

Nechalacho Rare Earth Elements Project Closure and Reclamation Plan

MV2020D0013

MV2020L2-0010

March 26, 2025

Version 2

Version and Revision History

Version	Date	Sections Revised/Comments
1	3 July 2020	Original document
2	13 March 2025	Revision to align with updates to project

Table of Contents

1.0	INTRODUCTION	1
1.1	Company Name, Project Location & Effective Date	1
1.2	NWT Rare Earths Ltd. Environmental & Safety Policy	1
1.3	Purpose and Scope of the Closure and Reclamation Plan.....	1
1.4	Goal of the Closure and Reclamation Plan	2
1.5	Regulatory Requirements and Guidelines.....	2
1.6	Engagement	3
2.0	PROJECT DESCRIPTION	4
2.1	Location and Access	4
2.2	Site History	4
2.3	Site Geology.....	2
2.4	Project Summary	3
2.4.1	Bulk Sample Project.....	4
2.4.1.1	Mobilization.....	4
2.4.1.2	Camp.....	4
2.4.1.3	Open-Cast Surface Extraction Operations of the Bulk Sample Project.....	6
2.4.1.4	Mobile Equipment.....	7
2.4.1.5	Crushing, Screening, and Sorting	7
2.4.1.6	Water Usage	7
2.4.1.7	Site Access and Maintenance	8
2.4.1.8	Supporting Work.....	8
2.4.2	Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure.	9
3.0	PROJECT ENVIRONMENT	10
3.1	Atmospheric Environment	10
3.2	Physical (Terrestrial) Environment	10
3.3	Chemical Environment.....	11

3.4	Biological Environment	13
3.4.1	Ecosystems and Vegetation	13
3.4.2	Mammals and Birds	13
3.4.3	Aquatic Resources	14
4.0	PERMANENT CLOSURE AND RECLAMATION	15
4.1	Definition of Permanent Closure and Reclamation	15
4.2	Closure and Reclamation Goals	15
4.3	Closure and Reclamation Objectives	16
4.4	Reclamation Strategies	19
4.4.1	Bulk Sample Project	19
4.4.1.1	Open-cast Excavation	19
4.4.1.2	Waste and Ore Stockpiles	19
4.4.1.3	Surface Water Management Infrastructure	19
4.4.1.4	Supporting Infrastructure	20
4.4.1.5	Oil and Fuel Storage	20
4.4.2	Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure	21
5.0	PROGRESSIVE RECLAMATION	22
5.1	Contingencies	23
6.0	TEMPORARY CLOSURE	23
7.0	POST-CLOSURE MONITORING	23
7.1	Bulk Sample Project	23
7.2	Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure	24
8.0	FINANCIAL SECURITY	25
8.1	Bulk Sample Project	25
8.2	Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure	25
9.0	REFERENCES	27
10.0	GLOSSARY OF TERMS AND DEFINITIONS	28

10.1 LIST OF ACRONYMS, ABBREVIATIONS, UNITS AND SYMBOLS 28

TABLES

Table 1: Proposed Closure Objectives, Closure Criteria, and Actions/Measurements for the Nechalacho Project..... 17

FIGURES

Figure 1: Nechalacho Project Key Plan & Site Location 5
Figure 2: Bulk Sample Project Layout..... 5
Figure 3: Ore Sorting Plant Draft Flowsheet 7

APPENDICES

APPENDIX A
BULK SAMPLE PROJECT RECLAIM MODEL ASSUMPTIONS AND ESTIMATE SUMMARIES

PLAIN LANGUAGE SUMMARY

NWT Rare Earths Ltd. (NWT Rare Earths) proposes to produce a mixed rare earth concentrate from the Nechalacho deposit. The Nechalacho Rare Earth Elements Project (Nechalacho Project) is located at Thor Lake, about 5 km north of the Hearne Channel of Great Slave Lake and about 100 km southeast of Yellowknife, NWT. The purpose of NWT Rare Earths' Closure and Reclamation Plan (the Plan) is to provide a strategic plan for the effective closure and rehabilitation of land used by the Nechalacho Project. The Plan outlines the approaches and concepts that will be used to achieve the overall goal of returning the mine site to technically viable and, where practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities following the end of mining activities. This Plan applies to two distinct phases of development: the Bulk Sample Project Phase planned for the T-Zone area and the previously approved Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure.

The Plan is based on a "design for closure" approach, with the ultimate goal being a "walkaway" design. The closure and reclamation of Nechalacho Project facilities will be conducted following the terms and conditions of the Mackenzie Valley Land and Water Board (MVLWB) Land Use Permit and Water Licence, and consistent with federal and territorial closure and reclamation guidelines.

The Plan is a living document that will be updated throughout the life of the Nechalacho Project to adapt to and incorporate any changes (e.g., mine plan, regulatory changes, changes in requests by Affected Parties, and available technologies) that may arise. This will also include ongoing discussions with our neighbor Aboriginal communities and organizations and other Affected Parties.

1.0 INTRODUCTION

1.1 Company Name, Project Location & Effective Date

NWT Rare Earths Ltd.

Corporate Contact: Lisa Riley

Phone: 867-920-7273

Address: 5110 49th St, Yellowknife,

NT, Canada, X1A 1P8

Effective Date of Closure and Reclamation Plan: March 2025

1.2 NWT Rare Earths Ltd. Environmental & Safety Policy

NWT Rare Earths Ltd. (NWT Rare Earths) recognizes that maintenance of environmental quality is vital to the company's existence, progress, and continued development.

1.3 Purpose and Scope of the Closure and Reclamation Plan

The purpose and scope of this Closure and Reclamation Plan (the Plan) is to provide a strategic plan for the effective closure and rehabilitation of land used to support the components of the Nechalacho Rare Earth Elements Project (Nechalacho Project). The Plan outlines the approaches and concepts that will be implemented to achieve the overall goal of returning the mine site to technically viable and, where practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities following the end of mining activities.

The Plan is based on a "design for closure" approach, with the ultimate goal being a "walkaway" design. The closure and reclamation of Nechalacho Project facilities will be conducted in accordance with the terms and conditions of the Mackenzie Valley Land and Water Board (MVLWB) Land Use Permit (MV2020D0013) and Water Licence (MV2020L2-0010), and consistent with the *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007), and the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC 2013).

The scope of this plan is for the two distinct phases of the Nechalacho Project authorized by the MVLWB Land Use Permit MV2020D0013 and Water Licence MV2020L2-0010:

- 1) The Nechalacho Rare Earths Bulk Sample Project (the Bulk Sample Project), which consists of a small scale open-cast surface bulk sample operation, stockpiles, plant, and equipment storage area at the T-Zone deposit.
- 2) The Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure. This phase includes only preliminary preparation and construction activities in advance of full scale mining activities at the Basal Zone deposit.

These phases are further described in the project summary in Section 2.4. Full scale mining activities at the Basal Zone deposit are not in the scope of the MVLWB Land Use Permit MV2020D0013 and Water Licence MV2020L2-0010 or this Plan.

The Plan is a living document that will be updated throughout the life of the Nechalacho Project to adapt to and incorporate changes (e.g., mine plan, stakeholder input, and available technologies) that may arise. This will include ongoing discussions with Aboriginal communities and other Affected Parties.

1.4 Goal of the Closure and Reclamation Plan

Consistent with the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC 2013) the overall goal of the Plan is to provide the basis for a closure plan for the mine that will return the site and affected areas around the mine to technically viable and, where practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities following the end of mining activities. This goal will be supported by the four closure principles of:

- physical stability
- chemical stability
- no long-term active care requirements
- future uses (including aesthetics and values)

1.5 Regulatory Requirements and Guidelines

The main regulatory requirements and guidelines pertaining to the closure and reclamation of the Nechalacho Project facilities are as follows:

- Terms and conditions of MVLWB Land Use Permit MV2020D0013
- Terms and conditions of MVLWB Water Licence MV2020L2-0010
- *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007)
- *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC 2013).

