1
	Sub Account Merit Score		80		71		71		41	
	Sub Account Merit Rating		5.0		4.4		4.4		2.6	
Operational Costs	Tailings Deposition	6	6	36	6	36	2	12	4	24
	TSF Water Management	4	6	24	6	24	1	4	3	12
	Minewater Pond Pumping	1	2	2	5	5	6	6	1	1
	Sub Account Merit Score		62		65		22		37	
	Sub Account Merit Rating		5.6		5.9		2.0		3.4	
Closure Costs	TSF Cover	6	6	36	6	36	1	6	5	30
	Minewater Pond Reclamation	2	6	12	4	8	2	4	1	2
	Road Reclamation	2	6	12	6	12	3	6	1	2
	Sub Account Merit Score		60		56		16		34	
	Sub Account Merit Rating		6.0		5.6		1.6		3.4	
Post-Closure Costs	Inspection / Maintenance / Monitoring	2	5	10	5	10	6	12	1	2
	Risk of Additional Treatment Facilities	4	6	24	6	24	4	16	1	4
	Sub Account Merit Score		34		34		28		6	
	Sub Account Merit Rating		5.7		5.7		4.7		1.0	

Table 2.4.2.5-5: Project Economics Indicator Analysis (continued)

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Ancillary Costs	Fish Habitat Compensation	3	1	3	2	6	3	9	6	18
	SAR Compensation	1	1	1	1	1	6	6	3	3
	Road Realignment	3	6	18	3	9	6	18	1	3
	Haul Distance for Overburden Stockpiles	1	6	6	6	6	1	1	6	6
	Sub Account Merit Score		28		22		34		30	
	Sub Account Merit Rating		3.5		2.8		4.3		3.8	
Risk	Risk of EA or Environmental Approval Delays or Rejection	5	5	25	5	25	1	5	3	15
	Risk Arising from TSF Costs	3	4	12	4	12	1	3	3	9
	Delays from Displacing Local Residents	4	6	24	6	24	4	16	6	24
	Sub Account Merit Score		61		61		24		48	
	Sub Account Merit Rating		5.1		5.1		2.0		4.0	

Table 2.4.2.5-6: Socio-economic Indicator Analysis

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Aboriginal Land Use and Heritage Value	Access Effected Areas	6	5	30	6	36	5	30	1	6
	Wildlife Abundance	3	4	12	4	12	5	15	2	6
	Loss of Undisturbed Habitat	3	3	9	2	6	6	18	1	3
	Avoidance of Thunder Lake Watershed	4	6	24	4	16	1	4	5	20
	Sub Account Merit Score		75		70		67		35	
	Sub Account Merit Rating		4.7		4.4		4.2		2.2	
Land Use	Loss of Tree Stands	2	2	4	2	4	6	12	1	2
	Access Along Transmission Line	2	5	10	5	10	6	12	4	8
	Area With Air Quality Above Health Based Guidelines	4	6	24	6	24	1	4	6	24
	Sub Account Merit Score		38		38		28		34	
	Sub Account Merit Rating		4.8		4.8		3.5		4.3	
Operational Impacts (Air, Noise and Aesthetics)	Village of Wabigoon	5	5	25	6	30	1	5	5	25
	Residents and Cottagers Around Thunder Lake	5	6	30	4	20	1	5	6	30
	Nearby Rural Residents	5	2	10	4	20	1	5	6	30
	Aaron Provincial Park	3	6	18	5	15	1	3	6	18

Table 2.4.2.5-6: Socio-economic Indicator Analysis (continued)

Sub-Account	Indicator	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Value	Score	Value	Score	Value	Score	Value	Score
Operational Impacts (Air, Noise and Aesthetics) (cont'd)	Fugitive Dust	3	6	18	6	18	2	6	5	15
	TSF Elevation	1	1	1	1	1	6	6	1	1
	Frequency and Duration of Construction	4	4	16	4	16	1	4	3	12
	Sub Account Merit Score		118		120		34		131	
	Sub Account Merit Rating		4.5		4.6		1.3		5.0	
Location Infrastructure	Access Along Tree Nursery Road	1	3	3	3	3	6	6	2	2
	Sub Account Merit Score		3		3		6		2	
	Sub Account Merit Rating		3.0		3.0		6.0		2.0	
Drinking Water Quality	Potential for Seepage to Affect Drinking Water Wells	1	2	2	2	2	6	6	1	1
	Sub Account Merit Score		2		2		6		1	
	Sub Account Merit Rating		2.0		2.0		6.0		1.0	
Public Safety	Hazard Potential of TSF	6	3	18	3	18	5	30	4	24
	Hazard Potential of Minewater Pond	3	3	9	2	6	1	3	3	9
	Sub Account Merit Score		27		24		33		33	
	Sub Account Merit Rating		3.0		2.7		3.7		3.7	
Local Employment / Business	Risk to Local Economy	1	4	4	4	4	1	1	3	3
	Sub Account Merit Score		4		4		1		3	
	Sub Account Merit Rating		4.0		4.0		1.0		3.0	
Displacement of Residents	Potential for Displacing Local Residents	1	6	6	6	6	4	4	6	6
	Sub Account Merit Score		6		6		4		6	
	Sub Account Merit Rating		6.0		6.0		4.0		6.0	

Table 2.4.2.5-7: Environmental Sub-Account Analysis

Account	Sub-Account	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
Environment	Surface and Groundwater Quantity and Quality	4	5.4	21.6	5.1	20.4	4.4	17.6	1.8	7.2
	Aquatic Resources	6	4.3	26.0	4.7	28.0	3.1	18.7	5.6	33.3
	Terrestrial Resources	4	2.6	10.2	2.8	11.1	4.7	18.7	3.2	12.9
	SAR	5	4.2	20.9	4.4	21.8	4.0	20.0	2.5	12.3
	Atmospheric Emissions	3	5.9	17.8	5.3	15.9	3.3	9.9	2.5	7.4
	Protected Areas	4	3.2	12.7	3.2	12.7	5.1	20.4	3.9	15.6
	Closure / Post-Closure	4	3.9	15.6	3.9	15.6	1.9	7.6	4.2	16.9
	Account Merit Score		124.8		125.5		112.8		105.6	
	Account Merit Rating		4.2		4.2		3.8		3.5	

Table 2.4.2.5-8: Technical Sub-Account Analysis

Account	Sub-Account	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
Technical	Design Factors	6	4.2	25.4	3.8	22.6	3.2	18.9	3.7	22.2
	Safety Factors	5	3.5	17.5	3.3	16.6	3.4	16.9	3.9	19.4
	Water Management	5	4.9	24.7	4.1	20.3	3.3	16.5	2.7	13.5
	Expansion Capacity	2	4.0	8.0	6.0	12.0	6.0	12.0	5.0	10.0
	Compliance with Environmental Approvals	3	5.0	15.0	5.0	15.0	1.0	3.0	6.0	18.0
	Account Merit Score		90.6		86.5		67.3		83.1	
	Account Merit Rating		4.3		4.1		3.2		4.0	

Table 2.4.2.5-9: Project Economics Sub-Account Analysis

Account	Sub-Account	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
Economic	Capital Cost	6	5.0	30.0	4.4	26.6	4.4	26.6	2.6	15.4
	Operational Costs	5	5.6	28.2	5.9	29.5	2.0	10.0	3.4	16.8
	Closure Costs	3	6.0	18.0	5.6	16.8	1.6	4.8	3.4	10.2
	Post-Closure Costs	1	5.7	5.7	5.7	5.7	4.7	4.7	1.0	1.0
	Ancillary Costs	2	3.5	7.0	2.8	5.5	4.3	8.5	3.8	7.5
	Risk	3	5.1	15.3	5.1	15.3	2.0	6.0	4.0	12.0
	Account Merit Score		104.1		99.4		60.6		62.9	
	Account Merit Rating		5.2		5.0		3.0		3.1	

Table 2.4.2.5-10: Socio-economic Sub-Account Analysis

Account	Sub-Account	Weight	Alternative A		Alternative B		Alternative C		Alternative D	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
Socio-economic	Aboriginal Land Use and Heritage Value	6	4.7	28.1	4.4	26.3	4.2	25.1	2.2	13.1
	Land Use	3	4.8	14.3	4.8	14.3	3.5	10.5	4.3	12.8
	Operational Impacts (Air, Noise and Aesthetics)	4	4.5	18.2	4.6	18.5	1.3	5.2	5.0	20.2
	Location Infrastructure	1	3.0	3.0	3.0	3.0	6.0	6.0	2.0	2.0
	Drinking Water Quality	6	2.0	12.0	2.0	12.0	6.0	36.0	1.0	6.0
	Public Safety	5	3.0	15.0	2.7	13.3	3.7	18.3	3.7	18.3
	Local Employment / Business	2	4.0	8.0	4.0	8.0	1.0	2.0	3.0	6.0
	Displacement of Residents	5	6.0	30.0	6.0	30.0	4.0	20.0	6.0	30.0
	Account Merit Score		128.5		125.3		123.2		108.4	
	Account Merit Rating		4.0		3.9		3.8		3.4	

2.4.3 Waste Rock Management

The Project will generate an estimated 27 million tonnes of waste rock over the life of the mine. Almost all of this waste materials will be generated by open pit mining with underground mining generating just over 2 million tonnes of waste rock. The waste rock is anticipated to be PAG and will have to be managed for ARD during operations and following mine closure. The most critical aspects to consider when selecting a suitable location for these materials are:

- Haul distance from the open pit;
- Property ownership boundary;
- Distance to nearest receptors for sound control;
- Potential for water runoff and seepage control;
- Effects on sensitive wildlife;
- Effects on waters frequented by fish; and
- Effects on local access routes.

Haulage distance and the associated cost of waste rock storage is critical due to the large quantity of waste rock involved. Loading and dumping of materials is a base cost common to all alternatives, but there is also an added haulage cost per tonne-kilometre distance. Even small haulage distance differentials can amount to substantive cost differentials between alternatives. Therefore, it is critical that stockpile sites be located in close proximity to the open pit.

Property ownership is another critical consideration. Treasury Metals must hold surface rights (or options to obtain surface rights) for any selected sites. If the rights are not held or cannot reasonably be acquired for an alternative, then Treasury Metals will be unable to secure and utilize the location.

Distance to offsite receptors for sound control is also important. Where it cannot be demonstrated that sound guidelines can be met, the alternative will not be able to be approved. The hauling, dumping and management of stockpiled materials with heavy equipment (principally haul trucks and bulldozers) is a significant source of sound emissions. These operations are carried out on the same frequency as the mining operation (24 hours per day, 7 days per week). Heavy equipment sound can project over distances in excess of 1 km, and are additive to other sound sources such as drills and excavators used in the open pit. There are strict guidelines for permissible sound levels at sensitive area receptors (e.g., permanent and temporary residents, and institutional facilities).

A fourth critical aspect is potential for water runoff and seepage control during operations and following closure. Runoff and seepage from waste rock stockpiles must be collected and managed in accordance with MMER requirements, and site-specific Provincial environmental approvals.

Sites which cannot reasonably be integrated into a site-wide water management system are less attractive.

Among the more important environmental aspects to consider, aside from the general displacement of habitat, are the potential effects on wildlife and aquatic habitat. Regulations strongly encourage the protection of aquatic habitats that support fish and recommend that proponents make best efforts to develop waste rock stockpiles, which do not overprint waters frequented by fish.

The final critical aspect to consider is effects on local infrastructure, and most notably, access for local residents. Where stockpile locations will block existing access, reasonable alternatives must be available to develop alternative access routes for local residents and services that do not inconvenience people or generate a safety risk.

Alternatives for the storage and management of waste rock are:

- WRSA located to the north of the open pit (Alternative 1);
- WRSA located to the south of open pit (Alternative 2); and
- WRSA located to the north of the open pit with co-disposal of waste rock in the mined out areas of the open pit (Alternative 3).

2.4.3.1 Waste Rock Storage Area Located to the North of Open Pit (Alternative 1)

The placement of waste rock to the north side of the open pit allows for economical haulage as there is a sufficient area and capacity for all waste rock produced from the Project to be stockpiled within a very close distance to the proposed pit haulage routes.

The location north of the open pit provides the ability to place the entirety of the waste rock on private property owned by the company with the northern boundary lying contiguous to additional exploration claim properties also maintained by the company, which at the time of filing are within the provincial lease process. Noise and dust studies estimate that meeting emissions requirements will be possible for this location. The area to the north of the open pit facilitates the simplest water management strategy as generally all surface runoff from this area can be easily directed to the open pit for subsequent collection. In addition to providing topographical constraints to water management, the area is not sensitive to fish and fish habitat as no known creeks run though the area. Terrestrial habitat removal is minimized in this location as the area has been previously cut by forestry operations and regrowth has been minimal.

Based on the potential environmental effects identified for this alternative, it is anticipated that the potential effects to the human environment will be less than Alternative 2, but greater than Alternative C. Alternative 1 does not overprint any identified fish bearing creeks and overprints recently forested habitat that would be considered less ecologically productive compared to more mature forest. It is therefore anticipated that the potential effects to Indigenous peoples' traditional land uses (i.e.; hunting and fishing) would be minimized compared to Alternative 2.

2.4.3.2 Waste Rock Storage Area Located to the South of Open Pit (Alternative B)

The placement of mine waste rock on the south side of the open pit also allows for a similarly economical haulage profile compared to locating the WRSA to the north of the open pit as there is sufficient area directly to the south of the pit area that are nearly completely part of the private land package owned by the company.

The main drawback of this location is that it is generally down gradient from the open pit area as the topography moves from high to low in a southerly direction. This will not facilitate water management in the simple fashion that is allowed by the northern location. In addition, the placement of waste rock to the south of the open pit is located within a tributary of Blackwater Creek. The removal of this tributary will alter the hydrology of the watershed and will have a direct impact on fish and fish habitat within Blackwater Creek. For this reason, the southern location is considered not as desirable as Alternative 1, but is still acceptable.

Based on the potential environmental effects for Alternative 2, it is anticipated that there will be greater potential effects to the human environment compared to Alternatives 1 and 3. Alternative 2 will overprint a tributary of Blackwater Creek, which will have a direct impact on fish and fish habitat within the Blackwater Creek system. This alternative would be anticipated to remove a similar area of terrestrial habitat as Alternative 1, but would overprint more habitat than Alternative 3. It is predicted, based on the alternatives assessment completed in Section 5 of Appendix X that Alternative 2 would result in the greatest effects to the human environment of the three alternatives.

2.4.3.3 Waste Rock Storage Area Located to the North of Open Pit with Co-disposal within Completed Open Pit (Alternative C)

The WRSA to the north of the open pit is preferred to the southern location. One additional alternative was considered once the preferred location was selected. This alternative is to use a co-disposal method of surface rock placement combined with placement of rock within the completed open pit. As the open pit will be mined in sequence with three distinct pit bottoms, it will be possible to use the previously completed pit bottom for the direct placement of waste rock from the adjacent pit. Scheduling of the mineralized rock feed to the mill will determine the final volume of rock that is placed into the open pit. Based on the current Project design, it is anticipated that approximately 40% of rock will be placed into the pits.

The benefits of this alternative are similar to those of the northern location highlighted above with the addition that it will reduce the overall Project footprint, height and total volume of the final WRSA. This will further benefit noise reduction as the tipping of haul trucks will occur at a lower ground level as opposed to on top of the waste rock pile containing all of the waste rock from the Project. Water management will be further simplified as surface run-off will report directly within the open pit area and will need no further management (pumping, berming or ditching) to have it directed towards the open pit. Eventual closure of this alternative will subsequently be simplified as much of this rock will be permanently located under a water cover, which will reduce or eliminate ARD potential.

2.4.3.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of these alternatives.

Table 2.4.2.4-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response Influence on Assessment
TMI_354-AC(1)-28	Wabigoon Lake Ojibway Nation	View of Thunder Lake has cultural importance to the elders	Placing waste rock in the open pit will reduce the height of the WRSA making it less visible from Thunder Lake.
TMI_376-AC(1)-50	Eagle Lake First Nation	Concerns about location of waste rock site	There was a small portion of the WRSA presented in the original EIS that was located in the watershed to Thunder Lake. The shape of the WRSA has been changed as a result such that the entire footprint of the WRSA is within the Blackwater Creek catchment area and none of the footprint is in the catchment for Thunder Lake.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X5-3 (Waste Rock Management — Effects to the Human Environment) under the following criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

The results of the alternatives assessment indicate that the combination of surface storage north of the open pit and in-pit storage provides the least effects to Indigenous communities. This alternative addresses the concerns raised by Indigenous communities regarding the visibility of the WRSA from Thunder Lake, and the concerns about the WRSA being located within the Thunder Lake sub-watershed. Placing approximately 40% of the waste rock back into the open pit greatly reduces the overall footprint and height of the WRSA, decreasing the potential effects spiritual and ceremonial sites, traditional land uses, and Aboriginal and Treaty Rights. The lower height of the WRSA with the preferred option will also lessen the likelihood that the WRSA would be visible from outside the Project. Additionally, the WRSA located to the north of the open pit does not overprint any watercourses, and will not affect fish or fish habitat.

2.4.3.5 Selection of Preferred Alternative

The preferred location for the storage of waste rock material is to the north of the open pit combined with a co-disposal within the completed open pit (Alternative A) to the extent possible. Placing all of the waste rock produced from the Project in the WRSA either to the north of the pit (Alternative 1) or south of the pit (Alternative 2) were considered acceptable for all the criteria. The main difference is Alternative 3 allows for the smallest WRSA of the three alternatives, which results in the least environmental and socio-economic effects and lower operational costs to Treasury Metals in transporting less material. The results of the alternative assessment are summarized in Table 2.4.3.5-1.

Table 2.4.3.5-1: Waste Rock Management Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	WRSA to North of Pit	WRSA to South of Pit	Combination of Surface storage North of Pit and In-pit storage
Cost Effectiveness	Acceptable	Acceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Preferred
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Preferred
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Preferred
Final	Acceptable	Acceptable	Preferred

2.4.4 Overburden Management

During the site preparation and construction phase, overburden material will be removed from the open pit to allow mining to occur. Additionally, overburden will be removed from selected areas to allow the construction of components such as the processing plant and the impoundment for the tailings storage facility (TSF). In total, the Project will generate an estimated 5.9 million tonnes of overburden, which will need to be securely stockpiled for the duration of operations to be available for use in the reclamation of the site following the end of mining. It is not feasible to retain overburden within the open pit during operations as such action would interfere with and essentially preclude mining production operations. The overburden needs to be removed to access mineralized material. Temporarily stockpiling overburden and then placing the overburden back in the open pit is possible, but replacing any appreciable volume of materials back in the open pit at closure is cost prohibitive and is not considered.

