CREATING AND DELIVERING BETTER SOLUTIONS

www.eba.ca

North American Tungsten Corporation Ltd.

ISSUED FOR USE

MACTUNG MINE DECOMMISSIONING AND CLOSURE PLAN

W23101110.003

December 2008

EBA Engineering Consultants Ltd.
p. 867.668.3068 • f. 867.668.4349
Calcite Business Centre • Unit 6, 151 Industrial Road • Whitehorse, Yukon Y1A 2V3 • CANADA

EXECUTIVE SUMMARY

This document contains the Decommissioning and Closure Plan for the proposed Mactung Mine. The Mactung property is located in the Selwyn Mountain Range and covers the area around Mt. Allan on the Yukon side of the border with the Northwest territories; approximately eight kilometres northwest of MacMillan Pass. There is currently little use of the project area due to its remote location; however some trapping and guiding does occur in the area.

The proposed tungsten mine will operate year-round for approximately 11 years as an underground operation with surface disposition of a portion of the tailings into a Dry Stacked Tailings Facility. Concentrate from the project will be hauled from site using the North Canol Road. A water reservoir will be used to during the production phase to provide water for mineral processing. Fresh water will be pumped to the site from the Hess River Tributary. Power for the project will be provided by diesel generators. The underground nature of the minesite reduces the amount of surface infrastructure associated with the project which makes decommissioning easier and less costly.

The goal of decommissioning and closure activities for the site is to eliminate any long term potential negative effects from the project. Progressive reclamation will be conducted on areas that are no longer operationally required during the production phase. Reclamation research into revegetation techniques will be included in the progressive reclamation program for the site. Areas have been grouped into reclamation units in order to allow for the development of decommissioning plans and associated costing. Decommissioning plans have been developed based on mining industry standards and accepted engineering practice and principles. Identification of post closure monitoring and inspection programs for the property are also included in the decommissioning and closure planning.

The costing component for this plan is based on past experience and professional judgment. Earthworks sensitivity analyses have been conducted to allow for determination of the best combination of equipment for conducting the required works. The decommissioning and closure cost estimates as assessed by reclamation unit are included in Section 5.3, and a proposed security payment schedule is included in Section 5.4.

PAGE

PAGE

PAGE

PAGE

TABLES (WITHIN THE BODY OF THE REPORT)

FIGURES (ATTACHED)

1.0 INTRODUCTION

This Decommissioning and Closure Plan (Plan) has been developed by EBA Engineering Consultants Ltd. (EBA) to address the Yukon Environmental and Socio-Economic Assessment Act (YESAA) and regulatory requirements for a plan detailing decommissioning, reclamation, and closure activities for the proposed Mactung Mine.

The Plan outlines the components that will be carried out as progressive (during production) and post closure reclamation activities. The Plan is based upon the current mine plan and proposed infrastructure information as provided by North American Tungsten Corporation Ltd. (NATC).

1.1 BACKGROUND

The Mactung deposit was discovered in 1962 by James Allan, an Amax geologist, probably as a result of follow-up prospecting to a regional stream sediment survey carried out as part of the Ogilvy Reconnaissance Project (Allan, 1963). The deposit was originally known as MacMillan Pass Tungsten and then as MacMillan Tungsten before it became known as Mactung.

NATC is a Canadian mining company listed on TSX Venture Exchange. It owns the Mactung tungsten deposits in Yukon. The Mactung deposit has been characterized as one of the world's largest tungsten deposits and ranked as the largest undeveloped skarn-type deposit (USGS, 1998). The property consists of 113 mineral claims and 46 mining leases, with a total area of 4,541.6 ha. All leases and claims are 100% owned by NATC

2.0 SITE DESCRIPTION

The Mactung property is located in the Yukon in the Selwyn Mountain Range. The site is approximately eight kilometres northwest of Macmillan Pass on the edge of Mt. Allan. The nearest settlement accessible by road is the unincorporated community of Ross River, approximately 250 km southwest along the North Canol Road. It takes approximately six hours to travel between Ross River and the Mactung property. The site is directly accessible by helicopter and is approximately 185 km from Ross River. The Macmillan Pass Aerodrome, about 8 km south of the Mactung property is accessible by rotary and fixed-wing aircraft and is about 175 km from Ross River. The Mactung property is not accessible by water. The general location of the Mactung property is provided in (Figure 1).

2.1 LAND TENURE

Legal land tenure for the proposed project can be identified as Yukon Government crown land. The proposed mine site, including the service road, will remain crown land for the duration of the project, with an authorization for Quartz Mining. This authorization will include the right to the sub-surface mining of tungsten as well as surface activities which form part of mine operations.

Sections of the proposed mine access road on NATC's claims are currently undergoing a Designated Office Evaluation as part of a Class III exploration application. One section of road on NATC's claims will require an upgrade to be suitable for the operation phase.

The proposed aerodrome expansion and upgrade will not alter the status of the aerodrome which is currently public. Instead, a Memorandum of Understanding is proposed between NATC and the Government of Yukon (Department of Highways and Public Works), allowing the company to upgrade the facility to a level of mutual accord. NATC will conduct the upgrade and utilize the facility under the jurisdiction of Yukon government.

The North Canol Road is required for the duration of the project as a haul road for the transport of goods and materials as well as the hauling of tungsten concentrate. Over the past year NATC has been in discussion with the Yukon government regarding NATC's proposed use of the North Canol Road and the Pelly River Ferry. It is understood that the road is currently seasonal and its maintenance is the responsibility of Government of Yukon. It is also understood that the Yukon government is planning on upgrading the road for all year use.

2.2 MINERAL CLAIMS

The project occurs within the Mayo Mining District of the Yukon. NATC is the full owner of 151 quart mining claims which form the area proposed for the Mactung mine site (Figure 2).

2.3 OUTFITTING CONCESSION

Outfitting concessions have legal boundaries within which the owner has the right to outfit hunting to non-residents exclusively. Twenty outfitting concession are held within the Yukon and Outfitting Concession #9 has been identified to overlap with the proposed project.

2.4 TRAPPING CONCESSION

The Yukon Territory contains 360 registered trapping concessions and 13 group trapping concessions. These concessions are formed through legal boundaries which provide the holder with exclusives rights to the trapping of furbearing animals. The proposed project including the mine site, access road, service road and airstrip expansion is located within the defined boundaries of Trapping Concessions 111 and 112. The use of the North Canol Road for the duration of the project will overlap with the Trapping Concession 405. This concession is a large group concession which is held by Ross River Dena Council (RRDC) and is used by community members.

2.5 INTERIM PROTECTED LANDS

There are two interim protected blocks in the vicinity of the project site which have been selected by RRDC; these include RRDC R-44 and RRDC R-42. RRDC R-44 is located directly north of the proposed project site and RRDC R-42 is located to the south between the NWT border and the North Canol Road. The western point of the RRDC R-42 block is directly north of the MacMillan Pass Airfield. The interim protected blocks are not in the area of the project.

2.6 AUTHORIZATIONS

2.6.1 Exploration Phase

Exploration activities at the Mactung property have been conducted under Class III Mining Land Use (MLU) Approval #LQ00138, which is valid until November 2008. NATC has applied for a renewal of this approval for continued mineral exploration, underground construction, and construction of exploration roads.

2.6.2 Applicable Legislation

Quartz Mining Licence

Following the YESAA process, the Quartz Mining Licence, issued under the *Quartz Mining Act*, may be issued in two phases; the first will include authorization to proceed with construction activities which do not require licencing through the *Waters Act* (Yukon). The second phase will form the final component of the major licencing requirements for the proponent and will provide authority to finalize construction activities and proceed with the proposed mining program.

Type A Water Licence

Water licencing is conducted by the Yukon Water Board under the authority of the *Waters Act* (Yukon). The Mactung project will require a Type A Water Licence for its operation.

Applicable legislation, regulations, and approvals for this project are identified in Table 1, below. This table may be updated during the course of the project.

TABLE 1: APPLICABLE LEGISLATION REGULATIONS AND APPROVALS

Legislation	Regulations	Approvals
Canada		
Aeronautics Act	Canadian Aviation Regulations	Memorandum of Understanding for the expansion of an aerodrome
Canada Wildlife Act		
Canadian Environmental Protection Act		
Explosives Act	Blasting Regulations Ammonium Nitrate and Fuel Oil Order	Blasting Permit Explosives Factory Licence Explosives Magazine Licence Non-Mechanical ANFO Certificate Blasting Explosives Purchase and Possession Permit Permit to Transport Explosives

TABLE 1: APPLICABLE LEGISLATION REGULATIONS AND APPROVALS

Legislation	Regulations	Approvals
Fisheries Act	Metal Mining Effluent Regulations	Metal Mining Effluent Authorization Authorization for Works or Undertakings Affecting Fish Habitats
Migratory Birds Convention Act		
Navigable Waters Protection Act		Approval under Navigable Water Protection Act
Species at Risk Act		
Transportation of Dangerous Goods Act	Transportation of Dangerous Goods Regulation	Waste Manifest
Health Canada	Guidelines for Canadian Drinking Water Quality	
Yukon		
Building Standards Act		Building Permit
Dangerous Goods Transportation Act	Dangerous Goods Transportation Regulation	
Electrical Protection Act		Electrical permit
Environment Act	Storage Tanks Regulation Air Emissions Regulations Solid Waste Regulations Special Waste Regulations Contaminated Sites Regulation Spills Regulation	Storage Tank Permit Air Emissions Permit Solid Waste Permit Special Waste Permit Relocation Permit, LTF Permit
Gas Burning Devices Act		
Highways Act	Highways Regulations Bulk Commodity Haul Regulations	Over dimensional Weight permit Access permit Permit to work within the Highways right-of-way
Historic Resources Act	Archaeological Sites Regulation	Archaeological Sites Permit
Lands Act	Lands Regulation	
Occupational Health & Safety Act	Occupational Health and Safety Regulations (applicable Parts, including mine safety)	

TABLE 1: APPLICABLE LEGISLATION REGULATIONS AND APPROVALS

Legislation	Regulations	Approvals
Public Health and Safety Act	Eating and Drinking Places Regulations Sewage Disposal Systems Regulations Drinking Water Regulation	Sewage Disposal System Permit
Quartz Mining Act		Quartz Mining Licence
Territorial Lands (Yukon) Act	Territorial Lands Regulation Land Use Regulation Timber Regulation Territorial Quarrying Regulation Forest Protection Regulation	Land Use Permit Timber Permit Quarry Permit Land Lease
Waters Act	Waters Regulation	Type A Water Licence Type B Water Licence
Wildlife Act	Wildlife Regulations	
Codes and Guidelines		
Canadian Council of Ministers of the Environment (CCME)	Canadian Environmental Quality Guidelines Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Canada-wide Standards for Petroleum Hydrocarbons in Soil	
Canadian Dam Association Dam Safety Guidelines		
National Building Code		
National Fire Code		

2.7 GENERAL CLIMATE

Mean annual temperatures for the region are between -5 ºC and -8ºC, with daily temperature averages that range between -20 ºC in January to 8 ºC in July. The project area lies in the discontinuous permafrost zone of the Yukon. The Selwyn Mountains have the second highest annual precipitation levels (600-700 mm) in Yukon next to the Coast Mountains (Smith *et al.* 2004).

2.8 GENERAL WILDLIFE AND FISH

Approximately 170 species of mammals, birds, frogs, and fish may occur in the area of the mine and access road. These wildlife species occupy all habitat types from forested valleys to alpine cliffs. Many of these wildlife species are seasonal migrants, and occupy the area in the spring, summer, and fall (*e.g.* woodland caribou), while a few species remain throughout the winter (*e.g.* moose). Many seasonal migrants annually travel to the area to breed and a few remain in the area as summer transients. Species remaining over-winter include all mammal species, except caribou, and a few bird species.

Mammal species frequenting the area include caribou, moose, grizzly and black bear, wolf, lynx, wolverine, fox, marten, hare, and other small mammals. It is used by nesting migratory birds in the summer.

The surface waters in the Mactung area can generally be characterized as generally unproductive aquatic resources and with low fisheries potential that is restricted by low productivity and naturally elevated water quality parameters. Some isolated populations of Dolly Varden were found during fisheries surveys.

2.9 GENERAL VEGETATION

The ecology of the proposed access road into the Mactung Mine from the North Canol Road is largely forested valleys surrounded by steep rugged mountains typical of the Selwyn Mountain Range. The alpine above 1700 m asl is mainly talus slopes due to the steep grade of the mountains. The alpine gives way to thick willow dominated sub-alpine slopes between 1650 m asl and 1550 m asl. The boreal highland forested areas are a mix of sub-alpine fir with a lichen and moss understory on the majority of the slopes and sub-alpine fir-willow in drainage areas and avalanche chutes. Below 1400 m asl forests are a mix of white spruce and sub-alpine fir with a lichen and moss understory typical of the boreal lowland. Dry benches give rise to fescue grasslands and birch-lichen communities. A river system runs through the valleys with numerous feeder streams. The valley bottoms are a mix of willow-riparian communities with deep cuts banks and fast-flowing streams where the relief is greater. In flatter areas the water spreads out giving rise to sedge meadow fen systems. A total of 21 rare plants species were identified as having a potential to occur within the Mactung Project area. In 2006, one rare plant, dwarf nagoonberry (*Rubus arcticus* ssp. *acaulis*), was observed in the local area.