- *Northwest Territories Land Use Regulations* (Government of Northwest Territories 2018)
- *Northwest Territories Lands Regulations* (Government of Northwest Territories 2018)

1.6 Engagement

Engagement activities have been undertaken with the potentially affected communities, representatives of Aboriginal Parties, and other interested Affected Parties since 2005. NWT Rare Earths plans to continue engagement activities during development, operations, and closure of the Nechalacho Project.

Further details on engagement activities to date, and plans for ongoing engagement as the Nechalacho Project progresses, are provided in the Engagement Plan that is available on the MVLWB Public Registry for the Nechalacho Project.

2.0 PROJECT DESCRIPTION

2.1 Location and Access

The Nechalacho Project is located at Thor Lake in the Mackenzie Mining District of the Northwest Territories, about 5 km north of the Hearne Channel of Great Slave Lake and approximately 100 km southeast of the City of Yellowknife. The Property is shown on National Topographic System (NTS) map sheet 85I/02 at approximately 62°06'30"N and 112°35'30"W (6,886,500N, 417,000E – NAD83) (Figure 1).

The Property is remote but accessible year-round by float/ski/wheeled planes and helicopters from Yellowknife and seasonally by barge from Yellowknife or Hay River. The Property also has the potential for seasonal accessibility via ice road from Yellowknife

2.2 Site History

The Thor Lake area was first mapped by J.F. Henderson and A.W. Joliffe of the Geological Survey of Canada (GSC) in 1937 and 1938 (Avalon DAR 2011). According to National Mineral Inventory records of the Mineral Policy Sector, Department of Energy, Mines and Resources, the first staking activity at Thor Lake dates from July 1970 when Odin 1-4 claims were staked by K.D. Hannigan for uranium. The Odin claims covered what was then called the Odin Dyke and is now known as the R Zone. Shortly after, the Odin claims were optioned to Giant Yellowknife Mines Ltd. and were subsequently acquired by Bluemount Minerals Ltd.

In 1976, Highwood Resources Ltd., in the course of a regional uranium exploration program, discovered niobium and tantalum on the Thor Lake Property. The Property was staked as the Thor 1-45 claims and the NB claims were added in 1976 and 1977. From 1976 to 1979, exploration programs included geological mapping and sample trenching on the Lake, Fluorite, R, S and T Zones. Twenty-two drill holes were also completed, seven of these on the Lake Zone. This work resulted in the discovery of significant concentrations of niobium, tantalum, yttrium and rare earth elements (REE). Hole 79-1 intersected 0.67% Nb₂O₅, and 0.034% Ta₂O₅ over 24.99 m. Results also indicated an absence of uranium mineralization and that the anomalous radioactivity was due to thorium. Following this and inconclusive lake bottom radiometric and radon gas soil surveys, Calabras, a private holding company, acquired a 30% interest in the property through financing further exploration by Highwood. This was done through Lutoda Holdings; a company incorporated in Canada and owned by Calabras.

Recognizing a large potential resource at Thor Lake, Placer Development Ltd. (Placer) optioned the property from Highwood in March 1980 to further investigate the tantalum and related mineralization. Placer conducted magnetometer, very low frequency (VLF) electro-magnetic and scintillometer surveys on the Lake Zone. Thirteen holes were initially drilled in 1980.



This was followed by drilling five more holes in 1981 focused around drill hole 80-05 (43 m grading 0.52% Nb₂O₅ and 0.034% Ta₂O₅). Preliminary metallurgical scoping work was also conducted, but the mineralization did not prove amenable to conventional metallurgical extraction at the time. Placer relinquished its option in April of 1982.

From 1983 to 1985, most of the work on the property was concentrated on the T Zone and included geochemical surveys, beryllometer surveys, surface mapping, significant drilling, surface and underground bulk sampling, metallurgical testing and a detailed evaluation of the property by Unocal Canada. During this period, a gravity survey was conducted to delineate the extent of the Lake Zone. Five holes were also drilled in the Lake Zone to test for high grade tantalum-niobium mineralization and to determine zoning and geological continuity. Two additional holes were completed at the southeast end of Long Lake to evaluate high yttrium and REE values obtained from nearby trenches.

In August of 1986, the property was joint ventured with Hecla Mining Company of Canada Ltd. (Hecla). By completing a feasibility study and arranging financing to bring the property into production, Hecla could earn a 50% interest in the property. In 1988, earlier holes were re-assayed and 19 more holes were drilled into the Lake Zone, primarily in the southeast corner, to further test for yttrium and REEs. Hecla withdrew from the Nechalacho Project in 1990. The withdrawal came after the drilling was completed and a considerable amount of other work on the T Zone had been completed including some limited in-fill drilling, extensive metallurgical testing conducted at Lakefield and Hazen Research Ltd. in Denver and a marketing study on beryllium. In 1990, control of Highwood passed to Conwest Exploration Company Ltd. and the Nechalacho Project property remained dormant until 1996, at which time Conwest Exploration Company Ltd. divested itself of its mineral holdings. Mountain Minerals Company Ltd., a private company controlled by Royal Oak Mines Ltd., acquired the 34% controlling interest of Highwood, and Highwood and Mountain Minerals Company Ltd. were subsequently merged under the name Highwood.

In 1997, Highwood conducted an extensive re-examination of Thor Lake that included a proposal to extract a 100,000 tonne (t) bulk sample. Applications were submitted for permits that will allow for small-scale development of the T Zone deposit, as well as, for processing over a four to five-year period. In late 1999, the application was withdrawn.

Royal Oak's subsequent bankruptcy in 1999 resulted in the acquisition of the controlling block of Highwood shares by Dynatec Corporation. In 2000, Highwood initiated metallurgical, marketing, and environmental reviews by Dynatec Corporation.

In 2001, Navigator Exploration Corp. entered into an option agreement with Highwood. Navigator Exploration Corp's efforts were focused on conducting additional metallurgical research at Lakefield to define a process for producing a marketable tantalum concentrate from the Lake Zone. These efforts produced a metallurgical grade tantalum/zirconium/niobium/yttrium/REE bulk concentrate. The option was dropped in 2004 due to falling tantalum prices and low tantalum contents in the bulk concentrate.

Beta Minerals Inc. acquired Highwood's interest in the Thor Lake Property in November 2002 under a plan of arrangement with Dynatec. No work was conducted at Thor Lake by Beta Minerals Inc.

In May of 2005, Avalon purchased 100% interest and full title, subject to royalties, to the Thor Lake Property from Beta Minerals Inc. Subsequently in 2005, Avalon conducted extensive re-sampling of archived Lake Zone drill core to further assess the yttrium and heavy rare earth element (HREE) resources on the property.

Since 2007, Avalon has undertaken further drilling of the Lake Zone. Core from both historic drilling and recent drilling is stored at the Thor Lake site. Archived core has been re-boxed where necessary, with old core racks having been replaced with new ones. Core pulps and rejects are stored in a secure warehouse in Yellowknife and at site.

In 2020, Cheetah Resources Corp, now Nechalacho Resources (“Nechalacho”) and Avalon formed a new jointly owned operating company, NWT Rare Earths. Nechalacho and Avalon are each recorded as 50% owners in the mining leases covering the Nechalacho Project and NWT Rare Earths will be designated as manager of operations.