Given the relatively small footprint for the Project, the two viable options for locating the overburden stockpile(s) are the same as the options for the waste rock storage area (WRSA). Once the preferred alternative for the WRSA was identified (to the north of the open pit), the remaining location (to the south of the open pit) was where the overburden storage pile needed to be placed. However, within the general area south of the open pit, the following two options for the stockpiling of overburden have been considered:

- Two stockpiles south of the open pit (Alternative 1); and
- Single stockpile to the southwest of the open pit (Alternative 2).

2.4.4.1 Two Stockpiles South of the Open Pit (Alternative 1)

Separating the overburden stripped from the site into two separate stockpiles allows for greater flexibility in the location and shape of the stockpiles. The two stockpiles are able to be sited adjacent to the open pit, with Blackwater Creek Tributary 1 located between them. This lowers the overall capital and closure costs required for hauling overburden in the site preparation and construction phase and the closure phase, compared to Alternative B.

Situating the overburden stockpiles adjacent to the open pit greatly reduces the environmental effects for this alternative. The spatial extent of noise and dust emissions from the construction of the overburden stockpiles is largely reduced to the operations area. Both stockpiles are wholly sited within the Blackwater Creek watershed and do not overprint any watercourse or remove catchment area from adjacent sub-watersheds. Additionally, due to the achieved compact site footprint, the effects of this alternative to the human environment are minimal compared to Alternative 2.

2.4.4.2 Single Stockpile to the Southwest of the Open Pit (Alternative 2)

Placing the overburden stripped from the site into one large stockpile does not allow for the same flexibility in location and shape as was afforded to the other alternative. The stockpile for this alternative will need to be sited to the west of Blackwater Creek Tributary 1, and extends the operations area of the Project further west from open pit. This increases the overall capital and closure costs required for hauling overburden in the site preparation and construction phase and the closure phase, compared to Alternative 1.

The overburden stockpile location for this alternative will require that the operations area be expanded further west, closer to Thunder Lake and Wabigoon Lake. This increases the environmental effects of this alternative with a greater overall footprint of the Project and removing more terrestrial habitat. The spatial extent of noise and dust emissions from the construction of the overburden stockpile will extend further from the open pit and closer to the cottages on Thunder Lake. Unlike Alternative 1, the overburden stockpile will overprint a portion of Little Creek, which has been identified as a fish bearing watercourse, as well as will overprint a portion of the Thunder Lake sub-watershed. These environmental effects would result in greater potentially effects to the human environment, including traditional land uses and Aboriginal and Treaty Rights of Indigenous peoples who use the area compared to the other alternative.

2.4.4.3 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X6-3 (Overburden Management — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Although both alternatives site the overburden stockpile(s) adjacent to the open pit, placing all the overburden material into one stockpile (Alternative B2) requires that it extend past the current Project operations area into the Thunder Lake sub-watershed. This increases the potential effects to Indigenous peoples with greater terrestrial habitat being removed for hunting and trapping, as well as removes a portion of Little Creek which could be used for bait fishing. Alternative 1 results in less potential effects to Indigenous communities compared to Alternative 2. It should be noted the effects from the overburden stockpile(s) will be temporary from the site preparation and construction phase to the closure phase when the overburden stockpile is depleted for site reclamation.

2.4.4.4 Selection of Preferred Alternative

A summary of the alternatives assessment for the overburden management is provided in Table 2.4.4.4-1. The option of two overburden stockpiles located south of the open pit (Alternative 1) has been identified as the preferred alternative. The location adjacent to the open pit allows for a compact site footprint and limits the spatial extent of Project effects. It will be more economical than the other alternative with a reduced overall haul distance of the overburden material from the open pit to the stockpile. This alternative also does not overprint any watercourse and is sited wholly within the Blackwater Creek sub-watershed. A single stockpile to the south of the open pit was considered acceptable for all categories; however, Alternative 1 was considered preferred in cost effectiveness, effects to the human environment and effects to the physical and biological environments.

Table 2.4.4.4-1: Overburden Management Summary of Alternatives Assessment

Category	Alternatives	
	1	2
	Two Stockpiles South of the Open Pit	Single Stockpile to the South of the Open Pit
Cost Effectiveness	Preferred	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable
Effects to the Human Environment	Preferred	Acceptable
Effects to the Physical and Biological Environments	Preferred	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable
Final Rating	Preferred	Acceptable

2.4.5 Processing Method

Three process plant options were assessed for the Project as part of the alternatives assessment. Each option has the same crushing and grinding circuit concept, which will consist of a jaw crusher and a single stage semi-autogenous grinding (SAG) mill. However, the grind size is reduced from P_{80} 106 µm in Option 1 to P_{80} 75 µm in Options 2 and 3. This will result in a longer SAG mill and a larger motor for the increased power required, achieving the finer grind size.

Alternatives considered for the Project's ore processing are:

- Gravity and Carbon-in-Leach;
- Gravity and Floatation; and
- Gravity, Floatation and ILR.

2.4.5.1 Gravity and CIL (Alternative 1)

Alternative 1 is a standard carbon-in-leach (CIL) circuit and is considered the base case for the Optimization Study. The ore will be primarily 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 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 Anglo American Research Laboratories (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 electrowinning metal sludge will be smelted to produce doré. Leached slurry from the CIL circuit is processed in a cyanide destruction circuit prior to disposal in the tailings storage facility (TSF).

Gravity and CIL gold processing method allows for the highest ROI with the highest gold recovery at 95.5%. The CIL circuit downstream of a gravity circuit provides the lowest risk plant as CIL circuit residence time will compensate for any fluctuations in throughput or reduced recovery in the gravity circuit. Additionally, the produce from the processing method are gold/silver doré that is directly saleable. Although this alternative has a greater overall capital cost compared to Alternative B, the operational costs of Alternative 2 greatly reduce the ROI over the life of the Project. The overall cost for Alternative 1 is substantially greater than Alternative 2 and similar to Alternative 3 and may require the highest cost for effluent treatment to meet water discharge requirements.

To achieve high availability, the plant must be designed with standby equipment and provisions for short-term bypass to keep the plant running while equipment breakdowns are attended to. Although all three options have the same high-availability dry end with surge bin and emergency stockpile reclaim, only the CIL plant has bypass provisions for every tank and the capacity to maintain a high recovery operation if the gravity circuit is shut down.

Alternative 1 has 24 hours of slurry storage capacity built into the CIL circuit while Alternatives 2 and 3 have 30 minutes each built into the flotation circuits. If there is a significant flow surge or interruption in feed, it is unlikely that the Alternative 1 plant performance will be affected.

2.4.5.2 Gravity and Floatation with Off-Site Concentrate Processing (Alternative 2)

Alternative 2 is proposed as a cyanide-free processing flowsheet. In this option, the CIL circuit is replaced with a flotation circuit. The gravity concentrate will be upgraded using gravity techniques and direct smelting, as opposed to being leached in the intensive cyanide leach reactor. The flotation concentrate will be sold or toll treated (treatment by a third party, typically a smelter, who charges for the treatment of the material and either returns the refined material back to the owner or sells the refined material and reimburses the owner).

The overall flowsheet for this option is much simpler than Alternative 1, and the flotation circuit is expected to be similar to CIL in terms of operational complexity. The flotation circuit will achieve a lower gold recovery as compared to the CIL circuit, although silver recovery may increase over Alternative 1. By direct smelting the upgraded gravity concentrate, approximately 50% of the gold and 24% of the silver are recovered economically and sold as doré bar. The remainder of the gold and silver is recovered in the flotation concentrate, which will be dewatered to below the transportable moisture limit (TML) and sold or toll treated off-site. Both ways, there will be a significant reduction in revenue resulting from selling concentrate as compared to doré, and uncertainties will arise when trying to negotiate the value of the concentrate based on assays, transport and toll treatment costs. The primary advantage of Alternative 2 lies in the absence of cyanide and all cyanide associated issues (cyanide destruction, cyanide code compliance, operator training, and environmental risks). The TSF environmental compliance will be simplified with the absence of cyanide and leached metals in solution. Another notable benefit of Alternative 2 is that the tailings will be non-acid-generating because the sulphides will be recovered as part of the flotation concentrate and removed from the plant facility.

Alternative 2 produces a lesser amount of gold/silver doré as well as a gold-rich concentrate that requires significantly further downstream processing to be equally marketable. Processing of concentrate and refining of doré charges will be deducted from the gold/silver value.

To achieve high availability, the plant must be designed with standby equipment and provisions for short-term bypass to keep the plant running while equipment breakdowns are attended to. Although all three options have the same high-availability dry end with surge bin and emergency stockpile reclaim, only the CIL plant has bypass provisions for every tank and the capacity to maintain a high recovery operation if the gravity circuit is shut down.

Alternative 1 has 24 hours of slurry storage capacity built into the CIL circuit while Alternative 2 and 3 have 30 minutes each built into the flotation circuits. If there is a significant flow surge or interruption in feed, it is likely that the plant performance for Alternative 2 will be affected.

Alternative 2 avoids the use of cyanide and Option 3 minimizes the amount of material that is exposed to cyanide. The size of cyanide destruction equipment is reduced and the environmental risk is potentially minimized.

2.4.5.3 Gravity, Flotation, and ILR (Alternative 3)

Alternative 3 provides a flotation circuit similar to Alternative 2. However, in Alternative 3, the flotation concentrate and gravity concentrates will be intensively leached using cyanide. Gold will be recovered from solution using a Merrill Crowe circuit and smelted on-site to produce doré, which is directly saleable. The result is that a significantly smaller amount of material (approximately 5% of the plant feed) will be exposed to cyanide as compared to Alternative 1. Although this alternative has a greater overall capital cost compared to Alternative 2, the operational costs of Alternative 2 greatly reduce the ROI over the life of the Project. The overall cost for Alternative 1 is substantially greater than Alternative 2 and similar to Alternative 3 and may require the highest cost for effluent treatment to meet water discharge requirements.

To achieve high availability, the plant must be designed with standby equipment and provisions for short-term bypass to keep the plant running while equipment breakdowns are attended to. Although all three options have the same high-availability dry end with surge bin and emergency stockpile reclaim, only the CIL plant has bypass provisions for every tank and the capacity to maintain a high recovery operation if the gravity circuit is shut down.

Alternative 1 has 24 hours of slurry storage capacity built into the CIL circuit while Alternatives 2 and 3 have 30 minutes each built into the flotation circuits. If there is a significant flow surge or interruption in feed, it is unlikely that the Alternative 1 plant performance will be affected.

2.4.5.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X7-3 (Processing Method — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

The processing method alternatives assessment focuses mostly on the Project economics of each alternative. As Treasury Metals has committed that effluent from the Project will either meet PWQO or be less than background during the operations of the Project, the effluent from the different processing methods is not applicable to the assessment. There would be no identifiable effects to Indigenous peoples for any of the processing methods assessed.

2.4.5.5 Selection of Preferred Alternative

The three options were comparatively evaluated using evaluation criteria considered critical to the success of the Project. Table 2.4.5.5-1 provides a summary of the alternatives assessment complete for the Project processing method. Gravity and CIL processing (Alternative 1) was the preferred alternative of the three due to the cost effectiveness. Gravity and floatation with off-site concentrate processing (Alternative 2) was considered unacceptable due to the cost associated with have the third-party smelting of the floatation concentration. Gravity, floatation and ILR was considered an acceptable alternative for the Project, but Alternative 1 has the greatest ROI with the highest gold recovery of 95.5%. Therefore, Alternative 1 is the preferred alternative going forward.

Table 2.4.5.5-1: Processing Method Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Gravity and C.I.L. Processing	Gravity and Floatation with Off-site Concentrate Processing	Gravity, Floatation and ILR
Cost Effectiveness	Preferred	Unacceptable	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Acceptable
Final	Preferred	Unacceptable	Acceptable

2.4.6 Cyanide Containing Effluent Management

Cyanide will be used to leach gold and silver from the ore at the Goliath Gold Project, which is a standard process used worldwide for the production of gold. The preferred option for gold recovery (Section 2.4.5.5) is gravity and carbon–in-leach (CIL), where, cyanide is added to the ore slurry to leach gold and silver. The leached metals are removed from the slurry by activated carbon. The process stream contains ore without the gold and silver, along with a solution containing free cyanide and cyanide complexed with metals that must be treated appropriately. The following cyanide management all include a cyanide recovery process to allow the reuse of cyanide and reduction of discharge cyanide concentrations:

- Wash the leach tails slurry through CCD (Counter Current Decantation) thickeners to reduce the cyanide concentration below 50 ppm and discharge it to the tailings storage facility for natural degradation of remaining cyanide and removal of metals. A cyanide concentration of 50 ppm cyanide is the maximum permissible for tailings storage under the International Cyanide Management Code. Washing the stream through the CCD thickeners recovers a portion of the cyanide back to the process.
- Wash the leach tails slurry through cyanide recovery thickener(s) to recover a portion of the cyanide and destroy the remaining cyanide in the plant prior to discharge of the stream to the TSF. Metals are also reduced in the cyanide destruction circuit. In the TSF, additional natural cyanide degradation will occur.
- A combination of the above whereby cyanide is partially recovered in CCD thickeners, the slurry is discharged to the TSF with cyanide <50 ppm, and an effluent treatment plant is

constructed to destroy cyanide and remove metals contained in the TSF effluent (final effluent).

- Wash the leach tails slurry through cyanide recovery thickener(s) to recover a portion of the cyanide and destroy the remaining cyanide in the plant prior to discharge of the stream to the tailings facility. Metals are also reduced in the cyanide destruction circuit. In the TSF, additional natural cyanide degradation will occur. Further treat the tailings storage facility supernatant in an effluent treatment plant prior to discharge to the environment.

2.4.6.1 Natural Cyanide Degradation and Metals Removal in the TSF (Alternative 1)

Removal of cyanide and cyanide metal complexes by natural means has been practiced successfully in the mining industry for many years and is a widely accepted practice. A variety of mechanisms are responsible for the natural degradation process over time including volatilization, oxidation, adsorption onto solids, hydrolysis, biodegradation, and precipitation. Although these processes are effective for reducing cyanide, they can require approximately a year to produce acceptable effluent levels and they are difficult to predict.

One issue is that arsenic is not sufficiently removed by natural degradation and thus requires additional chemical treatment. Examples of Canadian plants that have employed natural degradation include the Lupin Mine and the Holt Mine.

Inherent in the natural degradation method is the discharge of cyanide containing slurry from the processing plant into the environment, albeit into a controlled environment. This presents risk to the Project in terms of both approval and perception. The TSF would need to be sized for the residence time required for effective treatment such that high purity water effluent water can be produced, and therefore the footprint and associated environmental impact would be drastically increased as would the cost of constructing and closing the TSF. The complexity of the TSF with respect to seepage, fencing for wildlife, and methods of bird entry prevention would also be increased due to the presence of elevated cyanide concentrations. In addition, due to the unpredictability of the processes involved, effluent treatment may still be required in the future.

For these reasons, this method somewhat meets the objectives of the Project, but is not the preferred method.

2.4.6.2 In-Plant Cyanide Destruction and Metals Removal Followed by Natural Degradation (Alternative 2)

By maximizing the recycle of cyanide and 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 MMER compliance 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. However, to meet PWQO standards at the point of discharge, the TSF would need to be sized for the residence time required for effective passive treatment such that high purity water effluent water could be produced. As result, the TSF footprint and associated environmental impact would be drastically increased as would the cost of constructing and closing the TSF.

For these reasons, this method somewhat meets the objectives of the project but is not a preferred method.

2.4.6.3 Natural Cyanide Degradation and Metals Removal Followed by Effluent Treatment (Alternative 3)

This method utilizes natural degradation processes to partially remove cyanide and metals from the effluent prior to final treatment using a chemical process suitable for treating effluent such as hydrogen peroxide oxidation or reverse osmosis. By removing only a portion of the cyanide, the tailings storage facility residence time can be reduced thereby reducing the size and cost of the tailings impoundment. The intent is to take advantage of whatever natural degradation occurs in the TSF (that has not been increased in size to allow for degradation), thereby saving effluent treatment reagent costs. This option has similar environmental and project impacts to the natural degradation only method, as well as the added cost of a chemical treatment plant. Albeit, the cost of operating the chemical treatment plant will be lower than the cost of operating the in-plant cyanide destruction circuit.

As a result, this method meets the objectives of the project but is preferable only to the natural degradation only method. The tailings storage facility would contain higher levels of cyanide and as such, pose increased risk to the environment.

2.4.6.4 In-plant Cyanide Destruction and Metals Removal Followed by Natural Degradation Followed by Effluent Treatment (Alternative 4)

By maximizing the recycle of cyanide and destroying cyanide prior to discharging the tailings to the TSF, potential cyanide contamination situations such as dam seepage TSF overflow during extreme storm events late in the project life are eliminated. By design, the cyanide treatment circuit will destroy cyanide in the leach tails to a level acceptable for MMER compliance 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.

To meet PWQO standards at the point of discharge while maintaining a reasonably sized TSF, an effluent treatment plant would be used to treat the tailings pond water discharge prior to release into the environment. The effluent treatment plant would rely on reverse osmosis technology to obtain high purity water for discharge.

For these reasons, this method is the preferred method.

2.4.6.5 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of alternatives.