2.10 SURFICIAL GEOLOGY AND TERRAIN

The topography is rugged and the area has been glaciated. Landforms include small glacier remnants, rock glaciers, glaciated surfaces, moraines and fluvio-glacial deposits (Kershaw, 1976). Rock talus slopes are common especially on Mount Allan. The valleys on the Yukon side of the border are locally relatively narrow and steep sided, while those on the NWT side are broader and have shallower gradients.

The valley floor lies at an elevation of about 1,400 m, while the peak of Mount Allan is at 2,200 m. The region is above the tree line and can be classified as arctic/alpine tundra. The vegetation is better developed in valleys and is limited mainly to grasses, small shrubs, moss, and lichen (Kershaw and Kershaw, 1983). Mountains, especially at higher elevations, are extensively covered with talus and intermittently with grasses, moss, and lichen.

2.11 TERRAIN HAZARDS

Active geomorphological processes in the study area include rockfall, debris slides, debris flows, avalanches, gully erosion and periglacial processes, e.g., rock glaciers.

Rapidly drained bedrock slopes of the upper valley walls and cirques are typically steep (greater than 70%) and moderately steep (50 to 70%). Rockfall is the primary erosional process on these slopes and the moderately steep to steep slopes are likely subject to avalanche. Rockfall involves the release of relatively small masses of rock (e.g., a single block or a few cubic metres) and movement downslope by freefall, rolling and bouncing. This is the most common process in the area and results in the formation of extensive talus slopes.

2.12 AVALANCHE HAZARDS

Avalanche hazard exists along the proposed access road and also at the mine site due to the mountainous terrain. Avalanche activity on the mine site is strongly influenced by wind drifting of snow. An avalanche hazard management program (Avalanche Program) will be in place during the winter months in order to ensure the safety of NATC personnel and contractors that are working on the Project. Any reclamation activities that are conducted during the early spring or winter months will be conducted in accordance with the requirements outlined in the Avalanche Program, which will be developed during the construction phase of the project.

3.0 DESCRIPTION OF PROPOSED PROJECT

The Mactung Tungsten Proposed Mine project has a reserve of 8 million tonnes based on an underground mine utilizing a combination of long-hole blast and mechanized cut-and-fill mining methods at a processing rate of 2,000 t/d of scheelite tungsten ore. The process plant consists of gravity concentration and flotation circuits that will recover 80% of the ore's tungsten, at an average concentrate grade of 67% WO_3 and a flotation concentrate grade of 55%. Concentrate will be hauled from the site via a year-round access road. The mine has an estimated 11.2-year life.

3.1 CONSTRUCTION PHASE

The construction of the Mactung Mine is scheduled to require approximately 24 months (Figure 3). It is anticipated that the construction phase could begin as soon as summer 2010 dependent on the permitting process. The following activities are scheduled to occur during the construction phase of the project:

- Establish staging areas near Ross River and near the Macmillan Pass Aerodrome,
- Construct temporary construction camp near the aerodrome,
- Develop one borrow site near the aerodrome for aerodrome upgrades,

- Develop one borrow sites near the aerodrome and proposed camp for road construction,
- Upgrade the existing Macmillan Pass Aerodrome,
- Upgrade the existing tote road (quad trail) to a haul road from the North Canol to Tributary E crossing,
- Construct a new haul road from the Tributary E crossing to the Tributary A crossing,
- Upgrade the existing service road to a haul road from Tributary A crossing to the Mactung site,
- Upgrade the existing seasonal service road to all-season service road from Tributary A crossing to the Hess River tributary,
- Construct a water intake infrastructure,
- Develop two borrow sites near mine,
- Construct infrastructure pads and site roads,
- Move the construction camp to the location of the permanent camp,
- Close and abandon the temporary aerodrome camp,
- Construct a fuel storage facility,
- Construct a processing plant,
- Construct an explosives magazine and an emulation plant,
- Construct a truck shop and administration building,
- Develop underground access,
- Construct the underground crusher and conveyor,
- Construct the powerhouse,
- Develop an underground access to ore body,
- Construct the Ravine Dam,
- Construct the dry-stacked tailings facility foundation,
- Construct the surface water management infrastructure, and
- Commission the facilities.

3.1.1 Temporary Staging Areas

The staging areas will be constructed at the three locations identified in Figure 4. The construction of the staging areas will be limited to; the removal of the trees in the area; the levelling of the ground surface by either balanced cut/fill methods or by a combination of cut and importing fill from existing nearby borrow areas to level the site; and the placement of a gravel surfacing to allow the areas to be accessed by trucks and heavy equipment and to promote drainage off the pad into the surrounding forested areas. Plans for the proposed staging areas are contained in Figure 5 and Figure 6.

A timber salvage plan will be developed with Government of Yukon Department of Energy Mines and Resources, Forestry Branch (Forestry) as a part of preparing the tender package. Tree removal will be conducted so that the timber will be salvageable, should this be required by Forestry.

Staging areas have been planned for the temporary storage of construction material during transportation from the various vendors to the applicable construction site. One staging area is planned for each side of the Pelly River crossing and another at the aerodrome.

3.1.2 Borrow Sites for Construction near Airstrip

The proponent will develop two granular borrow areas near to the existing Macmillan Pass airstrip. The granular borrow pits are sized to provide the required amount of fill to complete the upgrades to the airstrip and access road. Development of the borrow areas will include: removal of trees, as necessary; stripping of organics; and development of a pit by hauling selected fill to the construction area. The developed pit will have at least one access point and side slopes of 33.7^{o} (1.5H:1V), except in the working face where the slope will be temporarily steeper. Material produced in the pit that is unacceptable for use in construction of the airstrip and access road upgrades will be stored in the pit. The estimated volume of fill required for the airstrip and access roads upgrades are 150,000 m^3 and 200,000 m^3, respectively.

3.1.3 Temporary Construction Camp

A temporary construction camp will be constructed near the Macmillan Pass aerodrome to facilitate the upgrades of the airstrip and the access road. The camp will house approximately 49 people. This camp will later be moved to the main site and used as temporary accommodations for construction staff. The camp will consist of modular trailers, including: a kitchen/diner module, seven sleeper modules, a wash car module, a sewage treatment module, and a water supply module. A temporary diesel generator will power the camp. Heat for the construction camp will be generated using propane furnaces.

Construction of the temporary construction camp will be limited to removal of trees in the area; levelling of the ground surface by either balanced cut/fill methods or by a combination of cut and importing fill from existing nearby borrow areas to level the site; and placement of a gravel surfacing to allow the areas to be accessed by trucks and heavy equipment and to promote drainage off the pad into the surrounding forested areas. Sediment management measures will be used to ensure no sediment from the pads reports to water courses. Treated sewage effluent will be disposed of into a rock drain.

The use of modular trailers on a pad is a typical method for temporary camps. It makes it easier and quick to demobilize the camp, decommission the site and abandon the area. This type of camp is used worldwide and is an industry standard.

3.1.4 Upgrade Existing Macmillan Pass Aerodrome

The existing aerodrome at Macmillan Pass is approximately 460 m long and 15 m wide. NATC is proposing to upgrade the aerodrome to 1,375 m long and 30 m wide. The upgraded aerodrome will be capable of handling a 19-passenger Beechcraft 1900 or similar aircraft. NATC is also proposing to construct a 90 m by 60 m apron to allow the simultaneous parking of two Beechcraft 1900 aircraft.

Canadian Aviation Regulations prescribe the design requirements for a civil aerodrome. The upgrades will be conducted in accordance with these regulations The design of the aerodrome will be such that the transverse and longitudinal slopes will be no greater than 2%, and the finished elevation of the aerodrome will be above the 1:100 year inundation area for the Macmillan River flood. A flood protection berm may be required to prevent erosion of the aerodrome embankment; this will be determined during detailed design. The aerodrome will be designed for visual flight rules and runway lights will be provided for night use. The proposed aerodrome upgrades are shown in Figure 7.

The aerodrome upgrade designs will be reviewed and approved by the Government of Yukon, Department of Highways and Public Works. The upgrades will be constructed in accordance with any additional specifications provided by this Department.

3.1.5 Upgraded Existing Tote Road and New Haul Road Construction

NATC is proposing to construct a new 35 km haul road from 3 km south of the Macmillan Pass Aerodrome to the Mactung mine site. This road will connect to a road constructed under a Mining Land Use approval, which is further described in Section 5.4.2.6. The road will be 8 m wide with a ditch, which will be 1 m deep and maximum of 3 m wide. The deep ditch will accommodate stormwater flows and spring melt runoff. There will be a 4 m cleared section on either side of the alignment. The road will be designed for speeds between 30 and 50 km/h and have an average grade of 8% with a maximum grade of 12%. Cut sections of the road will have 26.7° (2H:1V) slopes and fill sections of the road will have 18.4° (3H:1V) slopes. The road will be surfaced with at least 0.2 m of crushed gravel. The road alignment will follow an old abandoned tote road alignment for the first 17 km. The road alignment will then continue over undisturbed ground to the existing pipeline service road near Tributary A. The road alignment is shown in Figure 8, and a typical cross-section is shown in Figure 9.

The road will traverse a number of potential avalanche areas. Avalanche control measures, including snow pack monitoring, controlled blasting, and impact barriers, will be designed and implemented in the sections of the road that will be in potential avalanche areas.

The proposed roads cross two rivers (more than 5 m wide) and approximately 25 streams (less than 5 m wide). The river crossings are the South Macmillan River and Hess River Tributary A. These rivers will be crossed by single-lane bridges, similar to those constructed along the North Canol Road. The streams will be crossed using culverts that will be sized to accommodate at least the 1:50 year peak flow, with a minimum size of 900 mm. The roadway in the vicinity of the culvert crossings will be designed for an overtopping scenario. Typical culvert crossing with road overtopping is shown in Figure 10. Regular repairs and maintenance will be conducted to ensure the roadway is in a condition to accept overtopping flows at all times

3.1.6 New Road to Hess River Tributary

NATC has submitted a YESAA application to construct a 3 km long 5 m wide road under its renewal for a Class III Mining Land Use (MLU) Approval #LQ00138. This road will travel from the location where the haul road will cross Tributary A to the Hess River Tributary. The purpose of the road is to access the proposed fresh water intake source for the mine.

The upgraded road will be 5 m wide with a 2.5 m cleared section on either side of the alignment. The road will be designed for speeds between 30 and 50 km/h and have an average grade of 8% with a maximum grade of 12%. The road will have a 1 m deep ditch on either side to accommodate stormwater flows and spring melt. Cut sections of the road will have slopes at 63.4° (0.5H:1V) in rock sections and 33.7° (1.5H:1V) in soil sections and fill sections of the road will have 18.4° (3H:1V) slopes. The road will be surfaced with at least 0.2 m of crushed gravel.

No bridges are anticipated for this section of the road, and the culverts will be sized to accommodate at least the 1:50 year peak flow for stream being crossed with a minimum size of 900 mm. The roadway in the vicinity of the culvert crossings will be designed for an overtopping scenario. Regular repairs and maintenance will be conducted to ensure the roadway is in a condition to accept overtopping flows at all times. The road alignment is shown in Figure 11 and a typical cross section is shown in Figure 12.

3.1.7 Water Intake Infrastructure

The water intake infrastructure at the Hess River Tributary will supply the camp with fresh water for domestic use and mill for use in the processing of the ore. The fresh water intake infrastructure will consist of a slot-cut into the rock-bank of the Hess River Tributary, two submersible pumps and two 10 km long pipes.

A 4 m wide by 10 m long slot will be cut into the rock face along the southwest bank of the Hess River Tributary and two low-flow high-head submersible pumps will be installed. Only one pump will operate at a time to ensure continuous water supply in the event that one pump fails or requires service. The fresh water will be pumped from the Hess River Tributary to the mine site through the two insulated and heat-traced HDPE pipes. The pipe lines will be constructed on a pipe bench adjacent to the access roads. The freshwater pipelines will connect to the freshwater storage and firewater tank near the accommodations complex on site. The freshwater storage and firewater tank will be fabricated from carbon steel and insulated and be approximately 10 m high and have a diameter of 11 m. The tank will have a usable capacity of 810 m^3; the freshwater and firewater capacities will be 128 m^3 and 682 m^3, respectively. A section of the intake structure is shown in Figure 13 with a plan and section of the pipeline bench along the access road shown in Figure 14. Water pumped to the site is contained in a tank that is shown in Figure 15.

3.1.8 Borrow Areas for Development at Minesite

The proponent will develop up to three borrow areas near the proposed mine site, as shown in Figure 16. Two of the borrow areas are to be developed for granular material and one rock quarry.

Development of the pit borrow areas will include the stripping and storage of organics and the development of a pit by hauling selected fill to the construction area. The developed pit will have at least one access point and side slopes of 33.7º (1.5H:1V), except in the working face where the slope will be temporarily steeper. Material produced in the quarry that is unacceptable for use in mine site development will be stored in the pit.

The borrow pits are sized to provide the required amount of fill to meet the demand for engineered fill to complete the mine site development. The estimated volume of fill required to be borrowed from the pits is approximately 750,000 m^3.

Development of the quarry borrow areas will include the stripping and storage of organics; stripping of overburden soils (to be used as engineered fill if it meets the specifications) and the development of a quarry by drilling and blasting the bedrock. The developed quarry will have at least one access point and side slopes of 14º (4H:1V) in the overburden soils and 26.6º in the blasted rock. Once the bedrock is blasted it will be processed using a mobile rock crusher designed to process the blasted rock specifications developed during detailed design phase of the project. Processing will include crushing with a jaw crusher, crushing with an eccentric hydraulic cone crusher, screening with a vibratory screen deck, and washing. The washing of the fine aggregate will be conducted for material required in concrete. Material produced in the quarry that is unacceptable for use in mine site development will be stored in the pit until final closure.