2.3 Site Geology

The Thor Lake mineral deposits occur within the Aphebian Blachford Lake Complex, which intrudes Archean Yellowknife Supergroup meta-sedimentary rocks of the southern Slave geologic province. The complex is of variably alkaline character and intrusive phases vary successively from early pyroxenite and gabbro through leucoferrodiorite, quartz syenite and granite, to peralkaline granite and a late syenite (Davidson 1982). There appear to be successive intrusive centres; an early western centre that is truncated by a larger second centre consisting of the Grace Lake Granite and the Thor Lake Syenite. Nepheline syenite underlies Thor Lake Syenite and is only known from drilling on the Nechalacho deposit.

Davidson (1978) subdivided the Blachford Lake Complex into six texturally and compositionally distinct plutonic units including Caribou Lake Gabbro, Whiteman Lake Quartz Syenite, Hearne Channel Granite, Mad Lake Granite, Grace Lake Granite, and Thor Lake Syenite.

Most of the Thor Lake Property is underlain by the Thor Lake Syenite where it occurs in the centre of the Grace Lake Granite. The Nechalacho deposit is seen confined solely to the Thor Lake Syenite.

The Grace Lake Granite is a coarse-grained, massive, equigranular, riebeckite-perthite granite with about 25% interstitial quartz. Accessories include fluorite, zircon, monazite, apatite, sphene, iron and titanium oxides, astrophyllite, an alkali pyroxene, and secondary biotite. Near the contact of the Grace Lake Granite with the Thor Lake Syenite, the two units are texturally similar and the contact appears to be gradational over a few metres rather than intrusive. The presence of interstitial quartz is the main distinguishing feature, although the granite is also pinker in colour and less readily weathered than the syenite. Because of their textural similarity and gradational contact relations, Davidson suggested that both rock types derive from the same magma.

The Thor Lake Syenite is completely enclosed by the Grace Lake Granite. It has been divided into five subunits, four of which are amphibole (ferrichterite) syenites that differ mainly in texture. The fifth and most distinctive subunit is a narrow arc of fayalite-pyroxene mafic syenite, which is locally steeply dipping and lies close to the margin of the main amphibole syenite and the Grace Lake Granite. It forms a distinct semi-circular ridge and has been locally termed the rim syenite. It can be traced for a distance of about 8 km. In outcrop, Thor Lake Syenite is

seen to transition to Grace Lake Granite with the appearance of quartz on the solidus in an otherwise felspathic rock.

The nepheline-sodalite syenite that hosts the Nechalacho mineralization has the following key distinctive features which contrast it to the Thor Lake Syenite and Grace Lake Granite:

- It has a distinct chemical composition showing under-saturation in quartz, with nepheline and sodalite variously as rock-forming minerals;
- It has a cumulate layering;
- It contains agpaitic zircon-silicates including eudialyte; and
- It is the host to the Nechalacho zirconium-niobium-tantalum-rare earth mineralization.

This syenite is only exposed at surface in a window through the Thor Lake Syenite in the area encompassing Long Lake to Thor Lake. It is believed to dip underneath that Thor Lake syenite in all directions. Also, the Nechalacho deposit mineralization, which occurs in the top, or apex, of the syenite, is also present in this window through the Thor Lake syenite. For the sake of convenience at this time, this unnamed syenite will be referred to in this report as the “(Nechalacho) nepheline sodalite syenite”.

The Nechalacho nepheline sodalite syenite consists of a layered series of increasingly peralkaline rocks with depth. A consistent downward progression is observed from hanging wall sodalite cumulates, through coarse grained to pegmatitic nepheline aegirine syenites which are locally enriched in zirconosilicates, to foyaitic syenite with a broad zone of altered eudialyte cumulates (Basal Zone). This upper sequence is strongly to intensely hydrothermally altered by various K, Na and Fe fluids. Pre-existing zircon-silicates are completely replaced by zircon, allanite, bastnaesite, fergusonite, and other minerals. Below the Basal Zone cumulates, alteration gradually decreases, with relict primary mineralogy and textures increasingly preserved. Aegirine and nepheline-bearing syenites and foyaitic syenites progress downward to sodalite foyaites and naujaite. Drilling has not extended beyond this sodalite lithology to date. Minerals related to agpaitic magmatism identified from this lower unaltered sequence include eudialyte, catapleite, and analcime.

2.4 Project Summary

NWT Rare Earths Ltd. is engaged in the exploration and development of rare earth element deposits in Canada. NWT Rare Earths proposes to produce a mixed rare earth concentrate from the Nechalacho deposit, located on its Thor Lake Property. The proposed project is referred to as the Nechalacho Project.

There are the two distinct phases of the Nechalacho Project authorized by the MVLWB Land Use Permit MV2020D0013 and Water Licence MV2020L2-0010:

- 1) The Nechalacho Rare Earths Bulk Sample Project (the Bulk Sample Project)
- 2) The Preliminary Site Preparation Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure

2.4.1 Bulk Sample Project

NWT Rare Earths' proposed first phase of development for the Nechalacho Project consists of the small-scale Bulk Sample Project and enabling infrastructure. It will focus on the North T-Zone, a clearly defined mineralised zone of limited size within Mining Lease NT-3179, approximately two km north of Avalon's planned large-scale mine and flotation plant.

The previously cleared North T-Zone will contain the small scale open-cast surface operation, stockpiles, plant, and equipment storage area. The previously approved and permitted plant site, construction camp, and tailings management facility are not required for the Bulk Sample Project.

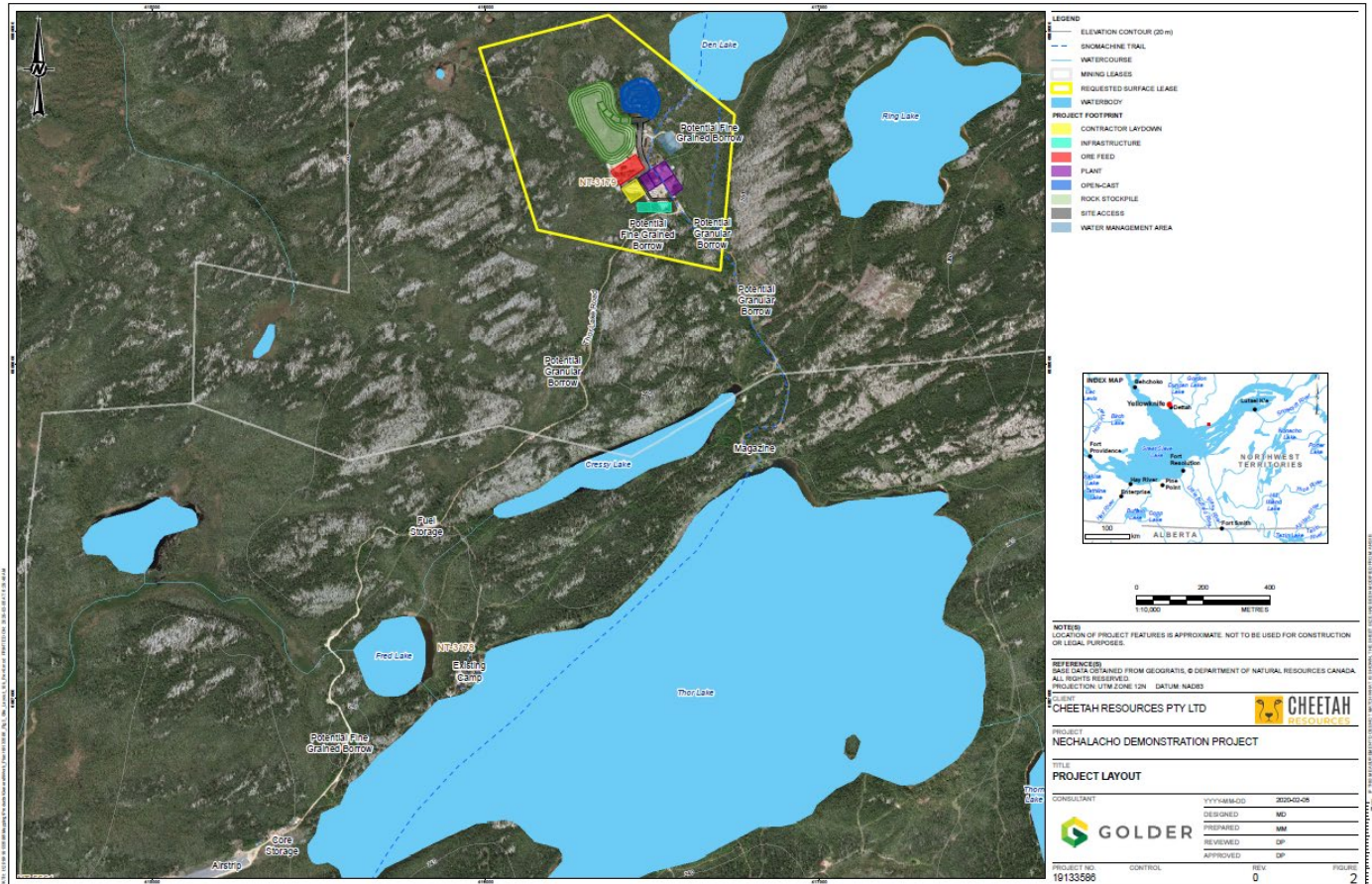
An indicative layout of the Bulk Sample Project operations and infrastructure is shown in Figure 2. The sorting plant and equipment will be located within the boundary of the existing disturbed areas.