Table 2.4.6.5-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response Influence on Assessment
TMI_342-AC(1)-16	Eagle Lake First Nation	Asked how the water will be treated and discharged, the amount of cyanide that will be used, the contaminates and transportation methods for cyanide	Water used in the gold extraction process containing cyanide will be reused to the extent possible, and then treated using the INCO/SO_2 process (which is widely used in the mining industry) to destroy the majority of the remaining cyanide. The resulting waste from processing, known as tailings, is a mixture of liquid and finely crushed rock from which gold has been extracted. The tailings will be pumped to the tailings storage facility (TSF) where the finely crushed rock in the tailings will settle over time. After treatment using the INCO/SO_2 cyanide destruction process, tailings directed to the TSF will meet the 1 mg/L total cyanide effluent discharge limit set out in the federal Metal Mining Effluent Regulations (MMER). The water covering the TSF will be recycled and used in the processing plant, and excess water that cannot be recycled will be treated in the effluent treatment plant and ultimately discharged to Blackwater Creek. Treasury Metals has committed (Table 10.0.1 of the EIS) that the final effluent discharged to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) established in Ontario to be protective to sensitive aquatic receptors. The PWQO are more stringent than the standards in Ontario for drinking water.
TMI_450-AC(1)-124	Metis Nation of Ontario	Provide specific detail around how in-plant cyanide destruction follow by natural degradation followed by effluent treatment will	By treating the tailings water within the plant to meet MMER discharge limits for cyanide means that the supernatant water will not pose an acute risk to wildlife, including

Table 2.4.6.5-1: Indigenous Community's Influence on Alternative Selection (continued)

Information Location	Indigenous Community	Concerns	Response Influence on Assessment
		ensure that wildlife and aquatic life are protected	waterfowl, which may access the TSF and come in contact with the supernatant water. There will be additional treatment within the TSF through natural degradation. Prior to the supernatant water coming into contact with aquatic life in Blackwater Creek, it will be treated by reverse osmosis process to meet PWQO.
TMI_633-AC(1)-306	Eagle Lake First Nation	The process chosen to deal with cyanide seems appropriate. Cyanide destruction through the INCO SO_2 – Air process will deliver water into the TSF with levels of cyanide below the levels acceptable to the MMER and PWQO standards. Furthermore, his 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". TSF will also undergo treatment at the Effluent Treatment Plant.	Treasury Metals concurs with the reviewer's position that the process selected to deal with cyanide is appropriate.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X8-3 (Cyanide Containing Effluent Management — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Although each alternative assessed for cyanide containing effluent management would meet PWQO or be less than background as per Treasury Metals commitment, water quality in the TSF varies for each alternative. The alternative that will contribute the least effects to Indigenous peoples is in-plant cyanide destruction followed by natural degradation follow by effluent treatment (Alternative 4). The water quality and cyanide concentrations for this alternative in the TSF will be the lowest of the alternatives and will therefore have the smallest effect to wildlife (i.e., waterfowl on the TSF). Due to the water quality and cyanide concentration in the TSF for this alternative, it has been determined to be the preferred alternative going forward.

2.4.6.6 Selection of Preferred Alternative

In-plant cyanide destruction followed by natural degradation followed by effluent treatment (Alternative 4) was the only method that meets provincial and federal effluent requirements, which is imperative for discharge into Blackwater Creek which has a low ability for dilution at the point of discharge. The summary of the alternatives assessment for cyanide containing effluent management is provided in Table 2.4.6.6-1 and shows that in-plant-cyanide destruction followed by natural degradation follow by effluent treatment is the only preferred alternative. Natural cyanide degradation in the TSF (Alternative 1) is preferred from a cost-effectiveness perspective, but was unacceptable from a physical and biological perspective with greater risk of not meeting provincial and federal effluent requirements. In-plant cyanide destruction follow by natural degradation (Alternative 2) and natural degradation follow by effluent treatment (Alternative 3) both were acceptable for all categories except effects to the physical and biological environments. For the same reason as Alternative 2, there is much greater risk of not meeting provincial and federal effluent requirements.

Table 2.4.6.6-1: Cyanide Containing Effluent Management Summary of Alternatives Assessment

Category	Alternatives			
	1	2	3	4
	Natural Cyanide Degradation in the Tailings Storage Facility	In-Plant Cyanide Destruction Followed by natural Degradation	Natural Degradation Followed by Effluent Treatment	In-Plant Cyanide Destruction Followed by natural Degradation Followed by Effluent Treatment
Cost Effectiveness	Preferred	Acceptable	Acceptable	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Unacceptable	Unacceptable	Unacceptable	Preferred
Potential Ability for Future Closure/ Reclamation Processes	Acceptable	Acceptable	Acceptable	Acceptable
Final	Unacceptable	Unacceptable	Unacceptable	Preferred

2.4.7 Cyanide Destruction

A number of proven and effective methods are available for treating cyanide. The selection of a particular process is based on the characteristics of the stream containing cyanide, the capabilities and cost of the process, and the applicable environmental regulations and guidelines. The most common cyanide removal processes in use in Canada today are the Inco SO_2-air process, natural degradation, hydrogen peroxide and alkaline chlorination. As Carbon-in-leach (CIL) has been selected as the preferred process for the Project, the discharge stream will be a slurry containing cyanide. A cyanide recovery thickener will recycle a portion of the cyanide back to the process and reduce the quantity of cyanide to be destroyed. The selected cyanide destruction process must be capable of treating the amount of cyanide present, and it must be capable of efficiently treating the slurry stream. The following four alternative methods for cyanide destruction for the Project were considered:

- Alkaline chlorination;
- Hydrogen peroxide;
- Natural degradation; and
- Inco SO_2-Air.

2.4.7.1 Alkaline Chlorination (Alternative 1)

Alkaline chlorination is a chemical treatment process involving the oxidation of free and WAD forms of cyanide under alkaline conditions. This process has been used widely for many years and is perhaps the most common cyanide destruction process. Although this process is used widely in other applications such as metal plating and industrial wastewater treatment, few mining operations still use the alkaline chlorination process and other oxidation processes have become more dominant.

The alkaline chlorination process is best applied on clear solutions where WAD cyanide, thiocyanate and/or ammonia removal is required. The process typically uses chlorine gas that requires special handling and environmental and safety considerations. In additional, iron and sulphides present in the ore may increase reagents consumption and decrease the efficiency of this method. The residual end products of this method include free chlorine and chloramines, which must be removed. Additional treatment may be required to remove iron complexed cyanide and metals. Alkaline chlorination is not a preferred method for treatment of the cyanide bearing waste stream.

2.4.7.2 Hydrogen Peroxide

Hydrogen peroxide is widely used to oxidize free and WAD cyanide in effluent. The process is not economically applied to slurries because of the high consumption of H_2O_2 form reaction with solids and the greatly increased residence time required. Utilization of the hydrogen peroxide process for the Project would best be applied through the use of a separate effluent treatment plant downstream of the tailings facility. Hydrogen peroxide could be considered an appropriate method if used in conjunction with natural degradation; however, the Inco SO_2-Air process has been determined to be the preferred method of cyanide destruction for the Project.

2.4.7.3 Natural Degradation

Removal of cyanide and cyanide metal complexes by natural means has been practiced successfully in the mining industry for many years and is a widely accepted practice. A variety of mechanisms are responsible for the natural degradation process over time including volatilization, oxidation, adsorption onto solids, hydrolysis, biodegradation, and precipitation. Although these processes are effective for reducing cyanide, they can require approximately a year to produce acceptable effluent levels and they are difficult to predict. In addition, arsenic is not sufficiently removed by natural degradation and thus requires additional chemical treatment. Examples of Canadian plants that have employed natural degradation include the Lupin Mine and the Holt Mine. Natural degradation has not been selected as a preferred method for the Project due to the additional requirements placed on the TSF and the relative unpredictability of the process.

2.4.7.4 Inco SO_2-Air

SO_2-Air destruction acting on the cyanide recovery thickener underflow has bene chosen as the preferred method for cyanide destruction. 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 the higher destruction efficiencies are achieved.

In the SO_2-Air process, free metal complexed cyanides (WAD cyanide) are oxidized to cyanate using SO_2 and air in the presence of copper catalyst in solution, at a pH of ~9. Free and weakly complexed metal cyanides are oxidized to cyanate by the following reactions:

$$CN^- + SO_2 + O_2 + H_2O \xrightarrow{Cu^{+2}\ Catalyst} OCN^- + SO_4^{-2} + 2H^+$$

$$M(CN)_4^{-2} + 4SO_2 + 4O_2 + 4H_2O \xrightarrow{Cu^{+2}\ Catalyst} 4OCN^- + 8H^+ + 4SO_4^{-2} + M^{+2}$$

Iron complexed cyanides are reduced to the ferrous state and precipitated as insoluble copper-iron-cyanide complexes. Residual metals released form the WAD cyanide complexes are precipitated as metal hydroxides. Thiocyanate is oxidized slowly and, under typical operating conditions, only 10-20% of thiocyanate is removed. While the SO_2-Air process effectively treats cyanide, it has poor removal efficiency for ammonia, cyanate and thiocyanate (products of the process) and additional treatment may be required. Over time, the constituents will degrade in the TSF. Ongoing cyanide destruction and tailings aging test work will confirm if final effluent treatment is required.

2.4.7.5 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of alternatives.

Table 2.4.7.5-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response Influence on Assessment
TMI_342-AC(1)-16	Eagle Lake First Nation	Asked how the water will be treated and discharged, the amount of cyanide that will be used, the contaminates and transportation methods for cyanide	Water used in the gold extraction process containing cyanide will be reused to the extent possible, and then treated using the INCO/SO_2 process (which is widely used in the mining industry) to destroy the majority of the remaining cyanide. The resulting waste from processing, known as tailings, is a mixture of liquid and finely crushed rock from which gold has been extracted. The tailings will be pumped to the tailings storage facility (TSF) where the finely crushed rock in the tailings will settle over time. After treatment using the INCO/SO_2 cyanide destruction process, tailings directed to the TSF will meet the 1 mg/L total cyanide effluent discharge limit set out in the federal Metal Mining Effluent Regulations (MMER). The water covering the TSF will be recycled and used in the processing plant, and excess water that cannot be recycled will be treated in the effluent treatment plant and ultimately discharged to Blackwater Creek. Treasury Metals has committed (Table 10.0.1 of the EIS) that the final effluent discharged to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) established in Ontario to be protective to sensitive aquatic receptors. The PWQO are more stringent than the standards in Ontario for drinking water.
TMI_450-AC(1)-124	Metis Nation of Ontario	Provide specific detail around how in-plant cyanide destruction follow by natural degradation followed by effluent treatment will ensure that wildlife and aquatic life are protected	By treating the tailings water within the plant to meet MMER discharge limits for cyanide means that the supernatant water will not pose an acute risk to wildlife, including waterfowl, which may access the TSF and come in contact with the supernatant water. There will be additional treatment within the TSF through natural degradation. Prior to the

Table 2.4.7.5-1: Indigenous Community's Influence on Alternative Selection (continued)

Information Location	Indigenous Community	Concerns	Response Influence on Assessment
			supernatant water coming into contact with aquatic life in Blackwater Creek, it will be treated by reverse osmosis process to meet PWQO.
TMI_633-AC(1)-306	Eagle Lake First Nation	The process chosen to deal with cyanide seems appropriate. Cyanide destruction through the INCO/SO_2 – Air process will deliver water into the TSF with levels of cyanide below the levels acceptable to the MMER and PWQO standards. Furthermore, his 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". TSF will also undergo treatment at the Effluent Treatment Plant.	Treasury Metals concurs with the reviewer's position that the process selected to deal with cyanide is appropriate.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X9-3 (Cyanide Destruction — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Treasury Metals has committed that effluent from the Project will either meet PWQO or be less than background during the operations of the Project, the effluent being discharge to Blackwater Creek from the different cyanide destruction methods is not applicable to the assessment. That stated, there are differing potential effects to Indigenous peoples for each alternative assessed. The Inco SO_2-air (Alternative 4) does not require the TSF to be expanded and potentially overprint more terrestrial and aquatic habitat, unlike Alternative 3. Alternative 4 also would produce the best effluent water quality going to the TSF and will therefore have the smallest effect to wildlife (i.e., waterfowl on the TSF). Due to the water quality and cyanide concentration in the TSF and the least potential effects to Indigenous peoples for Alternative 1, it has been determined to be the preferred alternative going forward.

2.4.7.6 Selection of Preferred Alternative

A summary of the alternatives assessment for the cyanide destruction method used for the Project is provided in Table 2.4.7.6-1. The Inco SO_2-air method was considered preferred out of the four alternatives, specifically for cost effectiveness, technical feasibility and technical reliability, effects to the human environment and effects to the physical and biological environments. Cyanide destruction (Alternative 1) was unacceptable for cost effectiveness and effects to the physical and biological environments. Alkaline chlorination (Alternative 2) was considered unacceptable for effects to the physical and biological environments. And hydrogen peroxide was considered unacceptable for cost effectiveness, effects to the human environment, and effects to the physical and biological environments.

Table 2.4.7.6-1: Cyanide Destruction Summary of Alternatives Assessment

Category	Alternatives			
	1	2	3	4
	Alkaline Chlorination	Hydrogen Peroxide	Natural Degradation	Inco SO_2-Air
Cost Effectiveness	Unacceptable	Acceptable	Unacceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable	Preferred
Effects to the Human Environment	Acceptable	Acceptable	Unacceptable	Preferred
Effects to the Physical and Biological Environments	Unacceptable	Unacceptable	Unacceptable	Preferred
Potential Ability for Future Closure/ Reclamation Processes	Acceptable	Acceptable	Acceptable	Acceptable
Final	Unacceptable	Unacceptable	Unacceptable	Preferred

2.4.8 Water Supply

The processing plant will consume an estimated average of 3,044 m^3/d during operations, most of which will come from water recovered from the tailings storage facility (TSF), runoff collected within the operations area, and water from the dewatering of the open pit and underground mine. It is expected that a nominal amount of fresh water will be required in the process, estimated on an average year to be approximately 58 m^3/d (Appendix F to the revised EIS). This freshwater 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 freshwater as required by the source. The following four alternatives for the required freshwater supply for the Project were considered:

- Wabigoon Lake (Alternative 1);
- Thunder Lake (Alternative 2);
- Tree Nursery Ponds (Alternative 3); and
- Groundwater (Alternative 4).

2.4.8.1 Wabigoon Lake (Alternative 1)

To source water from Wabigoon Lake, water would need to be pumped approximately 6.5 km via pipeline to the site, which would result in the greatest cost of the four alternatives identified. There is also the potential financial risk of permitting and EA delays due to local stakeholder concerns over water taking from Wabigoon Lake.

Wabigoon Lake is of sufficient capacity to supply the freshwater demands of the Project; however, the construction of the required pipeline has the potential to negatively impact fish and fish habitat, as well as remove terrestrial habitat for the 6.5 km pipeline corridor. The quantity of freshwater required for the Project that would be taken from Wabigoon Lake would not be a measurable effect to the lake water levels or to fish and fish habitat.

Although water taking from Wabigoon Lake would not result in any measurable change in water levels of the lake, local stakeholders and Indigenous communities have expressed concern over any Project effects to Wabigoon Lake, including water taking, due to the recreational, economic and traditional land uses that people practice.

2.4.8.2 Thunder Lake (Alternative 2)

To source water from Thunder Lake, water would need to be pumped approximately 4.9 km via pipeline to the site, which wold result in the second greatest cost of the four water supply alternatives. There is also substantial financial risk of permitting and EA delays due to local stakeholder concern over water taking from Thunder Lake.

Thunder Lake is of sufficient capacity to supply the freshwater demands of the Project; however, the construction of the required pipeline has the potential to negatively impact fish and fish habitat, as well as remove terrestrial habitat for the 4.9 km pipeline corridor. This would result in greater environmental effects compared to Alternative 3 and less than Alternative 1. The quantity of freshwater required for the Project that would be taken from Thunder Lake would not be a measurable effect to the lake water levels or to fish and fish habitat.

Although water taking from Thunder Lake would not result in any measurable change in water levels of the lake, local stakeholders and Indigenous communities have expressed concern over any Project effects to Thunder Lake, including water taking, due to the recreational, economic and traditional land uses that people practice.

2.4.8.3 Tree Nursery Ponds (Alternative 3)

The refined water balance for the Project (Appendix F) have reduced the freshwater requirements to a point where the freshwater needs can be supplied from the irrigation ponds located in the former MNRF tree nursery. This alternative has the lowest associated costs compared to the other alternatives with the shortest pipeline requirement. It also has the lowest potential financial risk of permitting and EA delays as the ponds are man-made and less concerns have been raised by local stakeholders and Indigenous peoples regarding water taking from these ponds.

The tree nursery ponds are of sufficient capacity to supply the freshwater demands of the Project while taking no more than 5% of the daily inflow into the ponds. Water taking of no more than 5% of the daily inflows to the creek was determined to not effect fish or fish habitat and is well within the natural variation of Thunder Lake Tributaries 2 and 3. The pipeline required to pump water from the ponds to the process plant would follow the existing Tree Nursery Road and would result in the least amount of terrestrial habitat removal compared Alternatives 1 and 2.

Alternative 3 is preferred from a human environment perspective. There are no residents or water users along Thunder Lake Tributaries 2 and 3 and there has been less identified use of the tree nursery ponds by local stakeholders compared to Wabigoon Lake and Thunder Lake. It has been documented that Indigenous peoples do use the tree nursery ponds for bait fishing, which is a practice that could be continued with the selection of this alternative.

2.4.8.4 Groundwater (Alternative 4)

As described in the hydrogeology report (Appendix M), groundwater levels measured were consistently within 7 m of ground surface and on average within 3 m of ground surface. Groundwater level fluctuations were typically on the order of 1 m to 2 m.

Each of the nine groundwater stations was sampled six times for water quality with assaying including major ions and anions as well as dissolved metals. All of the groundwater monitoring stations produced water suitable for freshwater consumption. With respect to drinking water, some manganese and iron assays were above provincial standards; however, these elements would be removed during the potable water treatment process.

The ability of wells to supply freshwater has yet to be assessed. However, as the total seepage into the proposed open pit and underground mine workings is predicted to be only 1,320 m^3/d, the production of water by a reasonable number of ground wells is assumed to be inadequate. Work completed to date suggests that the overburden characteristics north of the former tree nursery may yield wells with sufficient capacity, however, this is yet to be determined. Due to the technical uncertainty of capacity, groundwater supply is not considered viable at this time.

2.4.8.5 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of alternatives.

Table 2.4.9.5-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
TMI_344-AC(1)-18	Eagle Lake First Nation Wabigoon Lake Ojibway Nation	The source(s) of the water supply	The majority of the water used at the Project will come from reclaimed process, water from dewatering the open pit and underground mines, and runoff collected within the perimeter ditch around the operations area. A small volume of fresh water will be required for operations which will come from the irrigation ponds on Thunder Lake Tributaries 2 and 3.
TMI_810-AC(1)-391	Wabauskang First Nation	Do the irrigation ponds naturally recharge? What if there is a drought year?	The irrigation ponds naturally recharge with runoff from the upstream catchments. Treasury Metals will limit their withdrawal from these ponds to 5% of the inflow, which will be monitored on a continuous basis to identify the flows available for withdrawal. The makeup water requirements from the irrigation ponds is a relatively small component of the overall water balance and the modelling shows that needs can be accommodated within the 5% that Treasury Metals will limit the withdrawals rates to. In the event there are extended dry periods, Treasury metals would be able to use the water treatment plant to produce the required makeup water in the process.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X10-3 (Water Supply — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

A number of concerns have been raised by Indigenous communities regarding Project effects to Wabigoon Lake and Thunder Lake. These lakes have been identified as being culturally and spiritually important to a number of communities, which greatly influenced the water supply alternatives assessment. Although some communities have identified the use of the tree nursery ponds for bait fishing, this activity can be continued with the selection of Alternative 3. Water supply from the tree nursery ponds will have the least effects to traditional land use and, as well as meeting the identified preferences of Indigenous peoples.