The borrow quarry has been sized to provide the required amount of fill t to complete the mine site development. The estimated volume of high quality aggregate required to be borrowed from the quarry is approximately 50,000 m^3.

3.1.9 Infrastructure Pads and Site Roads

The proponent will construct a network of roads and pads on the north side of the valley as shown in Figure 17. The pads are required to provide level areas on which the infrastructure buildings, such as mill and camp, will be constructed. The site roads will connect the infrastructure pads together and to the proposed tailings, dam, borrow and accommodation sites.

Construction of the pads will involve clearing and storage of the overburden soil, and blasting the bedrock to below the desired pad elevation. Broken blast rock fill will be used to extend the pad desired width and to level the pad to the design elevation. The fill used to create the infrastructure pads will be placed and compacted in order to support foundations for buildings and some equipment. Slope angles will be determined during detailed design but will be in the order of 45º (1H:1V) for rock cuts and approximately 18.4º (3H:1V) for rock fills. Infrastructure foundations will be cast directly onto the bedrock surface prior to the placement of the levelling fill.

Due to the bedding angle and quality of the bedrock it may be necessary to provide a retaining wall or rock reinforcement bedrock cut slope. This will be reviewed during the detailed design phase and included in the design if necessary. This will not change the proposed overall footprint of the infrastructure.

3.1.10 Permanent Accommodations Complex

A permanent accommodations complex will be constructed on the 1850 m infrastructure pad for use during construction, operation and decommissioning. The complex will accommodate approximately 200 people during construction. Removal of some sleeping modules will allow the complex to house 150 people during the operation phase of the project. The accommodations complex will be constructed from modular units and will include: a kitchen, dining room, single occupancy dorms, man and female washrooms with showers, a sewage treatment plant, a potable water treatment facility and distribution system, and a recreation complex (complete with games and gym facilities). A temporary diesel generator will power the camp until the main generators and power distribution systems are online. Heat for the accommodations complex will be generated using propane furnaces.

Construction of the accommodations complex will be limited to placement of the modules on the compacted gravel fill overlying bedrock. The modules will be connected together in accordance with the manufactures recommendations and specifications. The potable water and sewage treatment facilities will be temporary and replaced with the permanent camp system when it is constructed. Treated sewage effluent will be disposed of into a rock drain until the Ravine Dam is constructed. After construction of the dam, the treated sewage effluent will be discharged into the reservoir. The potable water, sewage treatment and power systems will be designed to accommodate an additional temporary 49-person camp to be installed during construction. The layout of the accommodations complex is shown in Figure 18.

The use of modular units on a compacted gravel pad is a typical method for constructing accommodation complexes at remote sites. Constructing the modules offsite means all the units are pre-wired and plumbed to the appropriate codes, making it easier and quick to get the complex commissioned. Decommissioning is simplified as the units can be broken apart into their original modules it is easy and quick to demobilize the structure, decommission the site and abandon the area.

3.1.11 Decommission and Relocate Construction Camp

The temporary construction camp will be moved from the aerodrome site to the mine site once the access road construction and airstrip upgrades are complete. This is expected to be in September 2010. The construction camp will be installed adjacent to the permanent accommodations complex and will share its water, wastewater, and power infrastructure. The additional load on the infrastructure has been accounted for in the design of the accommodations complex.

Decommissioning of the camp at the aerodrome will include relocating all the modular trailers from the airstrip site to the minesite. No trailers, hose, pipe, wire, debris, garbage or equipment will be left on the site. The rock drain used for discharging the treated sewage effluent will be backfilled and the cleared pad will be left open to re-vegetate naturally.

3.1.12 Bulk Fuel Storage

Bulk fuel will be stored in three separate tanks. A tank will be located near the process plant to store fuel for use in the plant and power plant. The tank will be 15.5 m in diameter and 11 m high, storing 2,075,000 litres of diesel fuel. A second tank will be located in the same area as the first tank and store fuel for use in concentrate driers. The tank will have a diameter of 10 m and be 10 m high, storing 785,000 litres of diesel fuel. A third tank will be located near the equipment maintenance facility will store fuel for the mobile equipment fleet. The tank will have a diameter of 8 m and be 9 m high, storing 450,000 litres of diesel fuel. All bulk fuel storage tanks will be single walled tanks placed inside lined, bermed containment areas. The secondary containment areas will be sized to hold the larger of 110% of the largest tank or 10% of the total maximum volume of all tanks in the facility, in accordance with the National Fire Code.

3.1.13 Process Plant

A process plant building with foundation will house the equipment required to process the ore into a tungsten concentrate. The process plant will be built from construction materials shipped to site and will not be a modular or pre-fabricated building. The process plant will be constructed on the 1830 m infrastructure pad.

The foundations will be placed directly on bedrock and fill will be placed around them to level the pad to the design elevation. Foundations for lighter static (minor) equipment and the process plant building will be on compacted fill placed to level the infrastructure pad to the design elevation, as described in the infrastructure pads and site roads section. The process plant building will be erected on the building foundation.

Once the building is in place the major equipment will be installed on the previously poured foundations and the floor slab will be poured. Once the floor slab is complete the mechanical and electrical connections for the major equipment will begin and the installation of the minor equipment will commence. Installation of the ancillary equipment (stairs, catwalks, walkways, railings, etc.) will occur throughout the construction of the process plant, as applicable. The layout of the process plant is shown in Figure 19.

3.1.14 Equipment Maintenance Facility and Administration Building

To support the mining and processing operations, an equipment maintenance facility/warehouse building and an administration/shifter building will be required. The equipment maintenance facility building will be an approximately 60 m long by 16 m wide by 13 m high single-storey building. The building will be built with materials shipped to site and not as a modular or pre-fabricated building. The administration building will also house the mine dry and be 44 m long by 14.5 m wide by 6 m high. The administration building will be a pre-engineered building. Both buildings will be construction on the 1836 m elevation infrastructure pad. The layout of these buildings is shown in Figure 20.

3.1.15 Underground Mine Pre-Production

3.1.15.1 Mine Access

Access to the underground mine will be provided by two portals. One existing portal will be rehabilitated at elevation 1895 m (this was advanced to facilitate the 1973 bulk sampling program), and the second portal will be new and established at elevation 1836 m.

The portal close to the plant is the entrance to the conveyor decline. The section is a 512 m long, -13% grade, and 5 m x 5 m section decline that ends at the underground crushing station. There will be two conveyor belts installed in parallel along the decline. One conveyor belt transports ore up to the surface from the primary crushing station and the other conveyor transports backfill material from the surface to an underground storage area near the primary crushing station. The decline is also used for access of personnel and equipment in and out of the mine.

3.1.15.2 Waste Rock from Pre-Production Development

Approximately 124,000 m^3 of waste rock will be produced through the development of the underground infrastructure. This fill will be temporarily stockpiled approximately 500 m from the existing adit portal and conveyor entrances. Approximately 92,000 m^3 and 32,000 m^3 of waste rock will be stockpiled near the existing adit and conveyor portals, respectively. This fill will be used in the construction of site access roads and infrastructure fill pads, and it may be crushed for use in concrete aggregate if it is considered to be non-acid generating. Potentially acid generating waste rock will be used as backfill in the underground stopes during mine operations.

Prior to development of the waste rock dumps, all soil and vegetation from the designated footprint will first be salvaged and stockpiled. Run-off in the area of the surface waste rock dumps is intermittent so there will not be year-round discharges from the surface waste rock dumps. The infrastructure pads are located within the un-diverted Ravine Dam catchment and all drainage from these pads will report to that facility prior to being discharged to the receiving environment.

Material characterization will be conducted to segregate potentially acid generating (PAG) waste rock from non-acid generating (NAG) waste rock. Any temporary PAG rock dumps will be constructed in approximately 10 m lifts with a 45° maximum effective slope angle. The PAG waste rock from this phase will be progressively rehandled underground during the construction and operations phase.

The level of detail provided in this description is only conceptual and dimensions, volumes, lengths and measurements are approximate and provided only to give the reader an appreciation for the size and scope of the project.

3.1.16 Powerhouse

To provide electricity for the mine site, a powerhouse with five diesel generators (2.5 MW each) and a heat recovery system will be required. The powerhouse will be a single-storey 20 m long by 10 m wide by 7 m high pre-engineered building. The powerhouse will be built west of the process plant on the 1808 m infrastructure pad.

3.1.17 Ravine Dam

A dam and reservoir are required to store 120,000 m^3 of process water while it ages prior to it being reused in the process plant. Approximately 30 days of residence time is required to allow the reagents used in the process to break down prior to the water being reclaimed for use in the mill. The dam is designed to work as a plug flow reactor. The dam and reservoir are also required to detain runoff water from the affected mine footprint for water quality testing prior to it being released. NATC has classified the Ravine Dam as a significant consequence classification in accordance with the Canadian Dam Safety Guidelines (CDA).

According to the CDA, for significant classified dams, a 1:1000 year seismic event is recommended for design use. Also, CDA guidelines recommend that the design inflow flood be between a 1:100 and 1:1000 year flood event for a significant classified dam. The 1:100 year flood event was selected because the watershed is very small (2.5 km^2 of undiverted area) and flood inflows were determined from a regression analysis of the nearby South Macmillan River at km 407 of North Canol Road, as well the structure will be decommissioned at mine closure with no water retaining capabilities. Reducing from the South Macmillan River basin size of 997 km^2 to the design basin size of 2.5 km^2 will result in conservative flow estimates. Conservative inflows combined with the minimal effects of uncontrolled discharge (discharge of water if the reservoir is subjected to an event larger than the design event) is the reason that NATC has selected to use the lower bound of the guidelines.

The Ravine Dam will be approximately 315 m long and 35 m high. The dam will have a crest width of 25 m to both facilitate two-way haul traffic and improve its stability. The downstream slope angle will be 21.8° (2.5H:1V) and the upstream slope angle will be 18° (3H:1V) with a toe buttress which will have a crest width of 5 m and a slope angle of 14° (4H:1V). The dam will have a geosynthetic liner system with a concrete plinth, geosynthetic drain system, geosynthetic erosion protection system, and a sand and gravel superstructure.

Construction of the dam will involve stripping the entire dam footprint to the surface of the highly weathered and fractured bedrock. The stripped sand and gravel will be stockpiled for use as engineered fill later. The highly weathered and fractured bedrock surface will be excavated using machinery and hand scaling (no drilling and blasting as it may further fracture the bedrock at depth) to a less weathered competent bedrock surface. A concrete plinth will be constructed along this excavated area to facilitate the liner system to bedrock connection. The downstream portion of the superstructure will be constructed from engineered fill. The geocomposite drain and geosynthetic liner system will be placed on the surface of the downstream superstructure. The geosynthetic liner system will be covered with liner bedding and then the upstream superstructure will be constructed from engineered fill. The emergency spillway will be excavated through the crest and the fabric formed erosion protection will be installed along the upstream slope and through the emergency spillway.

The following is a brief description of the materials to be used to construct the dam. A typical cross-section and plan view are provided in Figures 21 and Figure 22, respectively.

Engineered Fill

Engineered fill will comprise the bulk of the dam structure and will be sourced from a borrow pit upstream of the Ravine Dam, increasing the size of the reservoir. Processing of the engineered fill should be limited to removal of boulders at time of truck loading and avoiding areas of high silt content in the pit. The engineered fill will be a well-graded gravel and sand with some silt. The borrow pit will not be developed to the bedrock surface leaving at least a 600 mm thick layer of compacted soil to reduce the flow rate of reservoir water into the fractured bedrock.

Geocomposite Drain

Geocomposite drain will be used to prevent porewater pressure build up in the engineered fill in the event of liner leakage. The geocomposite drain will also be used as downstream bedding for the liner system. The geocomposite drain will be a Geo-Comp 5, supplied by Layfield Plastics, or approved equivalent. The geocomposite drain is a single piece of Geo-Net (a plastic net used for soil reinforcement) bonded between two pieces of nonwoven geotextile.

Liner Bedding

Liner bedding will be used to protect the liner system from the engineered fill, and will be sourced from a borrow pit upstream of the Ravine Dam. Processing of the liner bedding will require screening. The liner bedding will be a well-graded sand with trace silt.

Grout-filled Fabric Formed Armour

Grout-filled fabric formed armour (fabric form) will be used to prevent erosion of the dam crest when the reservoir is operating. Fabric form is an enclosed sewn sock of nonwoven geotextile. The sock is sewn together in the factory to customized dimensions. Each sock is then pumped full of grout (20 to 30 MPa) in sections creating a series of grout panels. The grout panels will be 150 mm (6”) thick after hydration. Fabric forms are available from Layfield Plastics and other geotextile suppliers.

Overburden Excavation

The overburden excavation quantity will involve removing unconsolidated soils beneath the foundation of the dam. Review of existing geotechnical information shows that the material should qualify for use as borrow material for engineered fill if boulders are removed and areas of high silt content are avoided.