2.4.1.1 Mobilization

An ice road will be constructed from Yellowknife to the existing barge landing on Great Slave Lake (which can be completed without a Land Use Permit or Water Licence). The ice road will be used for the winter mobilization of the contractor's equipment to the site. The existing road network onsite will be used to mobilize equipment from the Great Slave Lake barge landing site to the final Bulk Sample Project site. Crew changes will be by charter aircraft from Yellowknife. Additional equipment and materials including the Ore Sorting Plant will be mobilized in the summer by barge on Great Slave Lake either from Hay River or Yellowknife.

2.4.1.2 Camp

NWT Rare Earths will use the existing and permitted 40-person exploration camp at Thor Lake for the Bulk Sample Project. While NWT Rare Earths is not planning to expand the existing camp, it is planning to set up a larger 18 foot by 20 foot dry, upgrade the existing tents, and remove one of the 50-foot bunkhouse trailers.



2.4.1.3 Open-Cast Surface Extraction Operations of the Bulk Sample Project

Ore will be accessed through a small scale, open-cast surface extraction operation. The site will be operated by a contractor. The proposed campaign approach will maximize opportunities for local contractors. The operation will consist of:

- Clearing, grubbing and topsoil removal where necessary
- Grade control
- Drilling and blasting
- Water holding ponds, if required, details to be included in the Construction Plan
- Establishment of any required retaining walls
- Excavating and hauling overburden and host rock material to temporary stockpiles for possible ongoing and subsequent use in infrastructure development
- Excavating and hauling mineralized material to stockpiles for crushing and sorting with the sorted rare earth ore removed by barge for processing off-site
- Rehabilitation works

NWT Rare Earths plans to conduct small scale open-cast surface extraction (bulk sample) as described in this document and under the authority of the mining leases and necessary surface authorizations. The open cast material not utilized from the open cast extraction may be used for the same activities that were proposed for material from the quarries contemplated by the existing authorizations.

The Bulk Sample Project operation will extract a total of approximately 1 M tonnes (t) of rock from a single open cast. Extracted rock will be classified for two uses:

- 1) Mineralized rock: Approximately 100,000 t of mineralized rock (ore) will be excavated and sorted.
 - The Ore Sorting Plant is estimated to produce up to 15,000 t of sorted rare earth ore, for shipment to the off-site Demonstration Process Plant.
 - It is anticipated that it will require three years to remove the 15,000 t of sorted rare earth ore from site to the Demonstration Processing Plant. The sorted rare earth ore may be transported in summer via two or three barge trips on Great Slave Lake per summer to Yellowknife or Hay River, or in winter via ice road to Yellowknife.
 - The remainder will be used for site infrastructure or stockpiled along with the non-mineralized rock.
- 2) Non-mineralized rock: Approximately 500,000 t of non-mineralized rock and non-mineralized ore sorted rejects will be used for site infrastructure (including road and airstrip improvements and retaining walls) or stockpiled on-site. The Waste Rock Management Plan will provide additional information on stockpiles

Based on results of leachate and humidity cell testing to date, the mineralized rock, sorted rejects and the non-mineralized waste rock is inert.

2.4.1.4 Mobile Equipment

Additional mobile equipment will be required for the Bulk Sample Project, as described in the Land Use Permit amendment MV2018C0011. The actual fleet will be confirmed in consultation with the primary contractor, Det'on Cho Nahanni Construction Ltd.

2.4.1.5 Crushing, Screening, and Sorting

The proposed process flowsheet for the Bulk Sample Project is shown in Figure 3. Ore feed will be screened on a double deck screen at 60 mm and 8 mm. The +60 mm ore will be crushed to -60mm with the crushed ore returning to the screen. The -8mm ore will be stockpiled for processing at a later stage. Material between 8 and 60 mm will be screened at an intermediate aperture to produce two particle sizes for feed to the Ore Sorting Plant. Each of the sizes will pass through the Ore Sorting Plant to produce a product with >40% total rare earth oxides. Final rejects from the Ore Sorting Plant will be stockpiled prior to use for other aspects of the Project (such as road and airstrip upgrades). The installed electrical power for the sorting plant is expected to be about 250 kW, supplied by diesel generators.

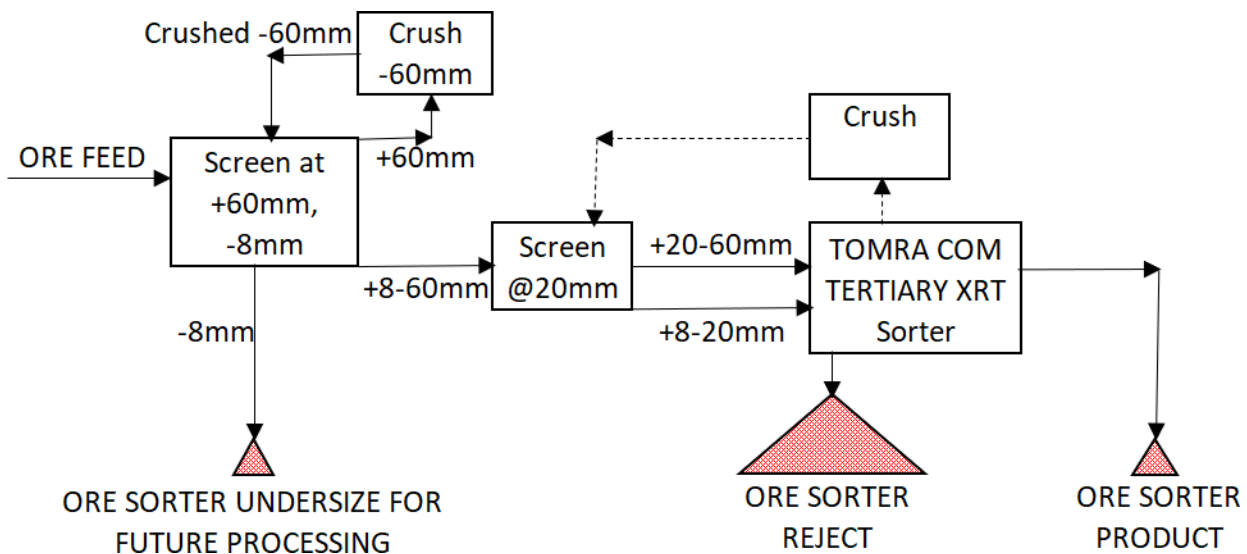


Figure 3: Ore Sorting Plant Draft Flowsheet

2.4.1.6 Water Usage

Process water is not required for the Ore Sorting Plant. Site water usage will be limited to dust suppression and camp water requirements. This also means there will be no process water discharge from the plant, therefore no

evaporation or tailings pond are required. The Ore Sorting Plant also does not require any chemicals or reagents. Water withdrawal from Thor Lake for camp use will be less than 75 m³ per day (the equivalent of five community water trucks). Water will be discharged to the locations approved under the Water Licence. Existing watercourses will remain undisturbed by the Bulk Sample Project footprint. The Construction Plan will provide further details on the settling pond to be constructed at the T-Zone to hold water from the open-cast and seepage from the rock storage areas prior to discharge according to effluent quality criteria defined in MV2020L2-0010.