2.4.8.6 Selection of Preferred Alternative

A summary of the alternatives assessment for the water supply for the Project is provided in Table 2.4.8.6-1. The results indicated the tree nursery ponds (Alternative 3) as being the preferred alternative for sourcing freshwater supply for the Project. The tree nursery ponds will have sufficient quantity to serve the needs of the Project. The ponds also provide the low capital needs associated with infrastructure development, and closure costs, in addition to providing low risk to the permitting timeline and is considered preferred for cost effectiveness. The pipeline will follow the existing tree nursery road, which results in less environmental effects from habitat disruption. Additionally, there has been far less concern brought forward by stakeholders and Indigenous peoples regarding the tree nursery ponds compared to both Thunder Lake and Wabigoon Lake. Water supply from Wabigoon Lake (Alternative 1) and Thunder Lake (Alternative 2) were considered acceptable for all of the categories; however, based on concerns raised from local stakeholders and Indigenous peoples they were not desirable locations. Sourcing water from groundwater was considered unacceptable for cost effectiveness.

Table 2.4.8.6-1: Process Effluent Treatment Summary of Alternatives Assessment

Category	Alternatives			
	1	2	3	4
	Wabigoon Lake	Thunder Lake	Tree Nursery Ponds	Groundwater
Cost Effectiveness	Acceptable	Acceptable	Preferred	Unacceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Preferred	Preferred
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Acceptable	Acceptable
Final	Acceptable	Acceptable	Preferred	Unacceptable

2.4.9 Water Discharge Location

There are several lakes and creeks capable of receiving the effluent from the Project. The three significantly sized bodies of water closest to the Project site in order of distance are: Thunder Lake (approximately 4.9 km), Wabigoon Lake (approximately 6.5 km), and Hartman Lake (approximately 14.4 km). These distances are estimated pipeline lengths, as opposed to straight-line distances. Each of these lakes is of sufficient capacity to assimilate the effluent from the Project. Secondary to this is the creek systems that are capable of receiving effluent from the Project. These include the Thunder Lake Tributary 3 at the Tree Nursery Ponds (approximately 2.2 km), and Blackwater Creek (approximately 1.5 km). The following alternative water discharge locations were considered:

- Wabigoon Lake (Alternative 1);
- Thunder Lake (Alternative 2);
- Hartman Lake (Alternative 3);
- Thunder Lake tributary 3 at the Tree Nursery Ponds (Alternative 4); and
- Blackwater Creek (Alternative 5).

2.1.1.1 Wabigoon Lake (Alternative 1)

Wabigoon Lake is the second farthest receiver with an estimated 6.5 km long pipeline. To reach Wabigoon Lake, the effluent pipeline must cross multiple creeks and roads including the TransCanada highway and the CP Railway line. Wabigoon Lake is the source of drinking water for the City of Dryden and discharge of mining effluent into the lake via an underwater diffuser could present social acceptance issues. The pipeline will require the removal of terrestrial and aquatic habitat and will negatively impact species within the area.

2.4.9.1 Thunder Lake (Alternative 2)

Thunder Lake is a highly valued fishing lake within the local community. The lake is perceived as naturally beautiful and there are a number of cottages located on the lake. Because of the close proximity of Thunder Lake and its assimilative capacity, it is the preferred effluent receiving lake out of Wabigoon, Thunder and Hartman lakes. In the interest of preserving the perceived value of Thunder Lake, other effluent receivers will be sought. In addition to the human acceptance concern, delivery of discharge via pipeline to Thunder Lake has the potential to negatively impact fish and fish habitat in addition to the terrestrial habitat loss.

2.4.9.2 Hartman Lake (Alternative 3)

Hartman Lake is the farthest lake identified as a possible effluent receiver with an estimated pipeline distance of 14.4 km. To reach Hartman Lake, multiple creek and road crossings are required in addition to the relatively lengthy access road required for maintenance of the pipeline.

Due to the length of the pipeline, the area of land impacted is significantly larger than the alternatives and the cost to the Project is significantly increased. Although Hartman Lake is likely to be the most socially acceptable lake for effluent discharge, it is the highest capital cost alternative and is not a preferred alternative. With increasing distance comes a larger number of piping low points that will require drainage during winter stoppages to prevent freezing increasing the complexity of operation.

2.4.9.3 Thunder Lake Tributary 3 at the Tree Nursery Ponds (Alternative 4)

Discharge into the tree nursery ponds will require ongoing environmental monitoring due to a lack of assimilative capacity of the ponds and the creek flowing through the ponds. This creek is a tributary to Thunder Lake and may present the same social issues as discharging to Thunder Lake directly. In addition, this the irrigation ponds creek at the former MNRF tree nursery have been selected as the preferred freshwater source for the Project, although this does not negate the possibility of discharging effluent downstream of the freshwater intake. Due to these complications, effluent discharge to the tree nursery ponds is not the preferred option.

2.4.9.4 Blackwater Creek (Alternative 5)

Discharge into Blackwater Creek will require ongoing environmental impact monitoring due to the lack of assimilative capacity. Using this waterway will present an ongoing environmental operating cost for treatment to the Project. Consideration will need to be given to the physical flow rate receiving capacity of Blackwater Creek throughout the seasons with the possible regulation of flows and temporary storage of effluent within the water management system. Blackwater Creek intersects Anderson Road, the TransCanada highway, and the CP railway line. Due to these intersections, the flow capacity of these crossings will need to be determined and taken into consideration when determining the maximum effluent discharge flow rate. Further to this overall capacity of the creek will need to be taken into consideration to ensure the continued stable aquatic environment (e.g., creek channel erosion). Due to its proximity to the processing plant, tailings storage facility, and eventual destination in Wabigoon Lake versus Thunder Lake, Blackwater Creek is the preferred final effluent receiver.

2.4.9.5 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of these alternatives.

Table 2.4.9.5-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
Meeting on April 30, 2014	Wabauskang First Nation	Discharge in Wabigoon River system.	Discharged water will likely find its way into Wabigoon River system. Treasury Metals is very sensitive to this concern and has committed that effluent will meet Provincial Water Quality Guidelines (PWQO) during the operations phase of the Project.
Meeting on December 1, 2014	Naotkamegwanning First Nation	Whitefish Bay representatives spoke of visiting a gold mine in Bisset, Manitoba. This mine utilizes three ponds and recycles waste water so that no water leaves the site. Treasury was asked if this was possible at the Goliath site.	Treasury advised that recycling will occur to the extent possible, but it is expected that some water will need to leave the site.
TMI_361-AC(1)-35	Wabigoon Lake Ojibway Nation	Wabigoon Lake is the biggest wild rice area in Canada and is used as a spiritual and teaching area. Concerns about effluent flowing into Wabigoon Lake through Blackwater Creek. Wild rice is important to lifestyle and culture. Concerns about impacts to health and quality of life due to taking away food source.	Treasury Metals is committed to ensure that the effluent from the Project would meet Provincial Water Quality Objectives (PWQO) prior to being discharged into Blackwater Creek. The PWQO were established at levels that provide protecting to sensitive aquatic receptors.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X11-3 (Water Discharge Location — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Effects of the Project on water has been an overarching concern raised by all Indigenous communities engaged through the EA process. That is why Treasury Metals has committed that during operations it will treat all effluent leaving the site will meet PWQO. To clarify, each alternative water discharge location is of sufficient capacity to assimilate the fully treated effluent, and it is only the perception of effects to discharge location that is of concern.

Thunder Lake is a location that communities have identified as being commercially, culturally and spiritually important and do not support the direct discharge to the Thunder Lake system (including Thunder Lake Tributaries). Wabigoon Lake is also a location that communities have identified as commercially, spiritually and culturally important and do not support direct discharge from the Project into the Lake. These alternatives were not considered preferred for this reason.

Hartman Lake has been identified by Indigenous peoples as being the preferred location for effluent discharge; however, it would result in the greatest environmental effects and capital cost for the Project and was not considered preferred. A pipeline would have to run 14.4 km from the Project site to Hartman Lake, which would remove a large area of terrestrial habitat and cross multiple watercourses.

The preferred alternative for effluent discharge is Blackwater Creek due to the limited negative environmental and Project economic effects, and based on the balance of concerns and preferences raised by Indigenous communities.

2.4.9.6 Selection of Preferred Alternative

A summary of the alternative assessment of the water discharge location for the Project is provided in Table 2.4.9.6-1. Blackwater Creek (Alternative 5) is capable of meeting the Project's water discharge needs and is considered the preferred alternative). Water discharge would be treated, restricted, and controlled and is not expected to have any adverse effects. Aquatic life will not be adversely affected due to effluent, changes in flow, or changes in quality. All aspects of the creek including aquatic life will be monitored in all phases of development. Lastly, Blackwater Creek provides the lowest cost option and one of the options identified as preferable to members of the public. Discharge into Wabigoon Lake (Alternative 1) and Thunder Lake (Alternative 2) were considered acceptable; however, based on concerns raised by local stakeholders and Indigenous peoples they were not considered preferable. Hartman Lake was considered unacceptable for cost effectiveness due to the greater piping requirements and distance. Discharge to the tree nursery ponds (Alternative 4) was considered acceptable, but the lack of assimilative capacity of the ponds and the creek flowing through the ponds may require Treasury Metals to periodically not discharge water from site.

Table 2.4.9.6-1: Water Discharge Location Summary of Alternatives Assessment

Category	Alternatives				
	1	2	3	4	5
	Wabigoon Lake	Thunder Lake	Hartman Lake	Tree Nursery Ponds	Blackwater Creek
Cost Effectiveness	Acceptable	Acceptable	Unacceptable	Acceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Acceptable	Acceptable	Preferred
Effect to the Physical and Biological Environment	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Final	Acceptable	Acceptable	Unacceptable	Acceptable	Preferred

2.4.10 Watercourse Realignments

The preferred plant site location for the revised EIS (Section 2.4.11) is located to the north of the open pit and to the west of Tree Nursery Road. This location does not require a diversion the diversion of Blackwater Creek Tributary 2 around the Plant site. This negates the need for a watercourse realignment around the plant site.

2.4.11 Plant and Infrastructure Location

The Project proposes to maximize the use of infrastructure that is already in place and does not assess alternatives for the following features:

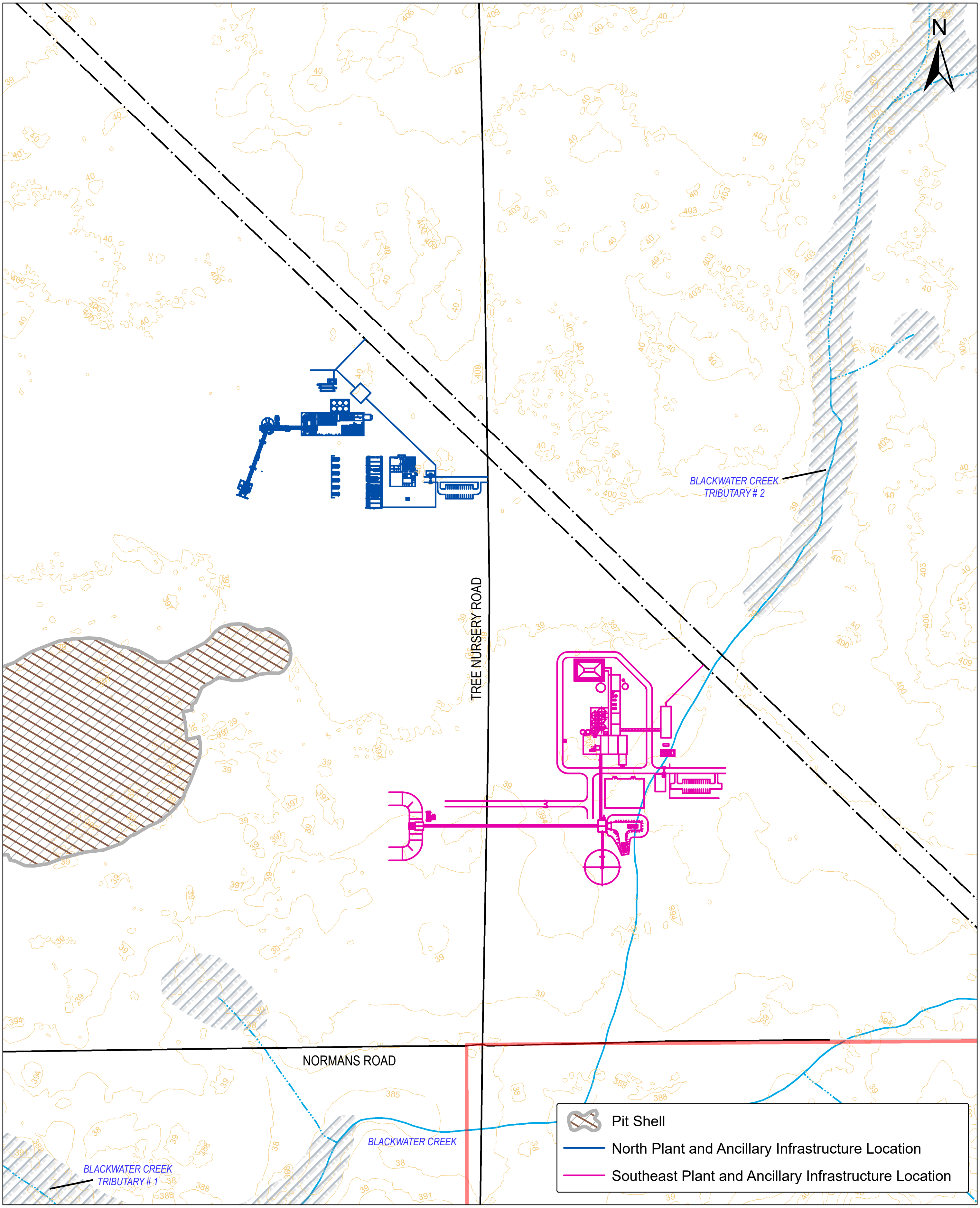
- Site access will be via existing roads such as Tree Nursery Road and Anderson Road. The company sees no benefit to creating an additional access road.
- Administrative offices and warehousing facilities are readily available at the current Project offices (former tree nursery offices) and the company sees no additional benefit to creating supplementary facilities expanded from the original footprint. Offices and administrative space will be incorporated within the processing plant facility to support the operational needs of the Project. Office and warehousing facilities therefore have not been assessed.

Excluding the aforementioned existing facilities, the processing plant and remaining infrastructure was assessed as part of a greater facility that will be constructed within a specified footprint. Treasury Metals sees no benefit to having separate facilities in differing locations. The overall site topography, location and layout of the proposed Project lend to the ability for all built facilities to be placed in one singular location.

Each facility location is required to be located in close proximity to the existing power line to limit construction costs for transmission line. The plant must also be at a sufficient distance to not interfere with mining operations while at the same time being placed close enough to not create a burden for transport of mineralized material.

The following alternative plant and infrastructure locations (Figure 2.4.11-1) were considered:

- Plant and infrastructure located northeast of the open pit area; and
- Plant and infrastructure located southeast of the open pit area.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	
Plant and Ancillary Infrastructure Alternatives	DESIGN: MP 28/03/2018 GIS: MP 28/03/2018 CHECK: MW 28/03/2018 REVIEW: MW 28/03/2018	
Figure 2.4.11-1	REV.2	

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

SCALE 1:7,000

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

0 100 200 300
Meters

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

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

2.4.11.1 North of Open Pit Area (Alternative 1)

The area to the north of the open pit is beneficial as it is further from the strike of the ore-body and hence has a lower probability of being located on the top of mineralized rock material that could be possibly mined in the future. The location to the north of the open pit would allow for a greater distance from the southern limit of the company's property and would provide a greater buffer from neighbouring residents on Tree Nursery Road. The topography and overburden conditions at this location would be well suited for the construction of the plant and infrastructure needs of the Project. Noise and air quality can be mitigated at this location to meet provincial permitting requirements.

Disadvantages of this location are that it will be marginally closer and marginally more visible to Thunder Lake Road residents. This location is situated on land that is under mining lease for use by Treasury Metals.

2.4.11.2 South and East of Open Pit Area (Alternative 2)

The area to the south and east of the open pit area has topography that would be ideal for the construction of the plant and infrastructure. Although this location is closer to the southern boundary, it is further from the Thunder Lake residents and thus less likely to be visible. Noise and air quality can be mitigated to meet permitting requirements.

This location is also located well within the boundaries of the Blackwater Creek watershed which will make the overall water management marginally simpler over the life of the Project. This location falls wholly within private land owned by Treasury Metals. It is likely that this location will require a diversion of Blackwater Creek Tributary 2 prior to construction, further impacting the aquatic environment.

2.4.11.3 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of these alternatives.

Table 2.4.11.3: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
TMI_613-AC(1)-286	Eagle Lake First Nation	Concerned that the site is close to water, should move the processing plant	Treasury Metals has identified an alternative location for the plant site, which could have reduced environmental effects, especially with respect to fish and fish habitat as the alternative location avoids the need for the diversion of Blackwater Creek.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X5-3 (Waste Rock Management — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

The locations of the alternative plant and infrastructure result in similar effects. However, the plant location to the south and east of the open pit would overprint a portion of Blackwater Creek Tributary 2, which would further impact the aquatic environment. Based on concerns raised by Indigenous communities, including Eagle Lake First Nation, it is preferable to have the processing plant located further away from water. Therefore, the alternative to the north and east of the open pit (Alternative 1) is preferred from the perspective of Indigenous communities.

2.4.11.4 Selection of Preferred Alternative

A summary of the alternatives assessment for the plant and infrastructure location is provided in Table 2.4.11.4-1. Locating the plant and infrastructure northeast of the open pit area (Alternative 1) is considered the preferred alternative. The primary difference between the plant and infrastructure locations is the need for diversion and the need to realign Blackwater Creek Tributary 2 prior to construction for the south and east location. However, the south and east location falls wholly within private land owned by Treasury Metals. Locating the plant and infrastructure southeast of the open pit area (Alternative 2) is considered acceptable but not preferred on the basis of having to realign Blackwater Creek Tributary 2.