Rock Excavation

Rock excavation is required to remove highly fractured bedrock which can provide a conduit for seepage water. The rock excavation will occur immediately beneath the concrete plinth creating a less permeable connection between the concrete and bedrock surface. Rock excavation will be limited to the highly weathered and fractured bedrock surface. Rock excavation will be conducted mechanically (with a ripper tooth attached to a bulldozer or an excavator, or by hand tools). Drilling and blasting is not recommended as it may further fracture the underlying rock. Since the bedrock excavation is limited to highly fractured and weathered rock, it will not be suitable for reuse as construction material, except for access roads.

Concrete Plinth

The liner system will be bolted to the sloped face of a concrete plinth; this is required to facilitate the connection of the competent bedrock surface to the liner system. The concrete plinth will be a 30 MPa reinforced concrete beam bolted to the underlying bedrock. Concrete aggregate will be sourced from the quarry. Processing of the concrete aggregate will involve controlled blasting in the quarry, crushing with both a jaw and hydraulic cone crushing plant, screening, and washing.

Liner System

The primary containment barrier will be a 40 mil double-sided textured high-density polyethylene (HDPE). The secondary containment barrier will be a geosynthetic clay liner, which will be 4.5 kg/m^2 of bentonite needle-punched between two 300 g/m^2 nonwoven geotextiles. These two geosynthetics will comprise the liner system. The liner system will only be installed in the structure of the dam. The reservoir will be unlined.

3.1.18 Dry-Stacked Tailings Facility

The dry-stacked tailings facility (DSTF) will be where the dewatered tailings will be stacked on the ground surface. Construction of the area will be limited to removing any organic soil layers and compacting the existing granular soils. The ground will be cleared as it is needed, and the total areas to be cleared will be approximately 25 ha.

The site access road will be developed and the portion of the DSTF footprint required for placement of tailings in the first year of production will be prepared. Foundation preparation will include removing organic material, which will be stockpiled at the base of the pile for potential use during reclamation. The existing sand and gravel soils will be compacted using a 15-tonne steel-drum vibratory compactor to provide a compacted base for the tailings placement. The placement and compaction of the tailings will occur during the production phase of the project. The compacted granular base will also act as a blanket drain under the DSTF structure to allow groundwater and seepage water to freely drain from beneath the pile. Figure 22 and Figure 23 show the complete tailings pile in plan and section, respectively.

3.1.19 Water Diversion Structures

Two water diversion structures will be constructed on the site to promote water flow around the DSTF and the Ravine Dam. One will be a berm structure constructed from compacted fill upgradient of the DSTF. The other will be a cut-and-fill structure constructed on the north side of the valley below the DSTF. The locations of the two structures are shown in Figure 22.

The intent of the diversion berm upgradient of the DSTF is to divert the 1:100 year runoff flow around the DSTF pile during production. The grade of the berm will be split near its centre; half the flow will be diverted to the east and half the flow will be diverted to the west. Both diversions will flow into the stream at the bottom of the valley and report to the Ravine Dam reservoir. The diversion berm is only required during the production phase of the project.

The intention of the runoff diversion structure up-gradient of the Ravine Dam is to route the 1:100 year runoff water from the north side of the valley around the Ravine Dam. The runoff water on the north side of the valley will not be impacted by the mining activities, with the exception of the flow through the diversion structure. The water will flow freely down a natural drainage path into the valley bottom stream. The runoff diversion structure is only required during the production phase of the project.

Construction of the diversion berm upgradient of the DSTF will require surface preparation and the placement and compaction of granular fill. The thin organic layer will be stripped from the surface and the exposed soils will be compacted. A 1 m high berm will then be constructed with 2H:1V sideslopes. The berm will not have a wide crest; however, equipment will be able to access the area immediately upstream of the berm to conduct annual maintenance. Erosion protection will be added to the upstream side of the berm if significant erosion is observed during production. Maintenance will include repairing localized eroded areas, repairing shallow surface slumps of material on the shell of the berm, and removing accumulated snow in the spring. A typical cross-section of the berm is shown in Figure 5.4.2-26.

Construction of the runoff diversion structure upgradient of the Ravine Dam will require both excavation and fill placement. A cut will be made to allow a 1 m wide flat section with slopes on either side. The cut slope will vary from 1.5H:1V to 2.5H:1V, depending on the soil conditions. The excavated soil will be used to construct a fill slope on the lower side of the hill from the cut. The fill slope will be 2H:1V and will have a 6 m wide bench separating the inside and outside slopes. The bench will allow equipment to access the entire length of the structure to conduct maintenance during operation. If the volume of fill required is larger than the anticipated cut, the additional material will be sourced from the borrow pit upstream of the Ravine Dam or in the vicinity of the DSTF. An erosion protection geomembrane will be added to the base and inside slopes if significant erosion or seepage is observed during operation. Maintenance will include repairing localized eroded areas, repair of shallow surface slumps and removal of accumulated snow in the spring. A typical cross-section of the diversion structure is shown in Figure 24.

3.2 OPERATION PHASE

The Mactung Project will use trackless mine equipment and diesel-powered loaders and trucks. Electric-hydraulic units will be used for lateral and long-hole drilling. The ore will be crushed underground and conveyed up to the plant on a 1,050 mm (42 in) wide conveyor belt, which will be installed on trays hanging from the back of the 5 m x 5 m decline. A second conveyor, installed beside the ore conveyor, will transport dewatered sand as backfill material, from the plant down to a discharging point close to the crusher station. The backfill material will be loaded with a LHD on returning 30 tonne haul trucks and transported to mined-out stopes.

3.2.1 Ammonium Nitrate Fuel Oil Emulsion Plant

The ammonium nitrate fuel oil (ANFO) emulsion plant will be located on the west side of Mount Allen, and will be constructed in accordance with Explosives Act requirements. The plant will produce 1000 kg of ANFO per day in a package type explosive, which will be hauled overland to the underground portal. The ANFO truck will haul the explosives underground, by way of the conveyor decline, after which the blast holes will be loaded.

3.2.2 Waste Management

3.2.2.1 Topsoil and Overburden

Topsoil and overburden materials at the minesite occur primarily in the lower valley floor where the access road, borrow area and Dry Stacked Tailings Facility are located. Topsoil and overburden from within the footprint of these infrastructure developments will be salvaged and stockpiled for use in reclamation activities at future stages of the mine life. The stockpiles will be seeded as part of an overall erosion and sediment management plan for the site.

Topsoil and overburden materials along the access roads to the site will also be salvaged and stockpiled for use in later reclamation activities. Sediment management activities (seeding and silt fencing) will be applied to the road stockpiles once they have been completed.

3.2.2.2 Waste Rock

No waste rock will be excavated during the operations phase of the Project.

3.2.2.3 Hazardous Materials

During the production phase a number of hazardous materials will be stored in varying quantities at the site. These hazardous materials consist of reagents, fuels, and other substances that are consumed by the mining and milling processes and by the site equipment used for construction of the tailings storage facility. Table 2 contains a summary of hazardous materials, estimated quantities and storage means for the production phase. Quantities are estimated at this time and will vary depending on usage and are representative of expected quantities upon re-supply.

TABLE 2. MACTUNG SITE SUMMARY OF HAZARDOUS MATERIALS

Material	Quantity	Production Phase Storage
Fuel and Hydrocarbons		
Engine Oil	10,000 litres	Equipment maintenance facility
Hydraulic Oil	10,000 litres	Equipment maintenance facility
Gylcol	5,000 litres	Equipment maintenance facility
Transmission Oil	5,000 litres	Equipment maintenance facility
Grease	2,000 kg	Equipment maintenance facility
Process Chemical		
Copper sulphate	500 – 3,000 kg	Reagent Storage Area
Depramin (starch)	500 – 10,000 kg	Reagent Storage Area
DF-250 Dowfroth (frother)	500 – 4,000 kg	Reagent Storage Area
Emcol	500 – 3,000 kg	Reagent Storage Area
Flocculants	500 – 3,000 kg	Reagent Storage Area
Hydrated lime	1,000 – 21,000 kg	Reagent Storage Area
P40 detergent	200 – 1,000 kg	Reagent Storage Area
Pamak (fatty acid)	500 – 10,000 kg	Reagent Storage Area
Quebracho (tree extract)	5,000 – 25,000 kg	Reagent Storage Area
Sodium silicate	2,000 – 30,000 kg	Reagent Storage Area
Xanthate Z-6 (KAX)	500 – 5,000 kg	Reagent Storage Area
Hydrochloric acid	100 – 400 kg	Reagent Storage Area and Assay Lab
Hydrofluoric acid	50 – 200 kg	Reagent Storage Area and Assay Lab
Nitric acid	100 – 400 kg	Reagent Storage Area and Assay Lab
Sodium bicarbonate	500 – 1,000 kg	Reagent Storage Area and Assay Lab
Sulphuric acid	100 – 400 kg	Reagent Storage Area and Assay Lab
General Chemicals		
Detergents	230 kg	Cookhouse
Adhesives	10 kg	Warehouse
Cement	20 tonnes	Warehouse
Muriatic acid	45 litres	Warehouse
Oxygen	50 cylinders	Warehouse
Paint	150 litres	Warehouse
Paint stripper	45 litres	Warehouse
Propane	50 cylinders	Warehouse
Salt	1 tonne	Warehouse
Dynamite and emulsion explosives	30 tonnes	Magazine
Ammonium nitrate	30 tonnes	Designated Site
Other Chemicals		
Adhesives	10 kg	Warehouse
Cement	20tonnes	Warehouse
Muriatic acid	45 litres	Warehouse

TABLE 2. MACTUNG SITE SUMMARY OF HAZARDOUS MATERIALS		
Material	Quantity	Production Phase Storage
Oxygen	50 cylinders	Warehouse
Paint	150 litres	Warehouse
Paint stripper	45 litres	Warehouse
Salt	1 tonne	Warehouse
Detergents	230 kg	Cookhouse
Hydrochloric acid	100 — 400 kg	Reagent Storage Area and Assay Lab
Hydrofluoric acid	50 — 200 kg	Reagent Storage Area and Assay Lab
Nitric acid	100 — 400 kg	Reagent Storage Area and Assay Lab
Sodium bicarbonate	500 — 1,000 kg	Reagent Storage Area and Assay Lab
Sulphuric acid	100 400 kg	Reagent Storage Area and Assay Lab

3.2.2.4 Hazardous Wastes

Hazardous wastes are not expected to be directly generated as a result of the mining production phase. Hazardous wastes during the production phase may potentially result from spills at the site. Contaminated soils will be progressively remediated at a land treatment facility should this be required during the life of the project.

3.2.2.5 Other Waste Products

Waste oil will be re-used at the site during production to generate heat in a waste oil burner. This reduces the need to truck this waste product from the site. Waste oil containers and oil filters will be collected and shipped from the site.

Domestic camp and food waste will be incinerated at the site in order to minimize the potential for this materials becoming an animal attractant. Other non-recyclable waste products will be disposed of in the frozen bedrock portion underground workings

3.2.3 Water Management

This section presents details on the water management for the production phase of the mine. The proposed operation will operate at a water deficit during the production phase and as a result will require make-up water. Make-up water for the processing will be sourced from the southern tributary of the Hess River and pumped approximately 13 km to the mill.

All run-off from the plant site and waste rock dumps will report to the Ravine Dam in addition to that coming from the Dry Stacked Tailings Facility which will occupy half of the Tributary C basin area. The remainder of the Tributary C runoff is routed around the Ravine Dam in the Diversion Channel.

The ravine dam reservoir is the primary water management structure at the site and acts as a reservoir allowing fatty acids from the processing to breakdown prior to being re-used. It has been estimated that approximately 30 days are required for this process to occur. The Ravine Dam is also sized to accommodate the 1:100 yr return period flood event.

A conceptual water balance for the Ravine Dam Reservoir is shown in Table 3. It shows the overall water deficit for the production phase (based on occurrence of winter flow discharges). The reservoir is sized to hold approximately 520,000 m3 of water in addition to approximately 120,000 m3 of process water. Water will be partially stored during the freshet period to ensure discharge criteria are met and then discharged from the reservoir into an energy dissipation structure to be located downgradient of the Ravine Dam.

TABLE 3: RAVINE DAM RESERVOIR - AVERAGE YEAR WATER BALANCE BY MONTH (L/S)

	Process Water	Runoff	DSTF Seepage	GW Discharge	Treated Effluent	UG Mine Dewatering	Process Water Reclaim	Reservoir Discharge	GW Seepage
	Inflow	Inflow	Inflow	Inflow	Inflow	Inflow	Outflow	Outflow	Outflow
January	46.9	6	0.3	6.6	0.5	1.0	-44.7	-10	-6.6
February	46.9	4	0.3	6.6	0.5	1.0	-44.7	-6	-6.6
March	46.9	4	0.3	6.6	0.5	1.0	-44.7	-5.4	-6.6
April	46.9	5	0.3	6.6	0.5	1.0	-44.7	-6	-6.6
May	46.9	81	0.3	6.6	0.5	1.0	-44.7	-87	-6.6
June	46.9	207	0.3	6.6	0.5	1.0	-44.7	-210	-6.6
July	46.9	131	0.3	6.6	0.5	1.0	-44.7	-171	-6.6
August	46.9	77	0.3	6.6	0.5	1.0	-44.7	-81	-6.6
September	46.9	59	0.3	6.6	0.5	1.0	-44.7	-61	-6.6
October	46.9	35	0.3	6.6	0.5	1.0	-44.7	-38	-6.6
November	46.9	15	0.3	6.6	0.5	1.0	-44.7	-18	-6.6
December	46.9	9	0.3	6.6	0.5	1.0	-44.7	-12	-6.6
Total Yearly Volume (m^3)	1479038	1665196	9461	208138	15768	31536	-1307612	-1862300	-129298

4.0 DECOMMISSIONING AND CLOSURE PHASE

4.1 RECLAMATION PROGRAM OBJECTIVE

The reclamation program objective is to decommission and reclaim the site to a sustainable condition with no long term negative environment effects. The closure plans developed for the site are based on industry standards for decommissioning and on accepted engineering practice and principles. Progressive reclamation is one of the primary components of the reclamation program objectives and this component is described in the next section. The conceptual decommissioning and closure plans are based on individual reclamation units presented in Section 4.4.