2.4.1.7 Site Access and Maintenance

The Demonstration Plant site will be accessed via an ice road from Yellowknife to the barge landing at Great Slave Lake and then the existing all-season road from the barge landing. Thereafter, the site will also be accessed by barge at the barge landing site, ice road, helicopter, wheeled and float aircraft.

Portions of the existing Thor Lake road between the barge unloading area and the airstrip, camp, and open-cast areas will be upgraded as necessary to facilitate safe and efficient vehicle and equipment transportation. Some minor realignments to the existing roads may also be required. Per the Erosions and Sediment Control Plan, silt fences (or equivalent erosion control measures) will be employed to prevent sediment release in watercourses. Embankment slope compaction, texturing, rip-rapping and active re-vegetation techniques will be employed as necessary to minimize potential erosion and sedimentation associated with development. All erosion and sediment control structures will be periodically monitored and maintained to ensure proper functioning.

Existing unused structures at the T-Zone will be removed to an approved disposal site to accommodate the Bulk Sample Project, including the steel shed, fuel tanks and wooden dry. The existing core storage area will be relocated to an alternate disturbed area in consultation with the Land Use Inspector/

2.4.1.8 Supporting Work

The following works will be required to support the Bulk Sample Project:

- Site preparation (clearing), topsoil stripping and storage where necessary
- Construction, maintenance, use and upgrading of site roads, letdown areas and pads
- Construction of sediment erosion control structures
- Construction of water management structures to store water from the open-cast pit and seepage from rock storage
- Possible upgrading and lengthening the existing all-season airstrip and apron
- Upgrade, operation and maintenance of the existing exploration camp
- Installation of preliminary diesel fuel storage tanks
- Use and storage of fuel

- Establishment of temporary power supply
- Temporary storage of explosives
- Crushing and/or use of rock for site preparations
- Construction of concrete foundation for infrastructure

2.4.2 Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure.

Currently NWT Rare Earths' has received a Type A Land Use Permit (MV2014D0001) and Type B Water Licence (MV2014L2-001) to permit site preparation and other early works activities to proceed. Early works construction equipment will be moved to the Nechalacho Project site using barges across Great Slave Lake and/or the winter ice road. Early work activities will include:

- preparation of a laydown area near the dock and early development of the plant site
- upgrade of the road to the Concentrator Plant site,
- establishment of a pioneer construction camp,
- temporary diesel fuel storage, power, temporary explosives storage, and
- development of the underground decline.

Subsequently, subject to obtaining the main Type A Land Use Permit and financing, major earthworks, site preparation, foundation work, main construction camp and fuel tank installation will then be undertaken, followed by the construction of the Concentrator Plant, Tailings Management Facility, underground mine and associated infrastructure; however, this is outside of the scope of the Bulk Sample Project and this Preliminary Site Preparation and Construction Phase.

3.0 PROJECT ENVIRONMENT

3.1 Atmospheric Environment

The Nechalacho Project has a continental polar climate characterized by long, cold winters and short cool summers. A meteorological station has been operating at the Nechalacho Project since June 2008. The station measures barometric pressure, rainfall, temperature, dew point, wind speed, wind direction, and incoming shortwave solar radiation. A tipping bucket rain gauge is used to measure precipitation. Meteorological stations in the vicinity of the Nechalacho Project provide additional climate data for the region, and include Yellowknife Airport, Inner Whalebacks, Lutsel K'e, Fort Resolution, Fort Reliance, and Pine Point.

The monthly average temperatures at the Nechalacho Project range from -26°C in January to 16°C in July. Monthly average temperatures rise above 0°C for significant periods of time in May and fall below 0°C for significant periods in October.

Average annual total precipitation at Thor Lake is approximately 275 mm. Rainfall predominates during May to October, and snowfall predominates during October to April.

Relative humidity (RH) is generally highest during the winter months, while summers are generally drier. During the winter months, mean % RH is between 70% and 90%. A gradual decrease in mean % RH begins to occur in late February, with levels of 40% to 70% commonly occurring during the summer months of June and July (Avalon DAR 2011).

The dominant wind direction at the Nechalacho Project is from the east-northeast during November to June. Wind directions have a tendency to be more dispersed from July to October; however, an east-northeast trend is still evident. The average hourly wind speed at 20 m above ground level is 4.54 m/s. Wind speeds at 20 m above ground are generally in the range of 2 to 6 m/s, with occasional wind speeds exceeding 10 m/s. The highest recorded hourly wind speed at this anemometer height was 14.7 m/s, occurring on November 15, 2009 at 1100 hrs. (Avalon DAR 2011).

Six snow courses were established at the Nechalacho Project in March 2009. Mean snow depths varied from 31.3 cm to 66.6 cm in the vicinity of Thor Lake. Forested areas that were generally less exposed to wind had a tendency to accumulate the thickest snow-packs.

3.2 Physical (Terrestrial) Environment

The landscape in the Nechalacho Project is dominated by bedrock outcrops, interspersed with veneers of unconsolidated till overlying bedrock and topographic depressions consisting of organic accumulations of variable depth. The organic rich horizons are poorly drained, which has led to a preponderance of bogs and fens in these areas.

Surficial materials of the Nechalacho Project include both glacial and post-glacial deposit types. Of the glacial deposits identified, discontinuous veneers (<1 m thickness) and blankets (>1 m thickness) of till material overlying bedrock are most common. Glacio-fluvial deposits were also described; however these have a tendency to be

very uncommon and form minor components of the mapped polygons. Glacio-fluvial landforms commonly associated with these types of deposits (e.g., kames, eskers, and outwash areas) were not observed within the Nechalacho Project.

Post-glacial deposits identified within the Nechalacho Project include lacustrine, fluvial, colluvial, and organic materials, of which, the first three form very minor components of the area overall (Avalon DAR 2011). Conversely, organic accumulations are fairly common throughout the area and can be generally found within depressions or overlying fine-grained till deposits and bedrock. Organic thicknesses ranged from thin veneers (i.e., <50 cm) to over 2 m.

Soils in the Nechalacho Project are comprised mainly of moderately well, poorly, and very poorly drained materials, occurring in patterns of coversoil, peaty Regosols, Gleyed Regosols, Brunisols, Cryosols and bedrock exposures throughout the area. The complexity of soil patterns observed is largely attributed to the lack of well-established drainage pathways throughout the area. The majority (37%) of the soils present in the Nechalacho Project are mineral and predominantly fine-textured. The Nechalacho Project is also largely represented by bedrock (27%), organic soils (13%), and water (22%).

The Nechalacho Project is located within the discontinuous permafrost zone, which results in the spatial distribution of permafrost being highly dependent on local factors (e.g., thin snow cover, northern exposure, presence of fine-grained sediments like silt and clay).