Table 2.4.11.4-1: Plant and Infrastructure Location Summary of Alternatives Assessment

Category	Alternatives	
	1	2
	Plant and Infrastructure Located Northeast of Open Pit area	Plant and Infrastructure Located Southeast of the Open Pit area
Cost Effectiveness	Acceptable	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable
Effects to the Human Environment	Preferred	Acceptable
Effects to the Physical and Biological Environments	Preferred	Accepted
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable
Final Rating	Preferred	Acceptable

2.4.12 Low-grade Ore Stockpile Management

During the open pit phase of operations, low-grade ore will be stockpiled so it can 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. This stockpile is anticipated to contain approximately 2.2 million tonnes of low-grade ore and will be fully exhausted by the end of the mine life. The location for the low-grade stockpile needs to minimize the travel for mine haulage equipment from the open pit while providing ease of access to the main crusher.

No alternative locations for the low-grade ore (LGO) stockpile were considered in the revised EIS given its temporary nature (will be fed to the mill and depleted by the end of mine life) and the critical need to be located proximate to the crushing facilities. There is only one location adjacent to the crushing facility that does not conflict with the preferred alternatives of other site infrastructure, which is to the east of the crusher. The underground portal and a ventilation raise are located just north of the crusher, where positioning a stockpile north of the crusher would interfere with underground operations and plant infrastructure. Any alternative locations for the LGO stockpile would have been immediately ruled out as being uneconomic if not located directly adjacent to the crushing facilities.

2.4.12.1 Selection of Preferred Alternative

The only feasible location for the LGO stockpile is to the east and adjacent to the crushing facilities, which provides a compact site footprint and limits both environmental and socio-economic effects from the Project.

2.4.13 Aggregate Supply

Geochemical characterization of the deposit and rock at the mine site has indicated that the majority of the rock tested to data could be classified as being potentially acid generating (PAG). However, the drilling to date used to define the PAG nature of the development rock has been largely focused toward mineralized areas of the future open pit and there has been less sampling in peripheral areas of the pit. If a suitable on-site aggregate source of non-PAG material can be identified with low metal leaching (ML) potential (especially within peripheral open pit limits), this material could provide some or all of the aggregate material for the Project. The three options considered for the Project include:

- Mine rock that is non-PAG;
- Dedicated on-site aggregate pit(s); and
- Commercial off-site aggregate pits.

2.4.13.1 Mine Rock that is Non-PAG (Alternative 1)

The use of mine rock as aggregate material would reduce the volume of waste rock managed at the surface, and thus would allow the height of the waste rock storage area (WRSA), the only onsite feature that would be visible from Thunder Lake. In addition this option would avoid the need for the additional disturbance of habitat associated with developing an onsite aggregate pit(s). The use of mine rock as an aggregate source would also require the implementation of a screening program to segregate suitable non-PAG materials from PAG waste rock. This option is considered to be technically feasible, and is the preferred option if sufficient quantities of non-PAG waste rock that can be segregated for use.

2.4.13.2 On-site Aggregate Pit (Alternative 2)

On-site aggregate pits provide an acceptable alternative that can provide material for construction and Project development. However, no existing on-site aggregate pit(s) are present, requiring the development of additional pit(s) increasing the loss of habitat. Additional equipment would be required for extraction and, which would increase costs as well as dust and noise impacts. In addition, no on-site source has been identified to date that contains non-PAG rock suitable for aggregate construction. This option is acceptable, but less desirable that the other two alternatives.

2.4.13.3 Commercial Off-site Aggregate Pit (Alternative 3)

Using an off-site location would require the lowest capital cost, but likely much higher operating costs as the aggregate would need to be purchased and hauled to the site for use. However, this alternative would be similar to Alternative 1 in that no additional closure costs would be associated with this option. Hauling of the aggregate to the site would increase the greenhouse gas (GHG) emissions associated with the Project, and the increased traffic would put pressure on the local access routes. The use of an offsite commercial aggregate source would provide an assured source of non-PAG material reducing the risks should sufficient non-PAG waste rock be able to be segregated onsite. Additionally, this alternative would result in increased commercial opportunities and employment within the region. This option is acceptable and would be the preferred alternative if sufficient volumes of non-PAG waste rock cannot be segregated onsite.

2.4.13.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of alternatives.

Table 2.4.13.4-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
TMI_622-AC(1)-295	Eagle Lake First Nation	Segregation or separation of PAG and non-PAG mine rock is not possible, because all rock types have high potential to be acid generating. How will Treasury build tailings structures and other mine structure without using this rock fill?	Off-site aggregate that is non-PAG was considered as an alternative in the alternatives assessment. This alternative would avoid the concerns regarding segregation of non-PAG rock for construction of the TSF.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X14-3 (Aggregate Supply — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Treasury Metals have noted that, while the majority of the testing of rock at the Project has been identified as PAG, the drilling to define the PAG nature of the development rock has largely been largely focused on the mineralized areas of the future open. There has been less sampling in peripheral areas of the pit where non-PAG material with low metal leaching (ML) potential may be available for use as an onsite aggregate source. Treasury Metals are also investigating the availability of suitable aggregate from existing commercial aggregate suppliers in the region in the event sufficient to supply of non-PAG material can be segregated onsite. The use of onsite non-PAG waste rock as aggregate, is sufficient quantities can be segregated, would have an number of advantages, including being able to reduce the height of WRSA to lessen its visibility from Thunder Lake. If sufficient non-PAG material be unavailable onsite, obtaining aggregate from existing commercial suppliers in the region would be an acceptable option, however, this would increase the local traffic during construction. Developing an aggregate source onsite would likely have the greatest effects on members of Indigenous communities as it would require additional land disturbance and increase the potential effects to the terrestrial and aquatic environments at the site. This would in turn affect the ability to practice traditional uses of the such as hunting, trapping, fishing and harvesting of plants for consumption and ceremonial uses.

2.4.13.5 Selection of Preferred Alternative

A summary of the alternative assessment of alternative aggregate supply for the Project is provided in Table 2.4.13.5-1. The results of the alternatives assessment have identified using non-PAG waste rock as the preferred alternative as this would involve no new land disturbance, would lessen the visibility of the WRSA, and would have a lower overall cost. However, there may not be sufficient waste rock at the periphery of the open pit with suitable geochemical properties to meet the needs of the Project. In this case, sourcing aggregate from an existing commercial supplier of aggregate in the region would become the preferred alternative. A commercial off-site aggregate supply would provide a reliable source of suitable low risk aggregates that would contribute to the regional economy and employment. However, obtaining aggregate from an offsite commercial supplier would represent higher costs for the Project.

Table 2.4.13.5-1: Aggregate Supply Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Non-PAG Mine Rock	On-Site Aggregate Pit(s)	Commercial Off-site Aggregate Source
Cost Effectiveness	Preferred	Acceptable	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Preferred
Potential Ability for Future Closure/Reclamation Processes	Preferred	Acceptable	Acceptable
Final Rating	Preferred	Acceptable	Acceptable

2.4.14 Non-hazardous Solid Waste Management

Solid, non-hazardous waste will be generated by the Project throughout its life and will need to be managed and disposed of appropriately to avoid environmental impacts. Treasury Metals can either dispose of this waste in a third party facility, or to dispose of the waste in their own facility. The latter option would require Treasury Metals to either obtain an existing facility or develop a facility on site. In the case of disposal at an existing facility, the most suitable location would be the municipal facility in Dryden. Treasury Metals has confirmed with the City of Dryden (personal communication, Colin Hawkins, Operations Manager) that the City of Dryden has the capacity, and is willing to provide landfill services for non-hazardous solid waste. The following alternative non-hazardous solid waste disposal scenarios were considered:

- Acquire an off-site landfill (Alternative 1);
- Develop an on-site landfill (Alternative 2); and
- Truck waste to an existing off-site facility (Alternative 3).

2.4.14.1 Acquire an Off-site Landfill (Alternative 1)

Alternative 1 would have the second highest capital cost of the three alternatives with the purchase of an existing facility and a potential risk of seepage from the facility leading to long-term liabilities. There would also be a cost at closure to close out the facility along with labour requirements for regulatory post-closure monitoring.

Acquiring an existing facility to dispose of non-hazardous solid waste reduces the effects to the terrestrial and aquatic environments compared to constructing a new facility (Alternative 2). However, trucking non-hazardous solid waste to an existing facility would produce GHG and noise emissions, as well as adding to the local highway traffic.

2.4.14.2 Develop an On-site Landfill (Alternative 2)

Alternative 2 would have the highest capital cost of the three alternatives and a potential risk of seepage from the facility leading to long-term liabilities. There would also be a cost at closure to close out the facility along with post-closure monitoring. Additionally, there is substantial risk in permitting and EA delays associated with this alternative.

Developing an on-site facility to dispose of non-hazardous waste would have the greatest effects to the terrestrial and aquatic environments compared to utilizing an existing off-site facility. The Project footprint would need to be expanded to fit the facility on the Treasury Metals property while considering land disturbance to terrestrial and aquatic environments. This could subsequently have potential impacts to traditional land use and Aboriginal and Treaty Rights of the newly disturbed area, as well as could potentially affect spiritual and ceremonial sites, if present. That stated, there would be less GHG and noise emissions from this alternative compared to Alternatives 1 and 3 as the non-hazardous waste would not need to be transported off-site.

2.4.14.3 Truck Waste to an Existing Off-site Facility (Alternative 3)

Alternative 3 would have the lowest capital cost of the three alternatives, but the greatest operational costs. Additionally, the off-site non-hazardous waste company would be liable for the waste facility and there is much less risk in permitting and EA delays associate with this alternative.

Utilizing an existing facility to dispose of non-hazardous solid waste reduces the effect to the terrestrial and aquatic environments compared to constructing a new facility (Alternative 2). However, trucking non-hazardous solid waste to an existing facility would increase the GHG and noise emissions from the Project, as well as add to the local highway traffic.

2.4.14.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of alternatives.

Table 2.4.14.4-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
TMI_452-AC(1)-126	Metis Nation of Ontario	No alternatives assessment was considered for non-hazardous solid waste management. Please provide alternatives assessment or remove from assessment altogether.	An assessment of alternatives for non-hazardous waste management was included in the revised EIS.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X15-3 (Non-hazardous Solid Waste Management — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

An alternatives assessment was completed as part of the revised EIS, which addresses the concern raised by MNO, and demonstrates the process used by Treasury Metals arrived at the preferred alternative. Transporting non-hazardous waste to an existing off-site facility is preferred from an environmental perspective and a Project economic perspective. Disposing waste on-site would further remove land that Indigenous communities could use for traditional land uses or to practice their Aboriginal and Treaty Rights and would have to be remediated for use in post-closure. The preferred alternative is Alternative 3 as it will have the least effects on Indigenous peoples.

2.4.14.5 Selection of Preferred Alternative

A summary of the alternative assessment for the management of non-hazardous waste is provided in Table 2.4.14.5-1. Alternatives considered for the management of non-hazardous waste are negligible due to the close proximity of the Project to the licenced facilities around the community of Dryden. Alternatives to trucking non-hazardous waste to an existing off-site landfill will require long-term monitoring and carry potential closure liabilities, making it less attractive from a cost-effectiveness perspective. Therefore, the preferred option is the trucking of non-hazardous waste to an existing licenced landfill facility (Alternative 3) and is preferred for cost effectiveness, technical feasibility and technical reliability, effects to the human environment, effects to the physical and biological environments and potential ability for future closure/reclamation processes. Alternatives 1 and 2 are considered acceptable for all categories, but are less preferable to Alternative 3. Treasury Metals may give consideration to controlled burning in accordance with environmental regulations and timing. Burning would include clean wood, and cardboard waste to reduce waste volumes.

Table 2.4.14.5-1: Non-hazardous Solid Waste Management Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Acquire an off-site landfill	Develop an on-site landfill	Truck waste to an existing off site landfill
Cost Effectiveness	Acceptable	Acceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Preferred
Effects to the Human Environment	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Preferred
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Preferred
Final Rating	Acceptable	Acceptable	Preferred

The waste produced at the Project site would be temporarily stored on-site and regularly transported by trucks to an off-site licenced facility which has currently not been identified. It has been confirmed in discussions with the appropriate authorities (City of Dryden, Public Works Operations Manager) that the City of Dryden Highway 502 Landfill site will have the capacity for the Project's waste disposal needs. This option allows for liabilities to be transferred to the landfill facility operator, which would benefit cost-effectiveness. Transport would increase traffic along local roads, thereby increasing the risk of potential collisions and spills, and relies on the services and management of the selected contractor.

2.4.15 Hazardous Solid Waste Management

Although volumes are expected to be small, there will be hazardous wastes generated by the Project throughout its life that will need to be managed and disposed of appropriately to avoid environmental impacts. Treasury Metals can use one of the following options for managing the relatively small volume of hazardous wastes generated:

- Acquire an off-site hazardous waste management facility (Alternative 1);
- Develop an on-site hazardous waste disposal management (Alternative 2); and
- Truck hazardous waste to an existing off-site management facility (Alternative 3).

2.4.15.1 Acquire an Off-site Hazardous Waste Disposal Facility (Alternative 1)

Acquiring an off-site hazardous waste disposal facility would add substantial capital costs to the Project with the purchase of the facility, and substantial operational costs to the Project having to hire additional labourers to operate the facility. There is risk in both permitting and EA delays associated with this alternative, which could take over a year to be approved. Additionally, there is potential liability risk to Treasury Metals for the facility and the transportation of hazardous solid waste, which would require long-term management and monitoring.

From an environmental perspective, there would be an increase in GHG and noise emissions from the transportation of hazardous waste off-site. There is also a greater potential for spills into the environment during the transportation of hazardous waste. That stated, utilizing an existing facility to dispose of hazardous solid waste reduces the effect to the terrestrial and aquatic environments compared to constructing a new facility (Alternative 2), which also reduces the potential effects to traditional land use, Aboriginal and Treaty Rights, and spiritual and ceremonial sites, if present.

2.4.15.2 Develop an On-site Hazardous Waste Disposal Facility (Alternative 2)

Developing an on-site hazardous waste disposal facility would constitute the greatest additional capital costs to the Project and the greatest financial risk out of the three alternatives. There is substantial economic risk in facility permitting and EA delays, which could take over a year to be approved. Additionally, there is potential liability risk to Treasury Metals for the facility which would require long-term management and monitoring. This alternative, along with Alternative 1, would have the greatest closure costs in having to close out the facility and remediating the site.

Developing an on-site facility to dispose of hazardous solid waste would have the greatest effects to the terrestrial and aquatic environments compared to utilizing an existing off-site facility. The Project footprint would need to be expanded to fit the facility on the Treasury Metals property while considering land disturbance to terrestrial and aquatic environments. This could subsequently have potential impacts to traditional land use and Aboriginal and Treaty Rights of the newly disturbed area, as well as could potentially affect spiritual and ceremonial sites, if present. There is also the potential for seepage to escape the hazardous solid waste facility and migrate to surface waterbodies and negatively affect water quality. That stated, there would be reduced GHG and noise emissions from this alternative compared to Alternatives 1 and 3 as the non-hazardous waste would not need to be transported off-site.

2.4.15.3 Truck Hazardous Waste to an Existing Licenced Off-site Facility (Alternative 3)

Trucking hazardous waste to an existing licenced off-site facility would be the most economic alternative out of the three options with the least capital costs. This alternative also provides the least amount of liability risk and risk of Project delays from permitting as Treasury Metals would not be responsible for the transportation or disposal of the waste once the licenced facility takes it from site. Additionally, no closure costs would be required for this.

From an environmental perspective, there would be an increase in GHG and noise emissions from the transportation of hazardous waste off-site. There is also a greater potential for spills into the environment during the transportation of hazardous waste. That stated, utilizing an existing facility to dispose of hazardous solid waste reduces the effect to the terrestrial and aquatic environments compared to constructing a new facility (Alternative 2), which also reduces the potential effects to traditional land use, Aboriginal and Treaty Rights, and spiritual and ceremonial sites, if present.

2.4.15.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of these alternatives.

Table 2.4.15.4-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
TMI_453-AC(1)-127	Metis Nation of Ontario	No consideration of alternatives for hazardous solid waste management has been provided in the alternatives assessment. The justification that "…the potential negative effects on the physical, biological and human environment are unacceptable when compared to transporting the material to an existing licenced [sic] facility." Is inappropriate and clearly is at cross purposes with the intended outcome of an alternatives assessment. Instead the alternatives should have been outlined, including the potential negative effects to allow for a comparison of effects. Please provide an alternative assessment for hazardous waste management.	An assessment of alternatives for hazardous waste management was included in the revised EIS.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X16-3 (Hazardous Solid Waste Management — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

An alternatives assessment was completed as part of the revised EIS, which addresses the request of MNO and shows the process used by Treasury Metals to arrive at the preferred alternative. Transporting hazardous solid waste to an existing off-site facility is preferred from an environmental perspective and a Project economic perspective. Disposing waste on-site would further remove land that Indigenous communities could use for traditional land uses or to practice their Aboriginal and Treaty Rights and would have to be remediated for use in post-closure. There is also the risk of seepage escaping the hazardous solid waste facility on-site and negatively affecting the water quality in surface waterbodies. The preferred alternative is Alternative 3 as it will have the least effects on Indigenous peoples.

2.4.15.5 Selection of Preferred Alternative

A summary of the alternatives assessment for the management of hazardous solid waste is provided in table 2.4.15.5-1. The preferred alternative is trucking hazardous waste off-site by licenced contractors to licenced management facilities (Alternative 3), which was preferred for cost effectiveness and effects to the human environment. There is a reduced overall capital and operational costs of Alternative 3 compared to Alternatives 1 and 2, with low liability risk and risk of Project delays due to permitting of a facility owned by Treasury Metals. Utilizing an existing facility also reduces the potential environmental effects of constructing a new facility on undisturbed land. Acquiring an off-site hazardous waste management facility (Alternative 1) is unacceptable for cost effectiveness. Developing an on-site hazardous waste management facility is considered unacceptable for cost effectiveness, effects to the human environment, and potential ability for future closure/reclamation processes.

Table 2.4.15.5-1: Hazardous Solid Waste Management Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Acquire an Off-site Hazardous Waste Management Facility	Develop an On-site Hazardous Waste Management Facility	Truck Hazardous Waste to an Existing Off-site Management Facility
Cost Effectiveness	Unacceptable	Unacceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Unacceptable	Preferred
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Unacceptable	Acceptable
Final Rating	Unacceptable	Unacceptable	Preferred

2.4.16 Domestic Sewage Management

During operations, the Project processing plant is expected to support the sanitary requirements of approximately 50 persons during the day shift. During construction, the requirement expands to around 400 persons. Due to the immediate proximity of the city of Dryden, neither a long-term construction camp nor permanent residences will be constructed for the Project. Given the large discrepancy in waste treatment demand for the construction versus operating phases, it is proposed that all sanitary waste generated during the construction phase be handled by an approved third party contractor and processed offsite. During the operating phase of the Project, the following methods of treatment were reviewed and will be considered further in later stages of the Project:

- Septic tanks and tile fields (Alternative 1);
- Package sewage treatment plant (Alternative 2); and
- Trucking domestic sewage waste off-site to licensed facility (Alternative 3).