4.2 PROGRESSIVE RECLAMATION PROGRAM

The goal of progressive reclamation is to reclaim areas that are no longer required for mine operations during the production phase. Progressive reclamation allows for a reduction in site liability as a result of ongoing reclamation activities. Only areas that are not being used or not planned for future use can be reclaimed during operations.

4.2.1 Reclamation Research

A reclamation research trial program will be developed for the Mactung Mine during the production phase. The research trial program will focus on evaluation of native species for site revegetation projects, fertilizer application rates and the potential for organic amendments. By developing trials for on-site testing NATC expects to ensure successful revegetation of reclaimed areas on closure. The nearby Cantung Mine will be decommissioned prior to the end of the production phase. The Mactung project will evaluate the successes of that decommissioning project and incorporate this information into the final decommissioning and closure plans.

4.3 ARD MITIGATION AND PREVENTION

This section of the plan describes the methods to be used at the Mactung Mine to control the potential effects from ARD. The principal objective in the selection of ARD control measures is to achieve the necessary environmental objectives in the most cost-effective manner. The effectiveness of any control measure is determined by the following site-specific factors:

- acid-producing potential of the mine waste, including the nature, quantity, and reactivity of sulfide minerals present, neutralizing potential of the rock, etc.,
- physical characteristics of the waste,
- climate, topography, and surface and groundwater hydrology,
- the expected time period over which the measure will be effective, and
- the sensitivity of the receiving environment to ARD.

Materials characterization and tracking are important tools to help manage and identify areas where potential risks may occur. Waste rock characterization allows for an understanding of the potential risk of ARD and helps to minimize unwanted use of PAG rock as a construction material. The potential for generation of ARD related to tailings disposition may be reduced by constructing tailings storage facilities in a manner that is favorable for implementation of long term ARD mitigation measures.

4.3.1.1 Waste Segregation and Blending

Waste segregation involves the careful removal and separate handling of various geologic units at a mine site. Mines with potentially acid generating (PAG) geologic units may also have other geologic units classified as non-acid generating. As a result, the segregation and separate handling of each unit provide two primary benefits. First, the volume of rock that may generate acidity and require treatment or special disposal procedures is minimized. These PAG and NAG units may be able to be blended for long term materials management.

The blending of acid-generating and acid-consuming rock units is similar to the alternative control technique of adding limestone or other neutralizing additives to the acid-generating waste. Consequently, successful blending is primarily dependent on the same factors as limestone addition, which include:

- the movement of water through the system,
- the nature of contact of acidic waste/water with the acid-consuming rock/water,
- the proportion of excess acid consuming rock, and
- the type and reactivity of the acid consuming minerals.

These factors determine the required procedure for blending. The costs of segregation and blending are site specific and dependent on the mine plan, the handling and transportation of the material, and the technique of blending.

4.3.1.2 Covers

Covers restrict the access of oxygen and moisture to potentially reactive wastes. The restriction of oxygen and moisture can serve to limit both the formation of acid and the subsequent transportation of the oxidation products into the environment. This section is focused on the installation of a final cover onto the surface of the DSTF at closure.

To be effective, the cover must have a low permeability to either air or water, and it must not have holes or imperfections where entry can occur. If large holes or cracks (desiccation, settlement, or tension) occur then oxygen passage through the tailings may take place as a result of convective air flow in response to natural barometric pressure changes and thermal gradients. The silty tailings materials in the DSTF is expected to have a moisture content of approximately 15% with the pore water expected to remain in the material due to capillary forces. Convective flow of air through the DSTF is expected to be minimal given the small particle size of the tailings and the fact that the material will have some residual moisture content.

The DSTF facility is being constructed in compacted lifts and the material is expected to have little long term settlement. The DSTF cover is located above treeline so there is not expected to be an issue associated with root penetration through the low permeability layer of the cover. The layer of material over top of the low permeability cover layer needs to be of sufficient thickness with appropriate drainage control to minimize potential long-term erosion and materials movement due to weathering and frost action.

A variety of materials may be used to provide surface covers depending on local availability and site conditions. These include different types of soils, synthetic membranes, water and a combination of soil and water, which result in saturated soil or bog conditions. The most effective means of excluding oxygen has been shown to be by means of a water cover; however this is not practical in the case of the Mactung mine. The other cover materials are generally more effective as inhibitors of infiltration in the control of ARD migration but can still be effective over longer time periods.

4.4 RECLAMATION UNITS

The following reclamation units have been identified for the development decommissioning and closure plans:

- Erosion Control and Sediment Management
- Camp and Ancillary Infrastructure;
- Access and Haul Roads;
- Explosives Storage Facilities;
- Processing Plant and Ancillary Infrastructure;
- Underground Access;
- Tailings Storage Facility;
- Ravine Dam;
- Diversion Channel;
- Borrow Areas;
- Hess River South Tributary Pumping Station
- Infrastructure Pads
- Contaminated Soils; and
- Post-Closure Monitoring Programs

The Processing Plant reclamation unit comprises all infrastructure located on the 1,830 m level and adjacent infrastructure pad. This includes areas such as the bulk fuel storage area and the Truck Shop, Administration Building, and Shifter's Office. The decommissioning of the infrastructure pads is included in the decommissioning activities for the Camp and the Process Plant.

The mined-out stopes of the underground workings will be progressively closed during production and should not require any further works. This reclamation unit includes the four planned openings to the surface that will be sealed during decommissioning. Adit closures are required to limit infiltration of surface water and to prevent access by person or animals into the closed underground workings.

4.5 DECOMMISSIONING AND RECLAMATION PLANS

This section presents the conceptual decommissioning and closure plans for the project. The decommissioning plans are presented by individual reclamation unit.

4.5.1 Erosion Control and Sediment Management

Erosion control and sediment management measures are critical to successful minesite reclamation. Some of the erosion control measures to be used at the Mactung site will include recontouring and revegetation of disturbed areas, silt fencing, enviro-matting and rock armouring of fine-grained soils in drainage channels. Sediment management measures will be implemented to minimize transport of eroded sediments and typically include sumps and settling ponds. The overall goal of these measures is to prevent erosion of fine-grained soils and minimize the introduction of sediment into the receiving environment. Erosion control and sediment management materials have been included in some of the reclamation cost estimates; however for the larger infrastructure units a lump sum figure has been estimated and included in the summary cost table

4.5.2 Camp and Ancillary Infrastructure

During decommissioning activities, all building, salvageable equipment and inventories will be removed from this location site. Hazardous materials will be removed from site and disposed of in an approved disposal facility. Any non-salvageable waste materials and structures will be broken down to ground level and preferably disposed in the underground workings.

4.5.3 Access Roads

The level of access road decommissioning will depend on whether the road pre-existed the mine.

The existing exploration trail that traverses the first approximately 17 km to the mine pre-dates the Mactung project and is a public road under the *Highways Act*. Decommissioning phase activities along this road would consist of returning the access level to ATV use only and stabilizing sections as required.

The construction of the new access road from the existing road to the mine site will be a private road during the operations phase and will be reclaimed during de-commissioning. Water bars to manage surface runoff and control erosion and berms to restrict human access will be incorporated where necessary. Bridges and culverts will be removed from this portion of the road. Natural drainage areas will be restored or stabilized, and roadbeds will be graded where necessary to provide adequate drainage. Following grading, roadbeds will be scarified/ripped and revegetated. If determined necessary for successful revegetation, growth media will be placed onto the prepared surface prior to revegetation. Areas with unstable cut or fill slopes will be stabilized as required.

The new road and pipeline bench to the Hess Tributary will be reclaimed during decommissioning, and the pipeline removed. Culverts will be removed, natural drainage areas restored or stabilized; and roadbeds will be graded where necessary to provide adequate drainage. Following grading, roadbeds will be scarified/ripped and revegetated. If determined necessary for successful revegetation, growth media will be placed onto the prepared surface prior to revegetation.

The access road to the drystack tailings, mill, camp and adits will be left in place following closure to maintain access to the site for monitoring and in the event that post-closure repairs to either the plugs or tailings cover system are required.

4.5.4 Explosives Storage Facilities

The explosives storage magazines will be removed from the site following the end of blasting activities at the site. The manufacturing plant will be de-commissioned and sampled during a post mining Phase II Environmental Site Assessment to determine whether additional remedial measures are required. Soil sampling will be conducted in the area of the magazines to ensure that remaining soils do not exceed the relevant land use standards in Yukon's *Contaminated Sites Regulation (Environment Act).*

4.5.5 Processing Plant

The processing plant will be de-commissioned at the end of the Production Phase. All milling and processing reagents and equipment will be sold for salvage where possible. Any remaining non-hazardous steel and building materials not feasible to be salvaged will be broken down and disposed of within the underground workings prior to plugging of these workings. The concrete foundation for the processing plant will be removed above surface broken down to slightly below ground level and with disposal of debris within the frozen bedrock component of the underground workings. The remaining subsurface concrete foundation will be covered with waste rock from the construction pad as part of recontouring activities.

4.5.6 Underground Access

The two surface raises (for ventilation) and the conveyor decline and ventilation adit will be plugged at closure to restrict the movement of surface runoff into the underground workings. The plugs are not required to be water-proof, however they should be water resistant. In addition these plugs will protect persons and animals from falling / wandering into the openings.

Backfilling of the underground openings will be conducted to fill the openings with rock to the point where the seals are to be installed. Shotcrete will then be applied to the opening in order to create a seal. Some additional rock may be backfilled onto the shotcrete surface for the larger openings to help protect it from the elements.

4.5.6.1 Underground Drainage

Surface water inflow is generally not the main source of water in underground mines. Surface water may flow into underground mines through portals, ventilation shafts, or possibly through fractures in the rock that develop by mining-induced settlement. For the Mactung Mine there is frozen bedrock that will limit groundwater effects from the underground workings until the underground workings extend below the regional groundwater table. Dewatering of the underground workings will be constant throughout the remainder of the operations phase. The rebound of the regional groundwater table has been estimated to occur within a couple of years following the end of mining.

The primary source of water in the underground workings will be groundwater because the workings will represent a depression in the local groundwater regime. Because the majority of the mine is above the water table in the area, the impact to the ground water is expected to be minor. Underground mine water will flow under gravity to a sump and will be pumped from the workings to the surface and used as process water. Post-closure monitoring of underground drainage is addressed in section 4.6

After closure, the pumping of mine water to the surface will be terminated. This will allow the workings to flood and the groundwater levels to recover toward pre-mining conditions. As this occurs, the workings will become an integrated part of the groundwater flow system. Hydrogeological investigations conducted at the site indicate that most of the mine-related water will flow into Tributary C; within the catchment area of the Ravine Dam.

4.5.7 Tailings Storage Facility

The Mactung Dry Stacked Tailings Facility (DSTF) will at closure contain approximately 2,130,000 tonnes of mostly PAG tailings. The DSTF will be constructed as a hillside fill. The soils beneath the DSTF are highly permeable soils which have a greater hydraulic conductivity than that of the placed tailings which will act to limit the ability of groundwater to penetrate the DSTF. The facility is designed to have an overall 4H:1V face which will allow for closure without requiring recontouring. At closure the DSTF will have a surface area of approximately 20 ha.

At closure cover material will be used to resist runoff erosion, prevent dusting and to create an appropriate growth media for project reclamation. There is a shortage of clay till in the project area which precludes the ability to use borrow materials to provide a natural cover. As a result of this shortage it will be necessary to construct the low permeability portion of the cover using an artificial liner.

The artificial liner will be placed onto the surface of the DSTF by contractors familiar with this type of installation. The liner material is rolled over the surface and seams are sealed to ensure that there is little to no leakage. A quality assurance/quality control measure for the liner installation includes testing of a number of seams. Granular material to cover the liner will be sourced from local borrow areas.

It has been estimated that approximately 176,000 m^3 of material are required to construct a 0.8 m thick protective cover overtop of the liner. A total of 70,000 m^3 of screened sand are required directly overtop of the liner in order to protect it. An additional 106,000 m^3 of gravels are required for covering the sand layer. The gravels will be sourced from the Ravine Dam facility during decommissioning activities on that facility. The cover material will be placed using conventional methods and efforts will be made to minimize surface compaction in order to reduce erosion. Perimeter ditching will be installed to collect any run-off from the DSTF during operations and this ditching will allow for monitoring of run-off chemistry to ensure that there are no issues relating to ARD or metals leaching from the DSTF facility.

Revegetation of the final cover surface will be conducted progressively as portions of the tailings are reclaimed in order to minimize surface erosion. Silt fencing will be installed in strips across the face of the cover material in order to minimize the ability for development of erosion channels prior to vegetation establishment.