Within the Nechalacho Project, landforms associated with permafrost consist mainly of frost-shattered bedrock and frost-heaved sediments that form small raised peat plateaus. Areas represented by permafrost degradation include thermokarst pits, collapsed fens and bogs, and thaw lakes.

In general, the active layer thickness within the Nechalacho Project range between 40 and 200 cm, with variability being attributed to local terrain features. Areas with thick (i.e., 10 cm to 1 m) peat accumulations were usually found to support permafrost (Avalon DAR 2011).

3.3 Chemical Environment

The Nechalacho deposit is hosted in the central portion of the Blachford Lake Complex, a multi-phase alkaline intrusive suite comprised of two related but spatially and temporally distinct phases: an earlier western suite of mafic dioritic, gabbroic, and peridotitic rocks, and the much larger eastern suite of granites to nepheline syenites, specifically the Grace Lake Granite (GLG), Thor Lake Syenite (TLS), and Nechalacho Nepheline Syenite (NNS). There is no overlap between the two suites, with no mafic rocks of the eastern suite occurring in the Thor Lake area.

Unlike the majority of base metal and precious metal deposits, the Nechalacho deposit is hosted in alkaline granitic to syenitic rocks, which tend to be geochemically stable and exceptionally low in sulphide-bearing minerals.

Four geologic units occur in the Nechalacho deposit:

- Grace Lake Granite (GLG)
- Thor Lake Syenite (TLS)
- Nechalacho Nepheline Syenite (NNS)
- Diabase dykes.

The Nechalacho deposit is situated in the core of the GLG-TLS portion of the Blachford Lake Intrusion, at the boundary between the two. Rocks of the NNS sub crop under Thor Lake and crop out between Thor and Long lakes. A number of diabase dykes transect the western and northern portions of the NNS under Thor Lake, and trend in a northeast-southwesterly direction through GLG and TLS.

The GLG and TLS are considered a single progressive crystallization phase rather than separate intrusive entities, and as such are geochemically similar. Both are pink, coarse grained, massive, with rare localized foliation reflective of regional stresses. The primary distinction between the two is quartz content; when quartz content exceeds 10%, the rock is classified as GLG. There is a progressive decrease in quartz inward from the outside of the intrusion, culminating in the quartz-free to quartz-poor TLS. Both units contain rare to accessory alkaline amphiboles and/or pyroxenes.

The geochemistry of the TLS-GLG is typical of granites world-wide, with TLS being very similar except for an expected decrease in silica (SiO_2) due to a paucity of quartz. Granite has very low weathering rates in Canadian northern climates due to the mineralogy of the rock, the low rainfall and low temperatures, and waters on granite bodies will generally have very low dissolved solids.

The sulphur (S) content of TLS is very low as indicated by the averages of 0.025 to 0.070%. Assuming that S is present as pyrite, which is a reasonable assumption as pyrite is the most common accessory sulphide in igneous rocks, the sulphide mineral content will be 0.09% to 0.26% (pyrite is 27% sulphur). These S concentrations are in the low range typical for soils.

Average carbon contents of TLS range from 0.34% to 0.55%, which calculated as calcite, the most common carbonate mineral species in Thor Lake area rocks, will give 2.8% to 4.6% calcite, as calcite is 12% carbon. This is a reasonable assumption as native carbon/graphite and sulphate contents of syenite will be very low. As a result, average carbonate contents is about ten times the level of sulphides present, and the rock will not be acid generating. This will agree with tests done to date on altered rocks from the area.

Uranium (U) and Thorium (Th) concentrations in the TLS averages as noted by Volker Muller (PhD, McGill, unpublished) are equal to, or lower than, typical granites with averages of 2.9 ppm and 14 ppm, respectively compared to granites in the 2.5 ppm to 6 ppm U and 33 ppm Th. Thus it is anticipated that given the low weathering rate, and low U and Th contents of the surface waters in contact with the TLS will be low relative to background values in waters in general.

3.4 Biological Environment

3.4.1 Ecosystems and Vegetation

The Nechalacho Project is located on the north shore of Great Slave Lake within the boreal forest of the Great Slave Upland High Boreal Ecoregion. Descriptions of the ecosystems and vegetation present within the Nechalacho Project were developed using a combination of ecosystem mapping, field surveys, and the compilation of historical information (Avalon DAR 2011). Ecosystem maps were developed for a local study area (LSA), which covered approximately 1,797 ha.

A total of 14 broad habitat types have been identified within the LSA. Several of the broad habitat types were further divided into 23 distinct ecosystem types for finer-scale mapping purposes. Four of the ecosystem types are non-vegetated and consist of lakes, ponds, shallow open water, and bedrock. An additional four types were characterized as anthropogenic and represent past and current development activities in the LSA.

The LSA is primarily treed and is represented by ecosystem types exhibiting a range of moisture regimes from very dry to very wet. The ecosystems mapped most extensively within the LSA are represented by drier lichen – bearberry woodland (LW), moist spruce – paper birch – toadflax forest (SP), and wetter black spruce – cloudberry – Sphagnum moss-bog-forest (BG). Each of these ecosystem types cover approximately 325 ha (15% of the total LSA), 303 ha (14%), and 291 ha (13%), respectively. Other less common ecosystem types within the LSA include jack pine – heath – lichen forest (JH), paper birch – aspen – willow forest (PA), and white spruce – horsetail – glow moss forest (WH).

Sensitive ecosystems account for approximately 34% of the LSA, of which the lichen – bearberry woodland (LW) and black spruce – cloudberry – Sphagnum moss bog forest (BG) ecosystem types form the majority.

Rare plant studies were conducted in 2009 and 2010 and involved both desktop research and field assessment. Prior to the conduct of field work, a preliminary list of plant species was created to identify species with a higher potential of occurring within the Nechalacho Project. The habitat requirements of the initial species identified were researched and the species list subsequently refined based on the types of habitats typically associated with the Taiga Shield. The result was a list of 25 plant species that had a higher potential to occur within the Taiga Shield, as well as the Nechalacho Project (Avalon DAR 2011).

No rare plant species were found within the proposed Nechalacho Project. Rock polypody (*Polypodium virginianum*) was identified east of Long Lake during field surveys in areas outside of the proposed infrastructure development. Its status ranking within the NWT is “undetermined”, and as such is not necessarily “rare”. Not enough is known about its frequency or abundance, however, to treat it as secure.

3.4.2 Mammals and Birds

Approximately 26 species of mammals, including boreal and tundra species frequent the Nechalacho Project. Tundra species, such as barren-ground caribou, are typically found within this Ecoregion during the winter months only, spending the summers on the tundra. Other species, such as moose, gray wolf, and wolverine are residents of both tundra and boreal forest and frequent the transitional Ecoregion to the north throughout the year. Boreal

species such as mink and beaver are reaching their northern limit at this latitude and are seldom found beyond the tree line.

The wolverine has been assessed by COSEWIC (2014) as “Special Concern” and ranked by GNWT Environment and Natural Resources as “Sensitive” under the general status program due to their low resiliency to human-caused effects, decreasing prey populations (e.g., caribou), and their innate low reproductive rates and delayed sexual maturity. However, wolverines are not protected under the *Species at Risk Act* (SARA).

Wolverine population densities are considered stable in the NWT, but populations are sensitive to disturbances because they only breed every two years, have small litters and kits can have high mortality rates. In the NWT, wolverine populations have no special protection but are managed under the *NWT Wildlife Act* hunting and trapping regulations.

The Taiga Shield Ecoregion is also home to about 150 species of birds, the majority of which are seasonal migrants. However, considerably fewer species are expected to occur in the area of the Nechalacho Project. The lakes and wetlands of the area provide habitat for a wide variety of waterbirds and shorebirds. A number of birds of prey, or raptors, use this region, either as residents or migrants.