2.4.16.1 Septic Tanks and Tile Fields (Alternative 1)

The septic system presents an alternative that is of low risk to Project development and offers reliability. The septic system will require additional capital expenditures for development and closure, in addition to increasing the land base for the Project, causing additional loss to terrestrial habitat. Septic systems also have the potential to leach into the environment, potentially impacting groundwater resources used for human consumption. Use of a septic system is an option for future discussion once domestic sewage rates have been calculated for the operating facility.

2.4.16.2 Package Sewage Treatment Plant (Alternative 2)

The package sewage treatment plant presents an alternative that is of low risk to Project development and offers cost-certainty. The sewage treatment plant will require capital expenditures for development and closure, in addition to increasing the land base for the Project, and therefore further disturbing terrestrial habitat. A sewage treatment plant is considered to be an option for future discussion once domestic sewage rates have been calculated for the operating facility.

2.4.16.3 Trucking Domestic Sewage Waste Off-site to Licensed Facility (Alternative 3)

Off-site treatment presents an option that requires limited closure costs, and initial capital expenditures. The trucking of domestic waste to an off-site alternative has a higher operational cost, and dependence on an external service provider. This option provides no capacity constraints and, due to external disposal, no additional environmental impacts are expected. It has been confirmed in discussions with the appropriate authorities (Dean Walker, City of Dryden, Waterworks Manager) that the City of Dryden Sewage Treatment Plant will have the capacity for the Project's disposal needs.

2.4.16.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X17-3 (Domestic Waste Management - Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Due to the relatively low sanitary requires of the Project based on the projected on-site workforce, treatment or storage of domestic sewage is not considered to be the preferred alternative. This would require an expanded Project footprint with the inclusion of either septic tanks or package sewage treatment system that could potentially disrupt the terrestrial and aquatic environments. This could potentially have an effect on Indigenous peoples' traditional land use and Aboriginal and Treaty Rights, as well as spiritual and ceremonial sites, if present.

2.4.16.5 Selection of Preferred Alternative

A summary of the alternatives assessment for the management of domestic sewage is provided in Table 2.4.16.5-1. All alternatives provide an effective and reliable alternative to meet Project domestic sewage management needs. The selected preferred alternative is that of off-site treatment (Alternative 3), which provides no capacity constraints and, due to the variable domestic sewage needs presented though construction and initial operations, allows for certainty that all domestic sewage will be handled in the proper manner. Alternative 3 is preferred for technical feasibility and technical reliability and potential ability for future closure/reclamation processes. Additionally, off-site storage presents no anticipated environmental impacts on sites besides vehicular accident. Utilization of septic tanks and tile fields is considered acceptable for all categories, but is less desirable than Alternative 3. Utilization of a package sewage treatment plant is considered preferred for cost effectiveness and acceptable for the other categories, but is considered less desirable to Alternative 3 due to the close proximity of licensed facilities to the Project. Once domestic sewage rates have been observed use of a septic system, or sewage treatment plant will be considered with consultation with the appropriate regulatory bodies.

Table 2.4.16.5-1: Domestic Waste Management Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Septic tanks and tile fields	Package sewage treatment plant	Trucking domestic sewage waste off-site to licensed facility
Cost Effectiveness	Acceptable	Preferred	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Preferred
Effects to the Human Environment	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable	Preferred
Final Rating	Acceptable	Acceptable	Preferred

2.4.17 Explosives Storage Facility

To facilitate the mining operations, blasting will be used at the Goliath Gold Project. Although Treasury Metals plan to keep the volume of explosives stored on-site to a minimum, there will be a need to store some explosives on-site to ensure operations are not delayed. The following alternative locations for the storage of explosives were considered:

- Northwest end of the former tree nursery (Alternative 1); and
- North of the deposit, east of the Tree Nursery Road (Alternative 2).

2.4.17.1 Northwest End of the Former Tree Nursery (Alternative 1)

Due to the location of Alternative 1, which allows for a larger explosives facility compared to Alternative 2, more explosive would be able to be stored at the site. This would decrease the frequency that explosives would need to be transported to site and would therefore decrease the overall costs. The location is also situated on previously disturbed land in the tree nursery, decreasing the effects to undisturbed terrestrial habitat. Further to this the location allows for Treasury to mitigate the security risks associated with an explosive facility as the area is currently excluded from public use due to current fencing, in addition to the security needs to be constructed with the facility. The current road that would be used to transport explosives to and from the facility would need to be upgraded to accommodate the increased traffic and to allow for safe transportation. This could have potential effects to the terrestrial habitat with increased construction or an increased road width.

2.4.17.2 North of the Deposit, East of the Tree Nursery Road (Alternative 2)

Due to the location of Alternative 2, which is restricted in size due to the proximity to employees and infrastructure, that facility would not be able to hold the same volume of explosives compared to Alternative 1. This would require more frequent deliveries of explosives to the site and would therefore increase the overall costs. Similarly to Alternative 1, Alternative 2 is sited on preciously disturbed land in the former tree nursery, decreasing the effects to undisturbed habitat. Additionally, this alternative would use Tree Nursery Road to access the explosives facility, which can accommodate the increased traffic of explosives transportation. This alternative will have less potential effects to the terrestrial environment compared to Alternative 1.

2.4.17.3 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X18-3 (Explosives Storage Facility — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Although Alternative 1 has the potential to have slightly greater effects to the terrestrial environment compared to Alternative 2, safety is the number one consideration for Treasury Metals in all aspects of the Project. The location of Alternative 1 allows for Treasury to mitigate the security risks associated with an explosive facility as the area is currently excluded from public use due to current fencing, in addition to the security needs to be constructed with the facility. That said, Alternative 1 would slightly increase the area of terrestrial habitat disturbed, which could potentially affect Indigenous communities' traditional land uses and Aboriginal and Treaty Rights.

2.4.17.4 Selection of Preferred Alternative

A summary of the alternatives assessment for the explosives storage facility is provide in Table 2.4.17.4-1 Both options present relatively similar alternatives in that both are easily accessible by current roads and infrastructure and both lie on relatively flat ground that has been previously disturbed. Each facility would maintain an equal footprint. The main benefit of the location on the extreme north end of the Tree Nursery property (Alternative 1) is the possible ability to hold a greater volume of explosives due to its distance from employees or infrastructure. Further to this the location allows for Treasury to mitigate the security risks associated with an explosive facility as the area is currently excluded from public use due to current fencing, in addition to the security needs to be constructed with the facility. The location at the northwest end of the Tree Nursery facilities has been selected as the preliminary location due to its proximity to the Project and the minimal environmental impact in access development that would be required for the location, opposed to the location north of the nursery facility which would require road upgrades potentially impact terrestrial habitat. Based on the assessment, Alternative 1 is the preferred alternative for cost effectiveness and effects to the human environment. Alternative 2 is acceptable for all categories, but is less desirable to Alternative 1 due to the capacity restrictions and safety considerations.

Table 2.4.17.4-1: Explosives Storage Facility Summary of Alternatives Assessment

Category	Alternatives	
	1	2
	Northwest End of the Former Tree Nursery	North of the Deposit, East of the Tree Nursery Road
Cost Effectiveness	Preferred	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable
Effects to the Human Environment	Preferred	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable
Final Rating	Preferred	Acceptable

2.4.18 Electrical Power Supply

It has been conservatively estimated that the Goliath project will require a maximum of 9.9 MW of electrical power to sustain operations at peak production. During the initial years of proposed mining, until the underground operations are in full production, the mine will use an estimated maximum of 6.8 MW. The primary power demand for the Project will come from the grinding and milling circuit, underground production and underground ventilation requirements. One local Hydro One 22 kV line is currently supplying the Project offices but it has been indicated that there is not sufficient capacity on this line to support mine operations.

The closest major power line is the Hydro One M2D 115/230 kV line which lies approximately 600 m northeast of the open pit. The Project is in the beneficial position to make use of this line for power supply as it has been indicated by the appropriate authorities that there is a provisional capacity available.

The following alternative electrical power supply scenarios were considered:

- Use of existing Hydro One power infrastructure (Alternative 1);

- Develop an on-site Natural Gas power generation facility (Alternative 2); and
- Develop Alternative means of power generation such as wind or solar (Alternative 3).

2.4.18.1 Use of Existing Hydro One Power infrastructure (Alternative 1)

Power is planned to be supplied to the Project from the 115 kV overhead M2D powerline which is owned, operated and maintained by Hydro One and is routed in an existing easement and cuts through the property. The company has contacted both Hydro One and the Independent Electrical System Operator to confirm that there is provisionally sufficient supply on the M2D line to power the Project over the course of its life.

The scope of the main power supply for the plant and related infrastructure for the initial open pit mining operation includes:

- Installation of an overhead line take off structure at a proposed tee-off point and construction of approximately 50-100 m of an 115 kV overhead line from the tee-off point to the plant HV switchyard. This scope and cost will likely be borne by Hydro One, with costs reimbursed through a signed take-off agreement.
- Procurement and construction of a 115 / 4.16 kV, 1 x 5 / 7.5 MVA transformer / outdoor switchyard at the process plant site (costs borne by the project).

For the future underground mine operation, a duplicate circuit breaker and 1 x 5 / 7.5 MVA transformer will be procured and installed to provide the additional underground mine 5 kV substation/switchgear. The costs required for this additional transformer and switchgear will be deferred until year 3.

This alternative represents the lowest capital cost alternative and is generally similar in operating costs to the other options. As much of the power generated in Ontario is now from clean sources this also represents the alternative with the least environmental impact overall.

This alternative further benefits from the nearly ideal location of the M2D power line and the ability to locate the processing facility as close to this line as possible. As such, the power supply as proposed represents the smallest footprint of the considered alternatives.

2.4.18.2 On-site Natural Gas Power Generation Facility

Due to the proximity of an existing Trans-Canada natural gas main to the site, natural gas generators have been identified as an alternative to generate the power required for the process plant and associated mine infrastructure.

Continuous 2000kW output natural gas generators are proposed and have been used to develop the capital costs for this option as industry feedback suggests generators larger than this size are uneconomical. For the initial open cut mining operation (years 1-4), four generators will supply the initial power requirements and provide N+1 redundancy to allow for generator planned and unplanned maintenance. For the future underground mine operation, an additional two generators will be installed to meet the additional underground power demand as well as continue to provide the system N+1 equipment redundancy.

The individual cost of each 2MW, 4160 V generator is approximately $2.4M CAD, which includes the supply and installation of:

- The generator and natural gas driven engine;
- Housing;
- Synchronous panels; and
- Disconnect and Load share equipment.

The estimate fuel consumption for one generator at 100% of the rated load (2000kW output power) is 17.08 MMBTU/hr, which corresponds to a respective generator mechanical and electrical efficiency (ISO 30146/1) of 42.2% and 40.0%.

Compared to a HV transformer, the generators are also maintenance intensive on an operating hour basis. The units need to be taken offline frequently for planned maintenance, i.e., oil changes, etc., which reinforces the requirement for the N+1 equipment redundancy. The operating life of the equipment is approximately 60,000 hours per generator. When the equipment exceeds 60,000 hours, a complete replacement is recommended.

This option represents a higher capital investment cost in relation to the existing Hydro One infrastructure. Though it does offer a benefit of slightly lower operation costs over the life of the Project. While the operation of this type of facility is certainly feasible over the course of the Project the company feels that the additional footprint, costs and environmental greenhouse gas emissions do not justify this alternative.

2.4.18.3 Develop Alternative Power Generation (Wind or Solar)

These power sources have developed in a meaningful way in the recent past and technology is helping to bring down the cost and up the availability of such power sources.

As part of this assessment it was concluded that the Project could not justify the additional risk of implementation of such technologies that have yet to be proven on a large scale industrial basis and certainly has not been proven for an existing operational mine.

Additional drawbacks of these systems are the extremely large footprints required, the very high capital costs needed for construction and the possible visual disturbance created by infrastructure such as windmills.

For these reasons, the use of alternative power generation has been ruled out of the screening process for this assessment.

2.4.18.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. The following table lists issues raised through the engagement process that are relevant to the evaluation of these alternatives.

Table 2.4.18.4-1: Indigenous Community's Influence on Alternative Selection

Information Location	Indigenous Community	Concerns	Response / Influence on Assessment
TMI_455-AC(1)-129	Metis Nation of Ontario	Section 2 of the EIS specifies that the "[p]ower supply will be taken directly from the existing 115 kV Hydro One M2D with an on-site substation … Treasury sees no benefits in creating a separate power source and no other options have been assessed." This misses the point of an alternatives assessment and does not fulfill the CEAA requirements of the EIS Guidelines. Further, there is no discussion of related piping and power infrastructure as part of the alternatives assessment.	An alternatives assessment for power supply options has been included as part of the revised EIS.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X19-3 (Electrical Power Supply — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

An alternatives assessment for power supply was completed as part of the revised EIS, which addresses the request of MNO and shows the process used by Treasury Metals to arrive at the preferred alternative. Based on the alternatives assessment for the electrical power supply for the Project, the use of the existing hydro line provides the most compact site footprint and the least GHG emissions. This benefits Indigenous communities by limiting the undisturbed habitat overprinted by the Project, allowing for more available land for Indigenous peoples to practice traditional land uses and Aboriginal and Treaty Rights. Issues have been raised about GHG emissions by a number of Indigenous communities. Consideration of this issue is implicit in the consideration of the alternative power supply.

2.4.18.5 Selection of Preferred Alternative

A summary of the alternatives assessment for the electrical power supply for the Project is provided in Table 2.4.18.5-1. As previously stated in Section 2.3.9.1, the use of existing Hydro One power supply infrastructure represents the lowest capital cost alternative and is generally similar in operating costs to the other options. As much of the power generated in Ontario is now from clean sources this also represents the alternative with the least environmental impact overall. This alternative also represents the lowest overall footprint of all the options with the ability to locate the power supply infrastructure as needed to suit the mining and milling operations. The use of the existing Hydro One M2D power line is selected as the preferred alternative for cost effectiveness, technical feasibility and technical reliability, effects to the physical and biological environments, potential ability for future closure/reclamation process. Developing an on-site natural gas power generation facility is considered acceptable for all categories, but is less desirable than Alternative 1. Developing alternative means of power generation such as wind or solar (Alternative 3) is considered unacceptable for cost effectiveness, technical feasibility and technical reliability and effects to the human environment.

Table 2.4.18.5-1: Electrical Power Supply Management Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Use of Existing Hydro One power infrastructure	Develop an on-site Natural Gas power generation facility	Develop Alternative means of power generation such as wind or solar
Cost Effectiveness	Preferred	Acceptable	Unacceptable
Technical Feasibility and Technical Reliability	Preferred	Acceptable	Unacceptable
Effects to the Human Environment	Acceptable	Acceptable	Unacceptable
Effects to the Physical and Biological Environments	Preferred	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Preferred	Acceptable	Acceptable
Final Rating	Preferred	Acceptable	Unacceptable

2.5 Project Alternatives — Closure

Treasury Metals is dedicated to the rehabilitation of the site over the life of the Project. Over the course of the closure phase, mining is completed and final reclamation measures for the site and related infrastructure are assessed and conducted. Closure methods have been selected to be consistent with Provincial regulatory needs and have been considered in order to prevent potential environmental effects. The following components were assessed:

- Open pit mine;
- Underground mine;
- Waste rock storage area (WRSA);
- TSF;
- Buildings and equipment;
- Infrastructure; and
- Minewater management and drainage.

A detailed certified Closure Plan (including financial reassurance) is required under Ontario Regulation 240/00 of the *Mining Act*. This detailed plan will be submitted by Treasury for review by applicable government agencies, First Nations, and general public. A conceptual closure plan based on preferred alternatives identified below is detailed in Appendix KK.

2.5.1 Open Pit Closure

The main objective for closure of the open pit is to bring the open pit area to a state that is both chemically stable, as well as physical safe. The closure of the open pit will follow the Mine Reclamation Code of Ontario (the Code) pursuant to the Ontario *Mining Act*. Section 21 of the Code provides for the following approaches for reclamation and closure of open pits in the order of their preference:

- Backfilling (with mineral waste; preferred if feasible);
- Flooding;
- Sloping (if flooding or backfilling are not appropriate);
- Boulder fencing or berming (if all of the above are impractical); and
- Chain link fencing (if none of the above is practicable).

The code also acknowledges that the process of closure may include various methodologies before the final closure and reclamation of the open is completed.

The following alternatives have been assessed for open pit closure:

- Natural flooding; and
- Enhanced flooding.

Backfilling with mineral waste was omitted from the assessment as it has already been selected as an alternative that a substantial amount of waste rock will be backfilled during operations. The cost to place the additional mine waste stored on surface would be cost prohibitive and would not allow the Project to move forward.

As the waste rock is PAG, the option of stockpiling boulders for a perimeter barrier is not available therefore a berm will placed around the perimeter of the open pits as per Section 25 of the Mine Reclamation Code. Clean, locally sourced material will be used to construct a perimeter berm.

The final goal of the open pit closure is to have an overflow water quality that is acceptable for passive discharge with no further treatment.

2.5.1.1 Natural Flooding (Alternative 1)

Treasury has defined the term natural flooding to include the flow of water by gravity or infiltration from groundwater to the open pit with no adjustments to the overall site water management. All pit inflow will be directly from precipitation falling into the pit, water flow from directly surrounding the pit and ground water infiltration. As the existing water table in the open pit area is near to the surface, it is anticipated that the fully flooded pit will subsequently rise to the surface level and overflow at the current Blackwater Creek Tributary directly to the south of the proposed open pit. An outlet would be constructed at final closure to facilitate this overflow.

This method of filling will provide exposure of both the open pit walls and mine waste that has been previously placed into the completed open pits and create the potential for acid rock drainage and metal leaching to occur. The time needed to create a stable state for open pit water quality characteristics will also be increased with this methodology. That stated, Treasury Metals has committed to batch treat the water in the open pit so that the discharge from the pit overflow into Blackwater Creek meets PWQO or is less than background. Alternative 1 would require more batch treatment than Alternative 2, which increases the overall cost of this alternative. Additionally, there is greater liability risk to Treasury Metals with the greater time it will take for the site to be closed out.