The surface of the DSTF will be backsloped to control surface runoff and minimize erosion of the sloped portion of the DSTF. Water from the surface of the DSTF will be collected by a perimeter drainage ditch system. Rip-rap will be placed into the drainage collection ditch to prevent erosion. Rip-rap design will be prepared by a registered Professional Engineer and will consist of competent NAG rock placed into the ditch as required. The ditching system will be designed to accommodate the 1:100 year return period flow for the DSTF. Post-closure groundwater monitoring is described in Section 4.6.

4.5.8 Ravine Dam

The reservoir of the Ravine Dam will be pumped down after the production phase of the project. Drainage patterns will be re-established through the reservoir area. The dam will be breached with a slot cut through the centre and an erosion resistant streambed will be constructed through the dam footprint. This streambed will connect with the re-established drainage patterns through the reservoir, making the valley bottom stream once again continuous from its headwater to its confluence with Tributary A.

Reclamation of the Ravine Dam will be conducted in a phased manner. Earthworks to breach the dam will begin after pumping down of the structure. The slot cut will be constructed with slopes from 2H:1V to 2.5H:1V depending on the overall height of the cut. A 2.5H:1V slope angle would be used in the deeper cut areas (slopes greater than 20 m in vertical height) through the center of the dam to ensure stability and the final cutslopes will be revegetated to minimize erosion. Earthworks will be conducted to an elevation slightly above the natural stream elevation in order to provide a sedimentation pond for the cleaning of sediments and re-establishment of the natural drainage courses. Final breaching of the facility will be conducted using an excavator and dozer to locally distribute fill materials and construct the drainage channel through the footprint of the structure.

Process related sediments that have accumulated within the reservoir during the production phase will require removal and disposal. These materials will be fine-grained with a high moisture content which makes collection and transport challenging. Sediments exposed following lowering of the reservoir will be allowed to freeze to make collection easier. Materials will be dozed into piles for transport to the DSTF facility for final disposal. Estimation of the potential volume of sediments that may require removal at decommissioning is not possible to any degree of accuracy; however some estimate of time to excavate potential sediments has been included in the costing component.

Re-establishment of natural drainage patterns will be conducted once the process sediments from the footprint of the reservoir have been collected. An excavator will be used to re-establish the natural drainage patterns with any excavated fill material being disposed of near to the channel. All disturbed areas will be revegetated and erosion control measures installed to minimize erosion prior to development of a sustainable vegetative cover.

The pumps will be removed from the dewatering wells and removed from site. The wells will be grouted back to surface to prevent contamination of groundwater.

4.5.9 Diversion Channel

The works on this infrastructure component will be conducted near to the end of the decommissioning activities on the site. The Diversion Channel will be decommissioned in a downstream direction to minimize potential flow effects. The channel will be in-filled using the construction waste which is located in the access berm along the lower edge of the channel. Revegetation of the diversion channel would be conducted immediately following recontouring activities and erosion control and sediment management features would be implemented where needed by a labour hand crew.

4.5.10 Borrow Areas

Borrow areas for the project will be reclaimed when no longer operationally required. Reclamation procedures will include the removal of any deleterious substances and regarding of any cut or fill slopes to a stable angle. Revegetation would be conducted on the area with vegetation selection based on pre-development vegetation.

4.5.10.1 Organics and Overburden Stockpiles

Piles or dumps of waste material will be stockpiled in such a manner as to facilitate phased/progressive reclamation. Waste rock and overburden soil will be segregated from topsoil and growth media, where feasible, and salvaged for use in reclamation.

Topsoil and suitable growth media stored during construction will be used for progressive reclamation as required. Topsoil and suitable growth media that cannot be utilized immediately for reclamation will be stockpiled in an area where it will not be disturbed until needed for reclamation. Topsoil and suitable growth media stockpiles will be clearly identified to distinguish them from waste dumps. Topsoil and suitable growth media stockpiles will be planted with a vegetative cover or shall be protected by other equally effective measures to prevent water and wind erosion.

4.5.11 Hess River South Tributary Pumping Station

The pumps will be removed from the pumping station along with all surface infrastructure. A fence will be installed around the perimeter of the slot cut to prevent animals from falling into the river. The fencing will be installed by a contractor during decommissioning activities at this site.

4.5.12 Infrastructure Pads

Non-acid generating (NAG) waste rock will be used as required as rip-rap for bank stabilization, erosion protection and for the infrastructure pad construction. As previously mentioned, any NAG waste rock at the site will also be utilized for the construction of infrastructure (Mill and Camp) pads at the site. On closure, all infrastructure on the surface of the waste rock pads will be salvaged or removed to allow for reclamation. Compacted surfaces will be ripped to allow for drainage of the materials while the faces of dumps will be recontoured to a stable angle blending with the surrounding steep mountainous slopes.

The waste rock pads are above treeline and there is minimal soil present in the area. Placement of limited volumes of overburden and topsoil will be conducted to allow for some revegetation.

4.5.13 Contaminated Soils

A Phase II Environmental Site Assessment (ESA) will be conducted on the Mactung Mine following the end of the operations phase. The objective of the ESA will be to characterize the extent of contaminated soils and hazardous materials at the site. This information will then be used to confirm the original estimated volumes of materials requiring special handling during de-commissioning. The Phase II ESA will also include consideration of potential groundwater effects from site contamination. A land treatment facility to remediate contaminated soils is included in the project scoping.

4.6 POST CLOSURE MONITORING AND INSPECTION PROGRAMS

4.6.1 Surface Water and Groundwater Quality Monitoring

Post closure monitoring of water quality monitoring wells is a requirement under the federal Metal Mining Effluent Regulations (MMER). Monitoring of water quality is required for a period of three years following the issuance of notification of closure of the mill. During this three year period the sampling frequency for water quality monitoring at each identified Final Discharge Point (FDP) is weekly when flow exists.

Groundwater monitoring downgradient from the Dry Stacked Tailings Facility (DSTF) and the underground workings is proposed to occur for a total of 10 years following the end of the production phase. Sampling trips during the first three years would coincide with the other required water quality monitoring. The remainder of the testing would be conducted on two year intervals for the ten years.

4.6.2 Environmental Effects Monitoring

The MMER program has a requirement for the final Environmental Effects Monitoring (EEM) study to be undertaken within three years of site closure.

4.6.3 Post Closure Geotechnical Inspections

Geotechnical inspections to ensure that the cover system for the Dry Stacked Tailings Facility (DSTF) is functioning as per design are required annually for a period of three years. Following that initial period it is anticipated that an inspection frequency of every 5 years would be required for a total of twenty years.

5.0 DECOMMISSIONING AND RECLAMATION COSTS

5.1 COSTING METHODS

Costing for the decommissioning and closure of the Mactung Mine has been developed based on accepted standards and practices. Equipment rates were based on available

Yukon third party rates along with additional information obtained from a Yukon based earthworks contractor with large earthworks equipment.

Equipment Selection

The selection of equipment for the development of costs was conducted using two different methods, depending on the scale of the decommissioning activity. For smaller activities, the equipment sizing was primarily based on past professional experience.

For larger earthworks components (DSTF liner cover and Ravine Dam decommissioning), sensitivity analyses were conducted for different equipment sizes and numbers in order to determine which combination was the most cost effective. Haul calculations and earthworks components were developed using the Caterpillar Performance Handbook Edition 33 along with equipment specification for other equipment obtained via internet downloads.

5.2 COSTING ASSUMPTIONS

It has been assumed that the airstrip will not require deactivation following the end of mining. This facility will continue to be the property of the Government of Yukon and the improvements made as a result of the mining project will increase the ability of others to safely utilize this facility. The cost estimate presented in this section is based on 2008 equipment rates and does not account for inflation. The costing also does not account for any fuel surcharges that may result should prices rise as was experienced in the past few years. The costing includes a contingency of 15% except where otherwise noted. This level of contingency is standard based on the conceptual nature of the works described in the plans. The costing also assumes that mining and processing equipment that can be sold and salvaged will be removed at no cost to NATC prior to the decommissioning of site infrastructure.

5.3 RECLAMATION COST ESTIMATES BY RECLAMATION UNIT

The summary cost estimate for decommissioning of the Mactung Mine is shown in Table 4. Additional details on the costing are provided in the following sections.

TABLE 4. DECOMMISSIONING COST SUMMARY BY RECLAMATION UNIT	
Reclamation Units	**Estimated Cost**
Erosion Control/Sediment Management	$ 50,000
Camp and Ancillary Infrastructure	$ 30,000
Access Roads	$ 293,000
Process Plant Area	$ 185,000
Underground Access	$ 52,000
DSTF	$ 3,869,000
Ravine Dam	$ 416,500
Diversion Channel	$ 33,500
Borrow Areas	$ 42,500
Hess Tributary Pumping Station	$ 19,500
Contaminated Soils	$ 252,000
Post Closure Monitoring	$ 748,000
Decommissioning Cost Estimate Total	**$ 5,991,000**

5.3.1 Erosion Control and Sediment Management Materials

Erosion control and sediment management materials have been included in some of the reclamation cost estimates; however for the larger infrastructure units an additional $50,000 has been included in the summary cost table to reflect additional material requirements.

5.3.2 Camp and Ancillary Infrastructure

The decommissioning of the camp and ancillary infrastructure will involve the removal of any materials that may be salvaged or re-sold. The remaining buildings and materials will be broken down and transported underground for final disposal. It is estimated that it will require 6 shifts with 2 underground haul trucks and an excavator to rehandle waste building materials underground. Excavator and articulated haul truck time has also been included for placement of some organic material onto the reclaimed surface of this pad. The total estimated cost for this activity is $30,000.

5.3.3 Access Roads

The costing of the access road decommissioning was separated into three phases representing the three main road segments that will be decommissioned. The access road to the site will require minimal maintenance during the decommissioning phase in order to allow for equipment and personnel to reach the site. These costs are identified in Section 5.3.3.1. Decommissioning costs for the three road segments are identified in Section 5.3.3.2 to 5.3.3.4.

The estimated cost associated with access roads during decommissioning and closure is approximately $293,000.

5.3.3.1 Road Maintenance Costs

Road maintenance costs have been estimated for two summer seasons to allow for equipment and personnel to reach the site. Road maintenance will utilize the NATC mine grader as this machine will be at the site. Some excavator time for ditch and culvert maintenance has also been included. The estimated road maintenance costs for the access road during the decommissioning phase are approximately $51,500.

5.3.3.2 Hess River South Tributary Access Road

This 3 km section of road to from the upgraded access road to the Hess River South Tributary will be reclaimed during the decommissioning phase. A grader will be employed to scarify the road surface with an excavator being utilized for removal of culverts and retrieval of construction spoil materials. The works are expected to require approximately 120 hours of excavator time to complete. A total of 5 days of work for a three person labour crew has been included in the cost estimate for the purposes of implementing erosion control and sediment management measures along the reclaimed alignment. Culverts from the decommissioning of this road will be sold for re-use, if possible, or else will be disposed of in the underground workings. The estimated cost to reclaim this section of road is approximately $29,000.

5.3.3.3 Tributary A Junction to Minesite Access Road

The access road from the minesite to the junction at Tributary A will be reclaimed during the decommissioning phase. This road is approximately 10 km in length and traverses primarily moderate slopes with cut and fill construction. The access road will be reclaimed using an excavator with a grader support in portions for scarification of the road surface. It is estimated that the works require approximately 250 hours of excavator time to complete. A total of 7 days of work for a three person labour crew has been included in the cost estimate for the purposes of implementing erosion control and sediment management measures along the reclaimed alignment. Culverts from the decommissioning of this road will be sold for re-use, if possible, or else will be hauled to an approved landfill facility for disposal as this road will be decommissioned following the sealing of the underground workings. Costs of hauling the used culverts to Ross River have been included in the costing for this component. The estimated cost to reclaim this section of road is approximately $82,000.

5.3.3.4 Public Road to Tributary A Junction

The access road section from the Junction with Tributary A to the end of the pre-development public road will be reclaimed during the decommissioning phase. This road is approximately 18 km in length and traverse primarily flatter terrain with a couple of short sections where moderate to steep slopes exist. Reclaiming of this section of road will involve use of a grader for scarification and an excavator to conduct culvert removal and recontouring of ditches and spoil material. A total of 12 days of work for a three person labour crew has been included in the cost estimate for the purposes of implementing erosion control and sediment management measures along the reclaimed alignment. Culverts from the decommissioning of this road will be sold for re-use, if possible, or else will be hauled to an approved landfill facility for disposal as this road will be decommissioned following the sealing of the underground workings. Costs of hauling the used culverts to Ross River have been included in the costing for this component. The estimated cost to reclaim this section of road is approximately $91,000 (not including bridges). This costing includes a 15% contingency as it will be conducted during 2026 when there will be no other scheduled works aside from the site monitoring.

Bridge Removals

Removal of bridges along this section of road have also been estimated but are not included in the above costing. An excavator and articulated haul truck will be required as are a picker truck for transporting bridge components. A total of 3 days of work for a three person labour crew has been included in the cost estimate for the purposes of implementing erosion control and sediment management measures at bridge sites. The cost of removal of bridges along the access road is estimated at approximately $39,500.

5.3.4 Explosives Storage Facilities

The explosives manufacturing plant will be owned by the manufacturing company and they will be responsible for plant site remediation costs. NATC will ensure that remediation is conducted to the applicable standards and shall have third party sampling of the de-commissioned site conducted as part of Phase II ESA sampling. Costing of these studies is presented in the post closure monitoring cost section.