The Horned Grebe, Peregrine Falcon, Short-eared Owl, Common Nighthawk, Olive-sided Flycatcher, Rusty Blackbird and Bank Swallow are listed species that may occur in the Nechalacho Project (including the Great Slave Lake islands along the proposed shipping route).

3.4.3 Aquatic Resources

The Thor Lake watershed covers an area of 2,100 ha. The Ring Group (Ring, Buck, Drizzle, and Murky Lakes) constitutes 800 ha or 38% of that watershed, and about 19% of the annual Thor Lake discharge (1.8 million m³/yr).

In general, waters in the proposed Nechalacho Project have high alkalinity, hardness, and calcium. The lakes in the area tend to be relatively clear with low suspended sediment levels, and low nutrient and metals concentrations.

The Mine plan includes the deposition of process tailings in the area presently occupied by Ring, Ball, and Buck lakes, and the release of decant water into Drizzle Lake, which in turn drains into Murky Lake and then Thor Lake. No fish were captured in Ring, Ball and Buck lakes, three and two juvenile Northern Pike, respectively were captured in Drizzle and Murky lakes over three years of sampling effort. These lakes, which make up the Ring Lake group, are very shallow (<2.5 m), and are likely to either freeze completely in winter or have free water that becomes anoxic after freeze-up.

Thor Lake, and to some extent Long Lake (due to its connection to Thor Lake) are the main fish habitats in the Nechalacho Project. Both lakes support healthy populations of Lake Whitefish, Lake Cisco, and Northern Pike. These lakes can also be considered to be a closed system for fish because in-migration is excluded by a natural waterfall at the outlet of Thor Lake and because there are no lakes upstream that provide suitable habitats. As such, the fish populations in these lakes are self-sustaining.

4.0 PERMANENT CLOSURE AND RECLAMATION

4.1 Definition of Permanent Closure and Reclamation

Consistent with the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC 2013), permanent closure is the final closure of a mine site with no foreseeable intent by the existing proponent (NWT Rare Earths) to return to either active exploration or mining.

4.2 Closure and Reclamation Goals

The overall goal of closure and reclamation at the Nechalacho Project is to return the mine site to technically viable and, where practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities following the end of mining activities. A combination of established and new rehabilitation techniques will be reviewed and tested early in the operations phase to determine which approaches will be most appropriate and cost effective for the Nechalacho Project.

The closure and reclamation of Nechalacho Project facilities will be conducted in accordance with the terms and conditions of the anticipated MVLWB Land Use Permit and Water Licence and accepted mine reclamation practices in the NWT that are applicable, such as the *Mine Site Reclamation Policy for the Northwest Territories* (INAC 2002), the *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007), and the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC 2013).

The goals of closure and reclamation are to:

- Protect public health and safety;
- Minimize the adverse effects of mining on the environment;
- Establish conditions that lead to acceptable long-term physical and chemical stability in reclaimed areas;
- Establish conditions that are appropriate for the surrounding environment and identified end land uses; and
- Return the site and affected areas around the mine to technically viable and, where practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities following the end of mining activities.

These goals will be supported by the four closure principles of physical stability, chemical stability, no long-term active care requirements, and future uses (including aesthetics and values).

The following components will be incorporated into the overall design, as applicable, and into the closure and reclamation plan for applicable components of the Nechalacho Project:

- Buildings and site infrastructure will be located, to the extent practical, on previously disturbed land.

- Organic and mineral soils collected from the Nechalacho Mine site will be salvaged and stored for future reapplication during reclamation.
- Post-closure environmental maintenance and monitoring will be carried out if necessary for revegetation and surface stabilization efforts, as well as for surface and ground water quality until closure criteria are met. Successes will be compared to established targets.
- Appropriate and approved seed mixes and plant material will form the basis of the revegetation strategy. Native species will be collected and used where practical and cost effective. Commercially acquired seed, whether native or agronomic, will be certified weed-free.
- Use of agronomic species will be limited and will likely only occur in instances where the establishment of a rapid cover is required, and native species are unavailable or unsuitable to meet this purpose. Suitable agronomic species will likely be restricted to annuals that are easily controlled, have a limited ability to spread, are easily outcompeted (particularly by native species), and will not become a nuisance in the future. The ultimate objective will be to encourage the re-establishment of the pre-mining ground cover, which will also involve encouraging self-sustainable indigenous vegetation growth.
- Following the removal of surface facilities not required beyond closure, the remaining fill embankments, borrow pits, access roads, and development footprint will be scarified and re-contoured as required to achieve surface stability, blend with the surrounding landscape, cover soils will be placed, and the land will be revegetated.
- Infrastructure not required beyond closure will be decontaminated, dismantled, and removed from site where economic to do so. The remaining waste will be removed from site to approved waste management facilities as is presently being done and will continue to be done during operations.

Some of the identified actions may be modified following engagement activities that identify alternate responsible and sustainable end land uses, as well as potential users for facilities and infrastructure. When closure activities have been completed and closure criteria are met, a final closure report will be prepared along with an ongoing post-closure monitoring plan (if necessary) that will be provided to Aboriginal communities and other Affected Parties.

4.3 Closure and Reclamation Objectives

The development of closure objectives for the Nechalacho Project will be guided by the closure principles provided by the MVLWB and AANDC (2013).

Closure objectives describe what the selected closure activities are trying to achieve. Closure objectives are guided by the closure principles, are typically specific to project components, and must be measurable and achievable and allow for the development of closure criteria.

Closure criteria are the standards that measure the performance of selected closure activities in successfully meeting closure objectives. Closure criteria can be site-specific or adopted from territorial/federal standards and can be narrative statements or numerical values.

Actions/measurements are the activities and monitoring required to assess and/or measure site conditions in comparison to closure criteria and the final outputs. Table 1 summarizes the initial proposed closure objectives, closure criteria, and actions/measurements to meet the goal of achieving a “walkaway” design for the Nechalacho Project.

Post-closure environmental maintenance and monitoring may be carried out if required for revegetation and surface stabilization efforts, surface water quality and other required environmental components to verify achievement of closure criteria. Monitoring data will be compared to established closure criteria. Post-closure maintenance and monitoring is envisioned to be conducted as required to demonstrate achievement of closure objectives.

Table 1: Proposed Closure Objectives, Closure Criteria, and Actions/Measurements for the Nechalacho Project

Closure Objectives	Proposed Closure Criteria	Action - Measurements
Site Wide		
Mine areas are physically stable and safe for use by people and wildlife.	Satisfactory final inspection by a professional engineer and qualified person	Final landscape inspected and submission of as-built drawings or remaining engineered structures and report completed by a professional engineer.
Drainage pathways for surface runoff are physically stable.	Acceptable results of a geotechnical inspection completed by a professional engineer.	Final landscape inspected and submission of as-built drawings or remaining engineered structures and report completed by a professional engineer.
Lakes, streams, site runoff, and seepage water quality that are safe for people, vegetation, aquatic life, and wildlife.	Closure water quality criteria will be developed using generic guidelines and site-specific risk-based criteria and for the protection of aquatic life that includes operations experience and preconstruction background conditions.	Post-closure monitoring of lakes, streams, site runoff and seepage at appropriate on site locations.
Landscape features and vegetation match aesthetics of the surrounding natural area.	No visible buildings or equipment remain. Physically stable drainage pathways re-established. Acceptable plant biodiversity achieved at revegetation areas.	Inspection and submission of a summary report by a professional engineer or geoscientist.