2.5.1.2 Enhanced Flooding (Alternative 2)

Enhanced flooding can be defined as using additional water sources to achieve a higher rate of total water inflow into the completed open pit. This would be done by actively managing the proposed water management systems through the closure phase to ensure that any surface water runoff from the operations area be directed towards and eventually into the open pit. Most of these systems, such as drainage berms and ditches would already be in place and would solely necessitate the delay of the closure of these systems. Tailings water present in the TSF would be withdrawn, treated and used to help fill the open pit. The open pit would also continue to receive groundwater inflow. Much of the enhanced flooding would be passive in nature in that the overall site layout has been designed for much of the natural water flow to be directed towards the open pit.

This method of filling will provide for less exposure of both the open pit walls and mine waste that has been previously placed into the completed open pits and in turn will reduce the time available for potential acid rock drainage and metal leaching to occur. The time needed to create a stable state for open pit water quality characteristics will also be reduced. Treasury Metals has committed to batch treat the water in the open pit so that the discharge from the pit overflow into Blackwater Creek meets PWQO or is less than background. Alternative 2 would require less batch treatment than Alternative 1, which decreases the overall cost of this alternative. Additionally, there is less liability risk to Treasury Metals with a much shorter time for the site to be closed out.

2.5.1.3 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X20-3 (Open Pit Closure — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

The greatest distinction between the two alternatives is the difference in timelines for the open pit to fill, and the site to be fully closed. The site will not be accessible to Indigenous peoples for use until the site has been deemed safe, which would not occur until the pit has filled with water. Therefore, allowing the open pit to flood naturally would have a prolonged effect on Indigenous peoples’ traditional land uses and Aboriginal and Treaty Rights. Enhanced flooding would shorten the duration the site is unavailable and is considered preferred from this perspective.

2.5.1.4 Selection of Preferred Alternative

A summary of the alternatives assessment for open pit closure is provided in Table 2.5.1.4-1. The preferred alternative is to use enhanced flooding (Alternative 2). Little to no additional work will be needed to employ this alternative in that the majority of the water management systems will be in place at the time of closure. Enhanced flooding will reduce the time for flooding which will subsequently reduce the time needed for the closed open pit to reach a stable chemical state. This reduction in time further decreases risks or uncertainties while the open pit is in the closure phase. Alternative 2 is considered preferred for cost effectiveness, effects to the human environment and effects to the physical and biological environment. Natural flooding (Alternative 1) is considered acceptable for all categories, but less desirable than Alternative 2.

Table 2.5.1.4-1: Open Pit Closure Summary of Alternatives Assessment

Category	Alternatives	
	1	2
	Natural Flooding	Enhanced Flooding
Cost Effectiveness	Acceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Preferred
Effects to the Physical and Biological Environments	Acceptable	Preferred
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable
Final Rating	Acceptable	Preferred

2.5.2 Underground Closure

Underground workings will be closed out in accordance in Ontario Regulation 240/00, amended O.Reg. 307/12, and the Code of the Ontario *Mining Act*. Section 24(2) of Regulation that states the following to closure of underground mining activities:

> *All…mine openings to surface that create a mine hazard shall be stabilized and secured; and*
>
> *All surface and subsurface mine workings shall be assessed by a qualified professional engineer to determine their stability, and any surface areas disturbed or likely to be disturbed by such workings shall be stabilized.*

Due to the nature of these regulations, no alternatives were considered as part of the EIS. All infrastructure and equipment of value in the Project's 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, and cause no effect to the overall water management on site.

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

2.5.2.1 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

As the underground mine will be closed out in accordance with Ontario Regulation 240/00, amended O.Reg. 307/12, and the Code of the Ontario *Mining Act*, there appears to be no potential effect following closure. The underground mine workings will be both physically and chemically stable using natural flooding and will be isolated from the surface.

2.5.2.2 Selection of Preferred Alternative

Natural flooding of the underground working is the preferred alternative for the Project. No other alternatives were considered. Portal entrance will be closed in accordance with Ontario closure standards, sealed, and revegetated as the Closure Plan specifications.

2.5.3 Waste Rock Storage Area Closure

Once mining has been completed the mine waste storage areas must be closed out in accordance with Ontario Regulation 240/00, amended O.Reg. 307/12, and the Code of the Ontario *Mining Act*. Section 24(2) of Regulation 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 59(2) of the Code states the following:

> *In order to ensure the chemical and physical stability of the ML or ARD generating materials and that the quality of the environment is protected, the management plan [for waste rock stockpiles] shall consider, where appropriate:*
>
> - *The design and construction of covers and diversion works; and*
> - *The use of passive and active treatment systems.*

Section 71 of the Code states the following:

> *When revegetating waste rock storage areas … or other steeply sloped features, the following specific measures shall be considered, where appropriate:*
>
> - *Contouring to mimic local topography and blend into surrounding landscape;*
> - *The application of soil to a depth sufficient to maintain root growth and nutrient requirements;*

- *The incorporation of organic materials, mulches and fertilizers based upon soil assessment;*
- *The scarification or ripping of flat surfaces which may have been compacted by heavy equipment; and*
- *Improving site drainage, to prevent water erosion on rehabilitated areas.*

Due to the anticipated PAG characteristics of the mine waste rock, it was evaluated that the 'do nothing' approach for closure of the waste rock storage area (WRSA) would not be sufficient to meet the aforementioned needs. Instead, waste rock from the development of the three pits will be placed in a waste rock storage area as well as backfilled in the central and east pits. Approximately 15 megatonnes (Mt) off waste rock will be placed in the WRSA and 13 Mt will be returned to the west and central pits as backfill. The WRSA will be operated during the development of the west and central open pits. Once backfilling of the west pit commences, the WRSA will be closed and reclaimed.

2.5.3.1 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

Following operations, the WRSA will be closed and reclaimed in accordance with the relevant acts and regulations. A description of the WRSA closure design is provided in Section 3.2 of Appendix KK summarized in Section 2.5.3.2. The design is such to limit the ARD potential of the PAG waste rock and revegetate the WRSA to appear as a natural feature on the landscape. This option for the WRSA closure was considered to best limit potential effects to Indigenous communities in the long-term.

2.5.3.2 Selection of Preferred Alternative

Closure and reclamation of the WRSA will consist of placing a water-shedding cap over the WRSA that is tied into the up-gradient clay soil and vegetation of the cap and disturbed areas. The WRSA will grade as required and a pioneer or base/stabilization layer will be placed over the waste rock to fill voids. A low permeable layer of clay will then be placed over the pioneer layer. The clay layer will be tied into clay zone to provide complete encapsulation of the waste rock surface. A granular shedding layer will be placed over the clay layer to allow runoff to shed from the surface. A layer of topsoil, stockpiled from the site preparation activities, will then be placed over the granular layer and the final surface will be vegetated. Capping activities will allow for limited exposure for waste rock, limiting potential for ARD development. Vegetated surface will allow for recolonization by local biological community.

Runoff collection ditches will be realigned to direct runoff into the open pits. All disturbed areas surrounding the WRSA that are not required for mine operation will also be decommissioned and vegetated.

The west and central pits will be backfilled such that the waste rock will remain below the final water surface elevation of the flood pits. This will ensure the backfill remains under water in post-closure. Enhanced flooding will be used to ensure all waste rock covered to provide for less exposure of both the open pit walls and mine waste that has been previously placed into the completed open pits and reduce the time available for potential acid rock drainage and metal leaching to occur. The time needed to create a stable state for open pit water quality characteristics will also be reduced.

2.5.4 Tailings Storage Facility Closure

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 of the Ontario *Mining Act*. Section 24(2) of Regulation which states the following:

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

Sections 35 and 36 of the Code state:

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

Section 72 of the Code states:

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

The closure phase of the project for the TSF will be initiated once the mining activities and ore processing have been completed. The EIS has identified two potential alternatives for TSF closure:

- Permanent flooding; and
- Capping and reclamation.

2.5.4.1 Permanent Flooding

Permanent flooding of the TSF with a wet cover seen as a well-accepted closure strategy. This strategy is successful in providing an oxygen barrier to prevent development of ARD for PAG tailings, as projected for the Project. At closure the supernatant water present in the TSF would be withdrawn, treated and used to help fill the open pit. The final tailings beach surface regraded, and the tailings physically isolated with placement of a pioneer or base/stabilization layer over the tailings surface. The tailings would then be covered with non-process water to chemical isolate the tailings and prevent the onset of ARD.

The water reclaim pump, reclaim pipeline and tailings delivery and distribution pipelines will be decommissioned and removed from the site. The emergency overflow spillway will remain in place, with excess water from the TSF being directed to the open pit. The monitoring wells present in the crest of the dam can remain in-place as well as the monitoring wells located on the downstream area of the dam for use during the closure monitoring phase. Access roads that are no longer required will be scarified and revegetated.

Permanent flooding requires additional costs in the form of reinforcement or raises to dam structures due to additional water volume in addition to on-going monitoring and maintenance of water levels, and dam stability. Monitoring of the closed facility will be completed and will consist of annual Dam Safety Inspections of the closed facility as well as Dam Safety Reviews at the required timeline interval, as discussed above for the operations phase.

2.5.4.2 Capping and Reclamation

Closure and reclamation of the TSF will consist of capping the final tailings beach surface and reclamation of the facility. Supernatant water present in the TSF will be withdrawn, treated and used to help fill the open pit. The final tailings beach surface regraded, as required to ensure it is totally free draining. Grading of the final tailings beach surface will be completed in conjunction with placement of a pioneer or base/stabilization layer over the tailings surface to physically isolate the tailings and provide a trafficable surface. A low permeable layer will then be placed over the pioneer layer to limit the availability of oxygen to the tailings and manage the formation of ARD. A granular water shedding layer will be placed over the low permeability cover to allow runoff to be shed from the surface. A layer of overburden, stockpiled from the site preparation activities, will then be placed over the granular and the final surface will be vegetated. The downstream slopes of the embankments will also be regraded and covered with topsoil and revegetated. Vegetation will be consistent with local flora allowing for recolonization of the TSF area by the local biological community. The revegetation would avoid using species that would be gathered by members of indigenous communities for traditional uses to limit potential exposures to compounds present within the tailings.

The water reclaim pump, reclaim pipeline and tailings delivery and distribution pipelines will be decommissioned and removed from the site. The emergency overflow spillway will be decommissioned. The monitoring wells present in the crest of the dam can remain in-place as well as the monitoring wells located on the downstream area of the dam for use during the closure monitoring phase. Access roads that are no longer required will be scarified and revegetated.

Monitoring of the closed facility will be completed and will consist of annual Dam Safety Inspections of the closed facility as well as Dam Safety Reviews at the required timeline interval, as discussed above for the operations phase.

2.5.4.3 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

Based on the geochemical modelling of both Alternatives 1 and 2, it was determined that capping and reclaiming the TSF has the potential for seepage water quality to affect the surrounding surface watercourses. This was deemed as an unnecessary potential effect to Indigenous communities' traditional land uses and Aboriginal and Treaty Rights. Additionally, a primary concern raised by all Indigenous communities engaged with throughout the EA process is the importance of water. Therefore, permanent flooding has been determined to be the preferred alternative.

2.5.4.4 Selection of Preferred Alternative

As part of the revision of the EIS, it has been identified that there is an increased potential for ARD with a capping and reclamation option due to the potential for physical caps to degrade with time and allow oxidation to occur in the upper layers of the tailings. Therefore, based on the available geochemical information, seepage for the capping and reclamation option would be of a poorer quality and the potential for effects offsite would be increased. Therefore, permanent flooding of the TSF is the preferred option for closure of the TSF.

2.5.5 Buildings and Equipment Closure

In accordance with, Ontario Regulation 240/0, amended O.Reg. 307/12, and the Code of the Ontario *Mining Act*, buildings must be dismantled and removed. Subsection 24(2) of O.Reg. 307/12 of the Ontario *Mining Act* states the following:

All buildings, power transmission lines, pipelines, waterlines, railways, airstrips and other structures shall be dismantled and removed from the site to an extent that is consistent with the specified future land use.

It is generally assumed that buildings and equipment that are not suitable for re-sale or re-use off-site can be disposed of in a licenced landfill site. Hazardous materials such as gear boxes containing petroleum products must be shipped to a licenced landfill capable of receiving such materials. The two alternatives listed above are not exclusive in that off-site shipment of buildings and equipment can only occur if a market exists to obtain them. There is no guarantee that such a market will exist at the time of closure.

Primary buildings and related structures on the Project site will include the following:

- Ore processing plant (including primary crusher, and control room);
- Administrative building;
- Project office (former MNRF Tree Nursery facility);
- Maintenance shop, warehousing;
- Security hub;
- Explosives storage;
- Truck wash; and
- Fuel bay.

Two alternatives for the disposal of buildings and equipment have been determined:

- Disassembly and removal; and
- Re-use of acceptable buildings and equipment.

2.5.5.1 Disassembly and Removal

Disassembly and removal of mine buildings and equipment is a common practice in the industry. This alternative would result in greater closure costs to the Project for having to dismantle and dispose of buildings and equipment as opposed to either leaving the buildings in place or selling the re-usable mine equipment.

Leaving the buildings on site could be viewed as a positive or negative effect to the local community, depending on the view point. If the buildings are left in place, the site could not be fully reclaimed and revegetated to a natural environment. Alternatively, if the buildings are left in place and repurposed into something that could be used by the community, it could be a benefit to the region from the perspective of future employment and business opportunities.

Additionally, the physical and biological effects of the leaving the buildings in place could be viewed as both positive and negative as well. Leaving buildings in place would not allow for the reclamation vegetation of the site to a more natural environment, which could affect the use of the land by wildlife. However, there are some species in the area that are present at the site due to the buildings on-site that would not otherwise be present. This includes Barn Swallow, which is listed as Threatened under the Endangered Species Act.

2.5.5.2 Re-use of Acceptable Buildings and Equipment

Following operations of the Project, there will be buildings and equipment (i.e., MNRF former Tree Nursery Facility) that could be sold or re-used. This would reduce the overall closure costs to the Project for not having to dismantle and dispose of buildings and equipment as opposed to either leaving the buildings in place or selling the re-usable mine equipment.

Similarly to Alternative 1, leaving the buildings on site could be viewed as a positive or negative effect to the local community, depending on the view point. If the buildings are left in place, the site could not be fully reclaimed and revegetated to a natural environment. Alternatively, if the buildings are left in place and repurposed into something that could be used by the community, it could be a benefit to the region from the perspective of future employment and business opportunities.

Additionally, the physical and biological effects of the leaving the buildings in place could be viewed as both positive and negative as well. Leaving buildings in place would not allow for the reclamation vegetation of the site to a more natural environment, which could affect the use of the land by wildlife. However, there are some species in the area that are present at the site due to the buildings on-site that would not otherwise be present. This includes Barn Swallow, which is listed as Threatened under the Endangered Species Act.

2.5.5.3 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X21-3 (Infrastructure Closure — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

As stated in Sections 2.5.5.1 and 2.5.5.2, there are both positive and negative effects of re-using the acceptable buildings and equipment on site, depending on the perspective. From an environmental standpoint, the site could not be fully reclaimed and revegetated to near pre-mining conditions if the buildings are left in place. Alternatively, if the buildings are left in place and repurposed into something that could be used by the community, it could be a benefit to the region from the perspective of future employment and business opportunities.

2.5.5.4 Selection of Preferred Alternative

A summary of the alternative assessment for building closure is provided in Table 2.5.6.5-1. It is generally assumed that buildings and equipment that are not suitable for re-sale or re-use off-site can be disposed of in a licenced landfill site. Hazardous materials such as gear boxes containing petroleum products must be shipped to a licenced landfill capable of receiving such materials. The two alternatives listed above are not exclusive in that off-site shipment of buildings and equipment can only occur if a market exists to obtain them. There is no guarantee that such a market will exist at the time of closure.

Although re-use of acceptable buildings (Alternative 2) is considered preferred based on the alternatives assessment for cost effectiveness, effects to the human environment and effects to the physical and biological environments, it is difficult to predict whether a market will exist for the buildings following closure of the site. In the event that a market does exist, then Alternative 2 is preferred and will be implemented. If no market exists at the time of Project closure, the buildings will be disassembled and removed (Alternative 1) from the site.

Table 2.5.6.5-1: Building Closure Summary of Alternatives Assessment

Category	Alternatives	
	1	2
	Disassembly and Removal	Re-use of Acceptable Buildings
Cost Effectiveness	Acceptable	Preferred
Technical Feasibility and Technical Reliability	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Preferred
Effects to the Physical and Biological Environments	Acceptable	Preferred
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Acceptable
Final Rating	Acceptable	Preferred

2.5.6 Infrastructure Closure

In accordance with, Ontario Regulation 240/0, amended O.Reg. 307/12, and the Code of the Ontario *Mining Act*, buildings must be dismantled and removed. Subsection 24(2) of O.Reg. 307/12 of the Ontario *Mining Act* states the following:

> *All buildings, power transmission lines, pipelines, waterlines, railways, airstrips and other structures shall be dismantled and removed from the site to an extent that is consistent with the specified future land use.*
>
> *All transportation corridors shall be closed off and revegetated to an extent that is consistent with the specified future use of the land.*
>
> *All machinery, equipment and storage tanks shall be removed from the site to an extent that is consistent with the specified future use of the land.*

The primary Project site infrastructure includes roads, pipelines (including pump house and related infrastructure), power transmission lines and equipment.

The Project related access roads are expected to include:

- Site haul and access roads;
- Tree Nursery Road crusher diversion; and
- Service access roads.

The Project-related pipelines are expected to include:

- Tailings discharge and reclaim lines;
- Freshwater lines; and
- Other internal site water transfer lines.

The Project-related transmission lines are expected to include:

- 115 kV connecting line to the Provincial grid; and
- Smaller capacity distribution lines for routing power around the Project site.

Primary equipment for the Project (Appendix B) includes:

- Crushers and processing equipment housed within the primary crusher and in the ore processing plant;
- Conveyor systems, including conveyors linking the primary crusher, coarse ore stockpile transfer house and ore processing plant;

- Pumps and pump housing;
- Storage tanks; and
- Mobile heavy equipment including but not limited to: diesel and electric shovels, excavators, bulldozers, haul trucks, loaders, jumbos, bolters, load haul dump vehicles, scissor lifts, crane trucks, forklifts, graders, diamond drills, and explosive loaders.

Given potential future land use of the Project and use of infrastructure by others, a combination of the proposed alternatives may be implemented. Alternatives relating to the decommissioning of these items include:

- Decontamination and removal;
- Leave in place for future use; and
- Reclaim in place.

2.5.6.1 Decontamination and Removal (Alternative 1)

Disassembly and removal of mine infrastructure is a common practice in the industry. This alternative would result in greater closure costs to the Project for having to dismantle and dispose of all infrastructure as opposed to either selling or leaving some of the infrastructure in place.