5.3.5 Processing Plant and Ancillary Infrastructure

The costing for the decommissioning of the process plant and other site infrastructure includes an allowance for cranes and millwrights to be at the site during the decommissioning activities. A total of 21 shifts have been estimated for an excavator and two underground haul trucks to rehandle non-salvageable materials underground for final disposal in the frozen mine workings. Other costs include the use of the excavator and doze to recontour and scarify the infrastructure pad so that it blends with the surroundings. The cost of removal of the power distribution system (power poles and wire) has also been included in this section. The cost of decommissioning the Process Plant and the infrastructure pad has been estimated at approximately $185,000.

5.3.6 Underground Access

The four underground accesses are estimated to cost approximately $52,000 to decommission based on the use of shotcrete to seal the openings.

5.3.7 Dry Stacked Tailings Facility

The total costing for this reclamation unit is estimated at $3,869,000 and includes the following components.

An all-found cost for synthetic liner to cover the dry stacked tailings facility (DSTF) has been estimated at $10/m^2$ based on information provided by the manufacturer. This cost includes all machinery and materials to install the liner but does not include transport of the liner to the site. The surface area of the DSTF requiring this cover at closure has been estimated at approximately 220,000 m^2 which would cost approximately $2,616,500 for installation of the liner. Other liner types may be evaluated during the detailed design phase to allow for possible refinement of this cost.

An estimated volume of 220,000 m^3 of fill is required for the liner cover from the borrow source located adjacent to the toe of the DSTF facility. The placement of the earth cover on the DSTF will be conducted using surface haul trucks and larger sized excavators. Sensitivity analysis on the equipment indicated that the 777D sized haul truck loaded by a C385 sized excavator was the most cost efficient equipment; however this haul truck is too heavy for the trafficking on the surface of the DSTF. For this reason the cost estimate was prepared using 40T articulated haul trucks. This equipment combination supported with one grader and one dozer should be able to complete the earthworks in approximately 34 shifts. The estimated cost of the earthworks component is approximately $1,103,000.

Anticipated revegetation and sediment management costs were based on the use of hydroseeding while the sediment management works were primarily implemented by hand labour crews. This component cost is estimated at approximately $149,500.

5.3.8 Ravine Dam

The total estimated cost of the decommissioning works for the Ravine Dam is estimated at approximately $416,500 and includes the following components.

The Ravine Dam decommissioning and closure activities first involve the removal of deposited process related sediment from within the footprint of the facility. These sediments will be rehandled for 14 shifts by a C320 sized excavator and two A40 sized haul trucks. The estimated cost of this component is approximately $147,500. Re-establishment of the natural drainage patterns within the footprint of the facility will require approximately 7 shifts for an excavator and field labour crew. The estimated cost of this component is approximately $31,000.

The earthworks to breach the Ravine Dam will utilize the same equipment haulage fleet as the DSTF. Some of the excavation costs in for this facility are included in the DSTF as 106,000 m^3 of excavated material will be hauled there for placement. The cost of the remaining earthworks is estimated at approximately $196,000 and will utilize the same equipment as the DSTF works. Revegetation of the footprint of the Ravine Dam will be conducted by a hydroseeder for an estimated cost of approximately $42,000.

5.3.9 Diversion Channel

The Diversion Channel will be decommissioned over a 7 day period by a C320 sized excavator with erosion control and sediment management measures being implemented by a hand labour crew. The diversion berm upslope of the DSTF will be breached and recontoured in approximately 3 shifts using a D6 sized dozer. The estimated cost for the decommissioning of these items is approximately $33,500.

5.3.10 Borrow Areas

The decommissioning and closure of the borrow areas also includes machine time to reclaim the footprint of the organic and overburden stockpiles. This has a total estimated cost of $42,500 and includes the following two components.

Borrows from the construction and decommissioning phase will require reclamation activities to ensure that they are left in an acceptable condition. Decommissioning activities on the borrow areas will require approximately 6 shift for a D6 sized dozer to recontour slopes. Scarification of the borrow floor will be conducted by a grader. Two shifts for an excavator and articulated haul trucks are estimated to be required to transport overburden or organic materials for the borrows. The estimated cost of the borrow decommissioning is estimated at approximately $37,500.

Organic and overburden stockpiles will be used as sources of reclamation media during the decommissioning phase and as such their costs are incorporated into those estimates. The costs associated with decommissioning the footprint of these stockpiles is based on the use of a D7 similar sized dozer to scarify the footprint and an excavator to assist in the distribution of materials. The works are expected to require approximately 10 hours of time to complete. Revegetation costs are included in the for hydroseeding estimate for the DSTF due to the small anticipated footprint of any of these stockpiles. The cost has been estimated at approximately $5,000.

5.3.11 Hess River South Tributary Pumping Station

The decommissioning of the Hess River South Tributary involves little machine work. Removal of any structures at this location will be conducted along with installation of the perimeter fencing around the slot cut area. The works at this location are estimated to cost approximately $20,000.

5.3.12 Infrastructure Pads

Costing for the decommissioning activities on the two infrastructure pads has been included in the cost estimates for the Camp and the Process Plant.

5.3.13 Contaminated Soils

A Phase II Environmental Site Assessment will be conducted during the start of the decommissioning phase to identify and delineate the extent of contaminated soils as defined under the Yukon Contaminated site Regulations. A land treatment facility will be operated at the site for the three years after closure to remediate any contaminated soils identified during the decommissioning phase of the project. The total costing estimate of $252,000 for these items is shown below:

- Phase II Environmental Site Assessment: $80,000;
- Land Treatment Facility: $172,000.

5.3.14 Post Closure Site Monitoring Program Costs

Post closure monitoring costs were estimated based on the estimated number of studies that would be required following the end of operations. Costs for post closure monitoring studies and the timeframe following closure are estimated at $748,000, which includes the following:

- Geotechnical site inspections (to 20 years post closure): $213,000;
- Environmental Effects Monitoring under MMER: $144,000;
- Water quality monitoring under MMER: $230,000;
- Hydro-geological monitoring Year 4 to Year 10: $161,000.

5.4 SECURITY PAYMENT SCHEDULE

NATC proposes to use a financial vehicle suitable to the Yukon Government that would be submitted on a schedule based on the level of construction or operations for the Mactung Mine. The majority of the infrastructure will be at full disturbance level during the construction phase and the costs of decommissioning are incurred during that phase of the project. The exception to this is the footprint of the Dry Stacked Tailings Facility (DSTF) which will only involve minor site preparation prior to production. During production the placement of tailings into this facility results in the need for the cover system and the incurring of decommissioning costs. NATC proposes to submit incrementally for the DSTF based on the surface area of the tailing in the facility as this is the factor that controls cover costing. This would allow for financial security to grow with that facility until it reaches its maximum footprint and decommissioning cost.

6.0 DECOMMISSIONING AND CLOSURE SCHEDULE

The decommissioning and closure of the project are intended to occur primarily over a two year period (2024-2025) with an additional year (2026) being conducted on the access roads to the site. Table 5 shows the estimated completion date for decommissioning activities by reclamation unit.

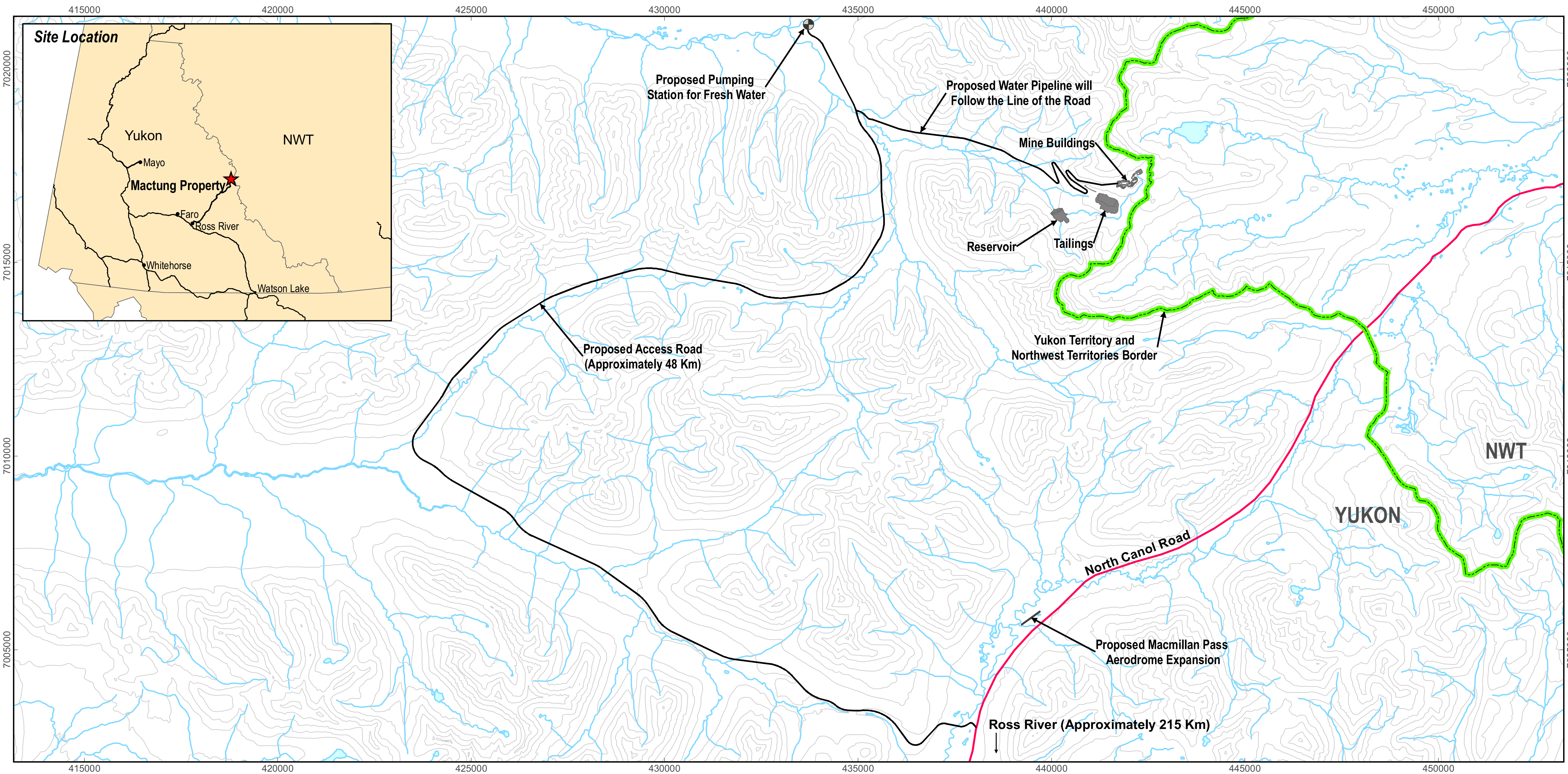
TABLE 5. DECOMMISSIONING SCHEDULE BY RECLAMATION UNIT	
Reclamation Units	**Estimated Completion**
Erosion Control/Sediment Management	October 2026
Camp and Ancillary Infrastructure	September 2025
Access Roads	October 2026
Process Plant Area	October 2024
Underground Access	September 2025
DSTF	September 2025
Ravine Dam	September 2025
Diversion Channel	September 2025
Borrow Areas	September 2025
Hess Tributary Pumping Station	October 2024

7.0 CLOSURE

This decommissioning and closure plan has been prepared for the proposed Mactung Mine based on the current project description. The plan is based on the use of best management practices and engineering design principles in order to achieve a stable long term closure scenario that can be achieved in a logical and rational manner. There is no need for long term treatment plants associated with the closure of the Mactung Mine.

The decommissioning and closure plan is intended to be updated on a periodic basis and to evolve with the project. The next scheduled update of this document would be based on the results of the detailed design phase and contain more comprehensive information on the project. Another update would be issued during the production phase and would present actual site infrastructure information in addition to as-built drawings which allows for refinement of closure costing.

FIGURES



LEGEND

- Proposed Access Road
- Proposed Mine Site Infrastructure
- Macmillan Pass Aerodrome Runway
- Existing Road
- NWT - Yukon Territory Border
- Contours (100m)
- Watercourse
- Waterbody

NOTES
Base data source: NTDB 1:50K, 1:250K
Site Plan adapted from original provided by Wardrop

ISSUED FOR USE

MACTUNG DECOMMISSIONING AND CLOSURE PLAN

Proposed Site Layout and Access Roads

PROJECTION	DATUM
UTM Zone 9	NAD83

Scale: 1:100,000
2 1 0 2
Kilometers

NORTH AMERICAN TUNGSTEN CORPORATION LTD
EBA Engineering Consultants Ltd.

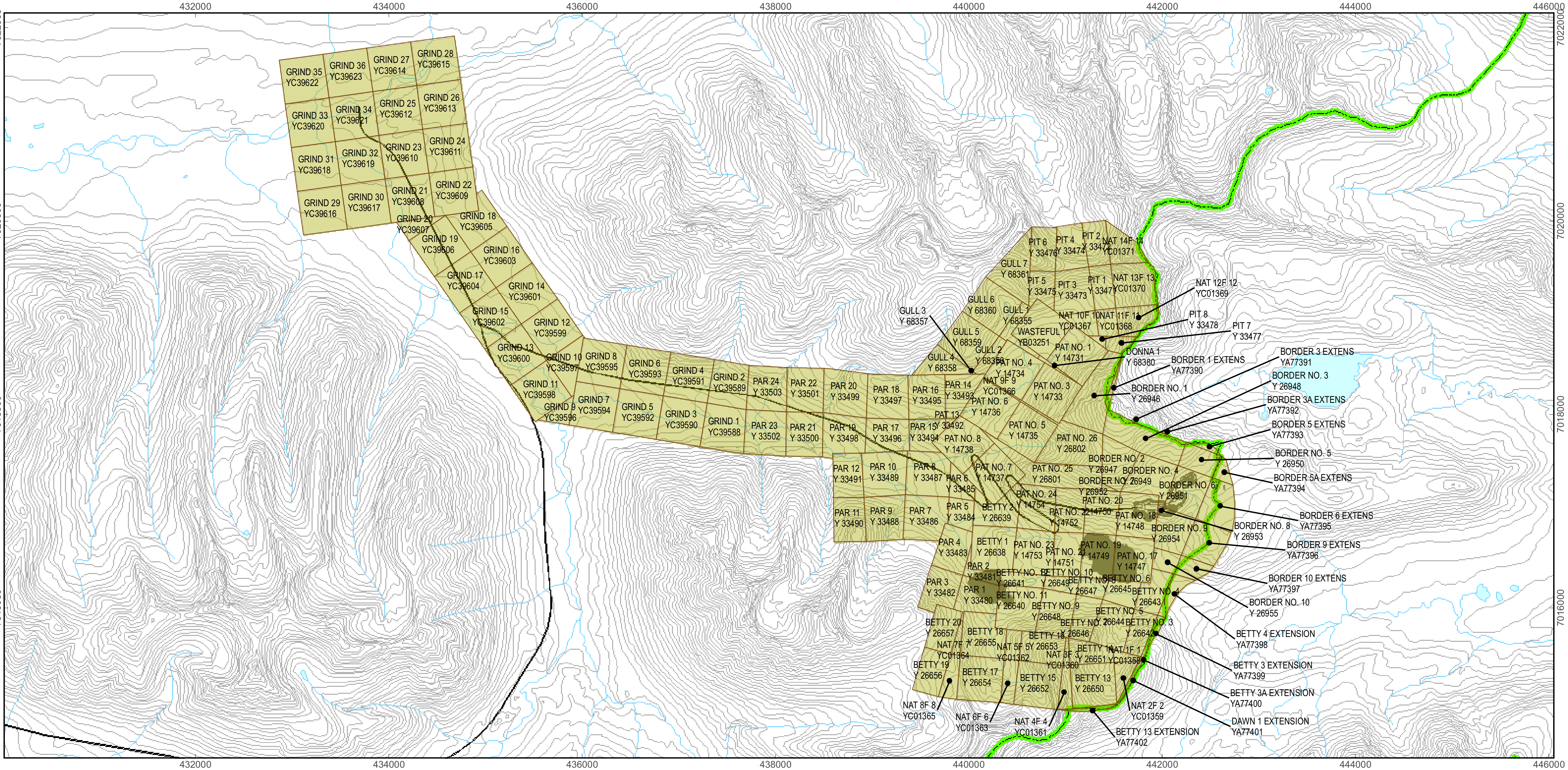
FILE NO.
W23101110_003_Figure1.mxd

PROJECT NO.	DWN	CKD	REV
W23101110.003	MEZ	SD	0

OFFICE	DATE
EBA-VANC	December 8, 2008

Figure 1

Q:\Vancouver\GIS\ENVIRONMENTAL\W231\W23101110_MacTung_AP\Maps\001_YESAA_Prep\Section_3.0\W23101110_001_Section3_Figure1.mxd



LEGEND

- NATC Mineral Claims
- NWT - Yukon Territory Border
- Proposed Access Road
- Proposed Mine Site Infrastrucutre
- Contours (20m)
- Contours (100m)
- Watercourse
- Waterbody

NOTES
Base data source: NTDB 1:50K, 1:250K, Yukon Geomatics
Site Plan adapted from original provided by Wardrop

ISSUED FOR USE

MACTUNG DECOMMISSIONING AND CLOSURE PLAN

NATC Mineral Claims - Mactung

PROJECTION	DATUM
UTM Zone 9	NAD83

Scale: 1:40,000
0.8 0.4 0 0.8
Kilometers

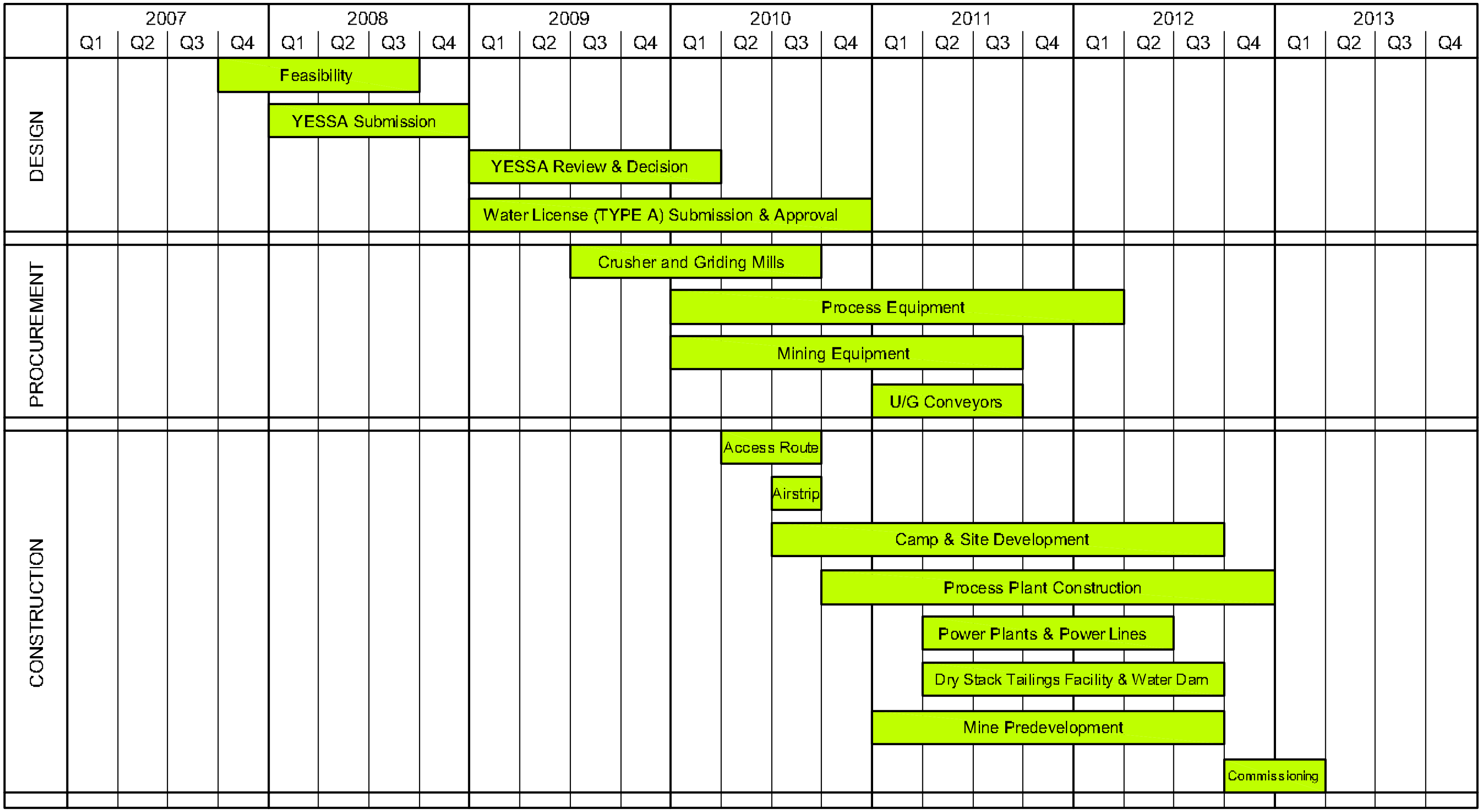
NORTH AMERICAN TUNGSTEN CORPORATION LTD
EBA Engineering Consultants Ltd.

FILE NO.			
W23101110_003_Figure2.mxd			
PROJECT NO.	DWN	CKD	REV
W23101110.003	MEZ	SD	0
OFFICE	DATE		
EBA-VANC	December 10, 2008		

Figure 2

O:\Vancouver\GIS\ENVIRONMENTAL\W231\W23101110_MacTung_AP\Maps\001_YESAA_Prep\Section_3.0\W23101110_001_Section3_Figure2.mxd

Q:\Edmonton\Drafting\DIVISIONS2007\Other Offices\W231\W23101110\Base ACAD Drawings\W23101110-Yessa Figures SD - Drawing 2.dwg [FIGURE 3] December 11, 2008 - 4:52:53 pm [BY: BOB RICHMOND]



ISSUED FOR USE

CLIENT

NORTH AMERICAN TUNGSTEN CORPORATION LTD

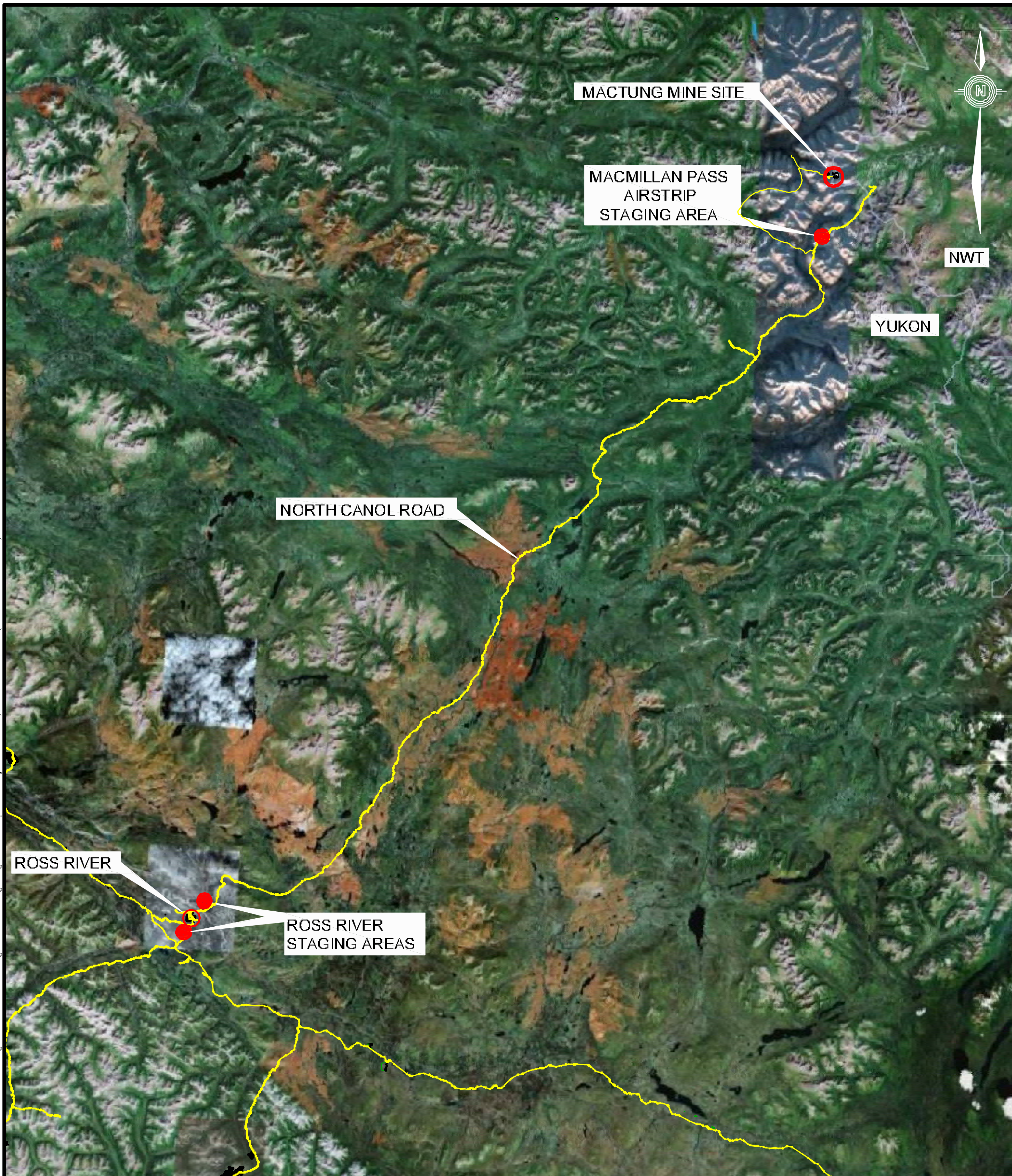
EBA Engineering Consultants Ltd.

MACTUNG
Decommissioning and Closure Plan

Construction Phase
Project Schedule

PROJECT NO.	DWN	CKD	REV
W23101110.003	BR	SCD	0
OFFICE	DATE		
EBA-WHSE	DECEMBER 2008		

Figure 3



NOTE: Background imagery provided courtesy of Google Earth and is shown for visual presentation only.

ISSUED FOR USE

0 500 000

Scale: 1: 1 000 000 (metres)

CLIENT

NORTH AMERICAN TUNGSTEN CORPORATION LTD

EBA Engineering Consultants Ltd.

MACTUNG
Decommissioning and Closure Plan

Staging Area Locations

PROJECT NO.	DWN	CKD	REV
W23101110.003	BR	SCD	0
OFFICE	DATE		
EBA-WHSE	DECEMBER 2008		

Figure 4