From an environmental perspective, removing all the site infrastructure would allow for the site to be reclaimed and revegetated. This would allow for Indigenous peoples to practice their traditional land uses and Aboriginal and Treaty rights on the land following closure.

2.5.6.2 Leave in Place for Future Use (Alternative 2)

Leaving infrastructure in place that could be re-purposed into an alternative use would reduce the overall closure costs to Treasury Metals. This would only be a viable option for infrastructure that could be used for other purposes (i.e., roads) and if an interested party was willing to acquire the liability of the infrastructure from Treasury.

Leaving the infrastructure on site could be viewed as a positive or negative effect to the local community, depending on the view point. If the infrastructure is left in place, the site could not be fully reclaimed and revegetated to a natural environment. Alternatively, if infrastructure is left in place and re-purposed into something that could be used by the community, it could be a benefit to the region from the perspective of future employment and business opportunities.

2.5.6.3 Reclaim in Place (Alternative 3)

Reclaiming the site infrastructure in place can be the most economic alternative for some infrastructure at the site, as well as limit potential environmental effects. An example of this are buried lines at the site, which would need to be excavated and removed if all site infrastructure were to be removed. This excavation would result in greater environmental effects and costs to Treasury Metals compared to filling the pipe with concrete and leaving underground. This alternative would only be applicable to alternatives that can be reclaimed in a way that does not leave potential environmental effects.

2.5.6.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X22-3 (Infrastructure Closure — Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;
- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

There are both potential positive and negative effects of re-using the acceptable infrastructure on site, depending on the perspective. From an environmental standpoint, the site could not be fully reclaimed and revegetated to near pre-mining conditions if the infrastructure is left in place. Alternatively, if the infrastructure is left in place and re-purposed into something that could be used by the community, it could be a benefit to the region from the perspective of future employment and business opportunities.

2.5.6.5 Selection of Preferred Alternative

Based on the alternatives assessment, the preferred alternative is to decontaminate and remove all Project-related pipelines, access roads, transmission lines and equipment, once they are decommissioned or no longer needed for Closure Plan implantation, maintenance, or monitoring requirements.

All haul roads and service roads associated with the Project have flexibility for potential future use. These roads may be left in place to support future land use, or reclaimed in place. It is anticipated that the MNRF Tree Nursery facility designated to serve as the Project office will remain in place. If any other buildings are retained for future use, all applicable access roads would remain in place. In turn, all freshwater pipelines and any associated infrastructure would have to remain in place. Closure responsibilities of these buildings and associated infrastructure would shift to whoever takes over the facilities.

Haul road and service road reclamation in place will occur progressively at closure when they are longer required for building access/maintenance/monitoring requirements. This is the cost-effective alternative that would allow the area to be reclaimed as terrestrial habitat or for future land use requirements.

Since all pipelines at the Project site will have specific function to the Project, all pipelines are best decontaminated and fully removed. All pipeline material would be moved to a licenced facility. As stated, in the event that buildings are retained for future use, the freshwater pipelines and any associated infrastructure would remain in place. This is anticipated to affect the Project office. Some pipelines due to site conditions or those installed underground may be reclaimed by decontamination and then filled and capped. This is a commonly used practice.

The 115 kV transmission line connecting the Project to the Provincial grid and the smaller transmission lines connecting various buildings and infrastructure around the Project site are specific in design to Project needs and therefore only have value to the Project. As per the regulatory requirements, these transmission lines will be removed. All materials of value or re-use would be sold or transferred to applicable utility suppliers or negotiated with other buyers. All materials not applicable for re-use or of value will be transferred to a licenced facility. In the event that buildings are retained for future use, the transmission lines will be left in place to provide power to these building. This is anticipated to include the Project office. Although not expected, if utility providers in the area are willing to take over the 115 kV line, substation and associated lines closure responsibilities would be passed in turn to the associated utility agency.

All machinery, equipment and other materials are anticipated to be dismantled and taken off-site for sale or re-use if applicable and economically feasible. Steel and other materials inert in nature from dismantled equipment will be disposed of in a licenced facility.

However, given potential future land use of the Project and use of infrastructure by others, a combination of the proposed alternatives may be implemented. Roads will be reclaimed in place, while some infrastructure may remain for future use. The Project office and its associated infrastructure will remain in place and for future use by Treasury. It is currently anticipated that all infrastructure not tied to the Project office will be removed following completion of all closure and post-closure activities unless future land use permits are required.

A summary of the alternatives assessment for infrastructure closure is provided in Table 2.5.6.5-1. Leaving in place for future use (Alternative 2) and reclaim in place (Alternative 3) are both considered acceptable for all categories. Decontamination and removal is considered preferred for potential ability for future closure/reclamation processes and acceptable for the rest of the categories.

Table 2.5.6.5-1: Infrastructure Closure Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Decontamination and Removal	Leave in Place for Future Use	Reclaim in Place
Cost Effectiveness	Acceptable	Acceptable	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Acceptable	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Acceptable	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Preferred	Acceptable	Acceptable
Final Rating	Preferred	Acceptable	Acceptable

2.5.7 Minewater Management and Drainage Closure

The Project's water management and drainage system includes a number of components that are tied directly to infrastructure (including pump stations, culverts, and collection ponds). It also includes changes made to the natural drainage of the region including a number of modifications directly affecting the Blackwater Creek watershed and drainage pattern.

Culverts and ditching at the Project site used to support road development and as required for drainage management around the project site. Ditching on the Project site will include:

- Road-site ditching;
- Water management ditching around Project components; and
- Ditching in support of regulatory management plans such as Metal Mining Effluent Regulations (MMER).

All ditching designed for regulatory requirements will be left in place until compliance is achieved and no longer needed. Once compliance is demonstrated, all ditching would be stabilized and left in place. Road-sized ditching will be stabilized and replanted if needed. Backfilling all ditches would serve no purpose and has not been considered as an alternative. If roads are to be used in future land use practices, all culverts and ditching will remain in place.

As part of the site water management, various ponds have been proposed as part of the design. These ponds include:

- Four collection ponds; and
- Minewater pond.

As dictated by Closure Plan requirements Subsections 71(1), (5) and (7) of the Code state the following relative to site preparation and drainage control for final closure, respectively:

- Contouring to mimic local topography and blend into the surrounding landscape;
- Improving site drainage to prevent water erosion on rehabilitated areas; and
- Contouring and sloping of impoundment areas must be integrated with engineering design.

Seepage collection ponds are used to dictate run off and to monitor seepage and collection. Collection ponds have been incorporated into the design in support of all major Project components. These Project components include the processing plan and the mine rock areas (overburden storage area, waste rock storage area, and low-grade stockpile). These ponds will be drained and closed in accordance with the requirements as designated by the Closure Plan. Should water quality be deemed not suitable to discharge water will be pumped though water treatment facility for discharge to the environment.

All pipelines associated with the water management system will be closed as per the details outlined in Section 2.4.7. Pipelines associated with the water management system include:

- Tailings discharge and reclaim lines;
- Freshwater lines; and
- Other internal site water transfer lines.

Three alternatives have been assessed for the minewater management and drainage closure, which include:

- Stabilize and leave in place;
- Partial removal (and restoration); and
- Removal (and restoration).

2.5.7.1 Stabilize and Leave in Place (Alternative 1)

Stabilizing and leaving minewater management structures and drainage systems in place would be the most cost-effective alternative negating the need for extensive reclamation. Although the land would not be reclaimed and revegetated to pre-mining conditions, there would still be opportunity for Indigenous communities to practice traditional land uses and Aboriginal and Treaty Rights. Additionally, leaving the minewater management and drainage systems in place would eliminate the need for additional disturbance to the environment as part of closure activities, but ongoing maintenance and monitoring may be required with this alternative, in accordance with Ontario Regulation 240/00, amended O.Reg. 307/12, and the Code of the Ontario *Mining Act* (Section 66), and in accordance with MMER requirements. Localized weather conditions may compromise stabilization efforts, creating potential for delivery of contaminants of concern (such as sediment release) into the Blackwater Creek watershed.

2.5.7.2 Partial Removal (and Restoration) (Alternative 2)

There are some constructed minewater management and drainage system features that are beneficial to leave in place from a water management perspective, and some that do not provide any identifiable benefit. Partially removing some of the features is more cost-effective than removing all the features from the site, and requires less monitoring costs compared to stabilizing and leaving the features in place. The site features that are likely to remain include the grading of the site and perimeter ditching to direct contact water with the site to the open pit. This water would remain within the Blackwater Creek sub-watershed and would reach Blackwater Creek via the overflow discharge point of the open pit. These remaining minewater management and drainage system features are not predicted to cause any environmental or socio-economic effects once the site has been revegetated.

2.5.7.3 Removal (and Restoration) (Alternative 3)

Removal of minewater management and drainage systems from the site would result in the greatest financial cost to Treasury Metals. It would also result in the greatest environmental effects to the environment compared to the other alternatives. If the perimeter ditching around the site is removed, a much greater volume of seepage would be able to migrate off-site and into surrounding surface watercourses. The site would be able to be revegetated and would be the closest of the three alternatives to return to pre-mining conditions. Indigenous communities could use the land for traditional purposes and could practice Aboriginal and Treaty Rights, but the potential change in surface water quality in the surrounding watercourse could negatively effect the use of them.

2.5.7.4 Information Relevant to Indigenous Communities

Throughout the EA process, Treasury Metals has worked to engage with local Indigenous communities to elicit input about the proposed Project. No specific feedback has been received regarding these alternatives.

The advantages and disadvantages of each alternative on Indigenous communities is provided in Table X23-3 (Minewater Management and Drainage Closure - Effects to the Human Environment) under the criteria:

- First Nation Reserves and communities;

- Spiritual and ceremonial sites;
- Traditional land uses; and
- Aboriginal and Treaty Rights.

Partial removal (and restoration) of the minewater and drainage systems would result in the greatest potential for employment opportunities for Indigenous communities with both long-term monitoring costs and removal costs at closure. Removing the minewater management features that do not provide any added benefit in the post-closure (i.e., the minewater pond and collection ponds) would be done to limit the noticeability of the Project in the post-closure. Only those minewater management features that provide an added benefit to water management and limit environmental effects in the post-closure will remain. This includes the perimeter ditching and the diversion of all contact water with the site to the open pit.

2.5.7.5 Selection of Preferred Alternative

A summary of the alternatives assessment for minewater management and drainage closure is provided in Table 2.5.7.5-1. Based on the above, the preferred alternative is to partially remove parts of the minewater management and drainage features that do not benefit water management in the post-closure, and leave features in place that do benefit water management (Alternative 2). Alternative 2 is preferred for cost effectiveness, effects to the human environment, effects to the physical and biological environments and potential ability for future closure/reclamation processes. Stabilizing and leaving in place (Alternative 1) and removal (Alternative 2) are both acceptable for all categories, but are less desirable than Alternative 2.

Table 2.5.7.5-1: Minewater Management and Drainage Closure Summary of Alternatives Assessment

Category	Alternatives		
	1	2	3
	Stabilize and Leave in Place	Partial Removal (and restoration)	Removal (and restoration)
Cost Effectiveness	Acceptable	Preferred	Acceptable
Technical Feasibility and Technical Reliability	Acceptable	Acceptable	Acceptable
Effects to the Human Environment	Acceptable	Preferred	Acceptable
Effects to the Physical and Biological Environments	Acceptable	Preferred	Acceptable
Potential Ability for Future Closure/Reclamation Processes	Acceptable	Preferred	Acceptable
Final Rating	Acceptable	Preferred	Acceptable

2.6 Summary of Alternatives

The alternative assessment was used to identify those alternatives considered as the basis of the EIS and provide a reasoning for the selection of alternatives. In analysing the potential effects of the Project on the environment there are cases where changes may be required to the Project configuration in order to mitigated effects or impacts. An example of this is the identification of a wet cover as the preferred long-term option for closure of the TSF in both the geochemistry (Section 6.3) and surface water quality (Section 6.8) effects assessment.

A summary of alternatives proposed for the Project is provided within Table 2.6.

Table 2.6: Summary of Alternatives

Project Element	Alternatives Assessed	Assessment Results	Section
Alternatives to the Project	Proceed with the Project	Preferred	Section 2.3
	Delay the Project	Acceptable	
	"Do Nothing"	Acceptable	
Mining Method	Open pit only	Acceptable	Section 2.4.1.1
	Underground only	Unacceptable	Section 2.4.1.2
	Combination of open pit and underground mining methods	Preferred	Section 2.1.4.3
Tailings Storage Facility and Minewater Pond	Surface impoundment that utilizes conventional slurry deposition technology northeast of the pit and the minewater pond directly south	Preferred	Section 2.4.2.2.1
	Surface impoundment that utilizes conventional slurry deposition technology northeast of the pit and the minewater pond to the west	Acceptable	Section 2.4.2.2.2
	Filtered stack tailings deposition technology located south of the open pit and the minewater pond west of the open pit	Acceptable	Section 2.4.2.2.3
	Surface impoundment that utilizes conventional slurry tailings deposition technology to the east of the open pit and the minewater	Acceptable	Section 2.4.2.2.4

Table 2.6: Summary of Alternatives (continued)

Project Element	Alternatives Assessed	Assessment Results	Section
	pond to the northeast of the open pit.		
Waste Rock Management	WRSA north of pit	Acceptable	Section 2.4.3.1
	WRSA south of pit	Acceptable	Section 2.4.3.2
	Combination of surface storage north of pit and in-pit storage	Preferred	Section 2.4.3.3
Overburden Management	Two Stockpiles South of the Open Pit	Preferred	Section 2.4.4.1
	Single Stockpile to the Southwest of the Open Pit	Acceptable	Section 2.4.4.2
Processing Method	Gravity and CIL processing	Preferred	Section 2.4.5.1
	Gravity and floatation with off-site concentrate processing	Unacceptable	Section 2.4.5.2
	Gravity, flotation, and ILR	Acceptable	Section 2.4.5.3
Cyanide Containing Effluent Treatment	Natural cyanide degradation in the TSF	Unacceptable	Section 2.4.6.1
	In-plant cyanide destruction followed by natural degradation	Unacceptable	Section 2.4.6.2
	Natural degradation followed by effluent treatment	Unacceptable	Section 2.4.6.3
	In-plant cyanide destruction, natural degradation followed by effluent treatment	Preferred	Section 2.4.6.4
Cyanide Destruction	Alkalinity chlorination	Unacceptable	Section 2.4.7.1
	Hydrogen peroxide	Unacceptable	Section 2.4.7.2
	Natural degradation	Unacceptable	Section 2.4.7.3
	Inco SO_2-air	Preferred	Section 2.4.7.4
Water Supply	Wabigoon Lake	Acceptable	Section 2.4.8.1
	Thunder Lake	Acceptable	Section 2.4.8.2
	Tree nursery ponds	Preferred	Section 2.4.8.3
	Groundwater	Unacceptable	Section 2.4.8.4
Water Discharge Location	Wabigoon Lake	Acceptable	Section 2.4.9.1
	Thunder Lake	Acceptable	Section 2.4.9.2

Table 2.6: Summary of Alternatives (continued)

Project Element	Alternatives Assessed	Assessment Results	Section
	Hartman Lake	Unacceptable	Section 2.4.9.3
	Thunder Lake tributaries at the tree nursery ponds	Acceptable	Section 2.4.9.4
	Blackwater Creek	Preferred	Section 2.4.9.5
Plant and Infrastructure Location	Plant and infrastructure located northeast of the open pit area	Preferred	Section 2.4.11.1
	Plant and infrastructure located southeast of the open pit area	Acceptable	Section 2.4.11.2
Low-grade Ore Stockpile	Low-grade ore stockpile located east and adjacent to the crushing facilities	Only Feasible Alternative	Section 2.4.12
Aggregate Supply	Mine Rock that is Non-PAG	Preferred	Section 2.4.13.1
	On-site aggregate pit	Acceptable	Section 2.4.13.2
	Commercial off-site aggregate pit	Acceptable	Section 2.4.13.3
Non-hazardous Solid Waste Management	Acquire an off-site landfill	Acceptable	Section 2.4.14.1
	Develop an on-site landfill	Acceptable	Section 2.4.14.2
	Truck waste to an existing off-site landfill	Preferred	Section 2.4.14.3
Hazardous Solid Waste Management	Acquire an off-site hazardous waste disposal facility	Unacceptable	Section 2.4.15.1
	Develop an on-site hazardous waste disposal facility	Unacceptable	Section 2.4.15.2
	Truck hazardous waste to an existing off-site facility	Preferred	Section 2.4.15.3
Domestic Sewage Management	Septic tanks and tile fields	Acceptable	Section 2.4.16.1
	Package sewage treatment plant	Acceptable	Section 2.4.16.2
	Trucking domestic sewage waste off-site to licensed treatment facility	Preferred	Section 2.4.16.3
Explosives Storage Facility	Northwest end of the former tree nursery	Preferred	Section 2.4.17.1

Table 2.6: Summary of Alternatives (continued)

Project Element	Alternatives Assessed	Assessment Results	Section
	North of the deposit, east of the Tree Nursery Road	Acceptable	Section 2.4.17.2
Electrical Power Supply	Use of Existing Hydro One power infrastructure	Preferred	Section 2.4.18.1
	Develop an on-site natural gas power generation facility	Acceptable	Section 2.4.18.2
	Develop alternative means of power generation such as wind or solar	Unacceptable	Section 2.4.18.3
Open pit closure	Natural flooding	Acceptable	Section 2.5.1.1
	Enhanced flooding	Preferred	Section 2.5.1.2
Underground Closure	Natural flood in accordance with Ontario closure standards	Only Feasible Alternative	Section 2.5.2
Waste Rock Storage Area Closure	Cap and reclaim	Only Feasible Alternative	Section 2.5.3
TSF closure	Permanent flooding	Preferred	Section 2.5.4.1
	Capping and reclamation	Acceptable	Section 2.5.4.2
Building and Equipment Closure	Disassembly and removal	Acceptable	Section 2.5.5.1
	Re-use of acceptable buildings and equipment	Preferred	Section 2.5.5.2
Infrastructure Closure	Decontamination and removal	Preferred	Section 2.5.6.1
	Leave in place for future use	Acceptable	Section 2.5.6.2
	Reclaim in place	Acceptable	Section 2.5.6.3
Minewater Management and Drainage Closure	Stabilize and leave in place	Acceptable	Section 2.5.7.1
	Partial removal (and restoration)	Preferred	Section 2.5.7.2
	Removal (and restoration)	Acceptable	Section 2.5.7.3