Closure Objectives	Proposed Closure Criteria	Action - Measurements
Safe passage and use for wildlife.	Risk of harm to wildlife as a direct result of passage through the project site comparable to surrounding area.	Assessment of remaining hazards to wildlife. Inspection and submission of a summary report by a qualified person.
Revegetation targeted to priority areas.	Revegetation activities have been completed at priority areas; acceptable vegetation biodiversity has been reached.	Inspection and submission of a summary report by a qualified person.
Prevent remaining infrastructure from contaminating land or water.	Removal of potentially hazardous materials and satisfactory final inspection by a professional engineer or geoscientist.	Post-closure site-wide assessment completed by a professional engineer or geoscientist. Post-closure monitoring of site runoff and seepage at appropriate drainage basins if required.
On-site disposal areas are safe for people, wildlife, and vegetation.	Removal of potentially hazardous materials and satisfactory final inspection by a professional engineer or geoscientist.	Post-closure site-wide assessment completed by a professional engineer or geoscientist. Post-closure monitoring of site runoff and seepage at appropriate drainage basins if required.
Contaminated soils and waste disposal areas that cannot contaminate land and water.	The mine site is remediated to site specific risk-based criteria. Potential contaminant sources are remediated on site or removed from site.	Post-closure site-wide assessment completed by a professional engineer or geoscientist. Post-closure monitoring of site runoff and seepage at appropriate drainage basins if required.
Portal (Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure only)		
Underground mine workings are physically stable.	Satisfactory final inspection by a professional engineer.	Inspection and submission of final As Built drawings and report signed by a professional engineer.
Underground mine adequately backfilled and sealed to prevent entry by wildlife or humans	Satisfactory final inspection by a professional engineer and qualified person	Inspection and submission of final As Built drawings and report signed by a professional engineer.
Underground mine should not contribute to the contamination of ground or surface water.	Closure water quality criteria to be developed using generic guidelines and site-specific risk-based criteria.	Post-closure monitoring of groundwater and surface water.

4.4 Reclamation Strategies

4.4.1 Bulk Sample Project

4.4.1.1 *Open-cast Excavation*

An open-cast excavation is planned for construction to obtain the bulk sample for processing. The excavation will be approximately 33 to 43 m deep and 20,529 m² in surface area. Ore-bearing rock will be drilled and blasted and then collected using excavators and trucks.

Upon completion of operations, it is expected that the open-cast excavation will be allowed to fill with groundwater and surface run off to create a lake.

4.4.1.2 *Waste and Ore Stockpiles*

Approximately 1 M tonnes of waste rock and overburden are expected to be generated over the duration of the Bulk Sample Project. Waste rock not used during construction will be deposited in a waste rock stockpile. Temporary ore sorter reject stockpiles will also be periodically transported and stored at the waste rock stockpile. The waste rock stockpile is planned to have a footprint of approximately 35,000 m².

The waste and ore stockpile area will be progressively reclaimed, where practical, by loosening exposed, compacted soils, applying a cover of available organic material, and allowing for the surface to revegetate naturally. This activity is expected to be started within the first year of operations for waste rock, while the inert ore storage pile will remain on site until closure. Remaining waste rock will be graded, covered with available organic material and allowed to revegetate naturally to ultimately achieve a landform that blends in with the existing environment. Ore will be sorted and transported off-site prior to shut down. If a small ore pile exists on site in the event of insolvency, the pile will be graded, covered with available organic material and allowed to revegetate naturally.

4.4.1.3 *Surface Water Management Infrastructure*

Surface water management infrastructure includes infrastructure such as ditches, culverts and water management ponds. At the conclusion of operations, surface water management infrastructure will be removed, and the ground will be re-contoured to restore natural preconstruction drainage. Water intake and discharge lines will be reclaimed and either disposed of underground or removed from site. Water management ponds will be breached and associated berms removed or recontoured. Waste rock from the containment berms may be utilized to stabilize discharge channels, if required. Site water control ponds will be breached and drainage ditches removed. Drained areas will be covered with coversoil and revegetated.

4.4.1.4 Supporting Infrastructure

Supporting infrastructure comprises the following:

- Sorting plant
- Administrative buildings
- Linear infrastructure (pipelines, powerlines)
- Fuel storage locations
- Explosives storage locations

Modularized components and diesel generators will be removed by barge for subsequent reuse or sale. Remaining infrastructure will be demolished and resulting waste removed to approved waste management facilities. Foundations will be buried under waste rock, covered with overburden and organic material, and allowed to revegetate naturally.

Following the removal of supporting infrastructure and required remediation, the remaining fill embankments, borrow pits, access roads, and development footprints will be scarified and re-contoured as required to achieve surface stability, blend with the surrounding landscape, and restore natural surface drainage.

Priority areas for contouring and stabilization will include those that are potentially hazardous to wildlife and could result in increased sedimentation into adjacent watercourses, altering both water quality and fish habitat.

4.4.1.5 Oil and Fuel Storage

Waste oils will be shipped off site. Unused explosives can be shipped off site, burned or destroyed on site. Maximum storage on site at any one time is estimated at two weeks supply. Unused chemicals, as well as any other hazardous waste material, will be either treated on site or shipped off site for reuse or disposal.

Fuel and lubricant tanks, if not sold or reused, will be steam cleaned on site and the wash water captured for subsequent treatment and discharge of the water to the receiving environment in conformance with water licence requirements. The fuel tanks will be dismantled and removed by barge for reuse, sale, or disposal. Associated above ground piping will be drained, washed, cleaned, dismantled, and removed by barge for reuse, sale, or disposal or placed underground.

Remaining fuel will be removed for resale, reuse, or recycling. Concurrent with the decommissioning of each fuel storage facility, soils in the area will be tested for hydrocarbons and remediated as appropriate, either by excavation and removal of contaminated soil or by in situ remediation. No landfarming for the remediation of hydrocarbon-contaminated soils is planned at this time.

4.4.1.6 Mobile Equipment

The mobile fleet onsite for the Bulk Sample Project will be considerably smaller than the future projects are anticipated to require. Most of the fleet are mobilized and demobilized during the work campaigns are not anticipated to remain onsite for an extended duration, Should the fleet remain at closure, the equipment will be used to support the closure works, demobilized and sold in functioning condition or as scrap metal. Equipment will not be sent to landfill.

4.0.1.1 Oil and Fuel Storage

Waste oils will be shipped off site. Unused explosives can be shipped off site, burned or destroyed on site. Maximum storage on site at any one time is estimated at two weeks supply. Unused chemicals, as well as any other hazardous waste material, will be either treated on site or shipped off site for reuse or disposal.

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4.4.2 Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure

NWT Rare Earths will further develop reclamation strategies for the Preliminary Site Preparation and Construction Phase before proceeding with this phase of development. However, preliminary strategies have been identified.

On the assumption that the main Nechalacho Mine Development Project proceeds, the rock produced from portal construction is planned to be used for the mine infrastructure pad, and rock from the quarry for the road as well as air strip expansion.

A temporary waste rock stockpile has been identified within the proposed footprint and within the drainage basin of the sediment ponds. Following removal and re-use of the rock, and on the assumption that the detailed engineering determines this location is not required for operations, the temporary waste rock stockpile area will be progressively reclaimed by loosening exposed, compacted soils, and applying a cover of overburden or stockpiled organics in preparation for re-vegetation. Removal of all the waste rock is expected to be completed within the first year of operations.

If the main Nechalacho Development Project does not proceed, Avalon will reclaim the portal and cleared areas in accordance with standard, accepted closure and reclamation procedures. The waste rock stockpile will be leveled and covered with available stockpiled overburden. The site would then be re-vegetated. The site would be monitored to confirm that the re-vegetation efforts have been successful.

5.0 PROGRESSIVE RECLAMATION

As described in the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC 2013), progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve a purpose. These activities can be completed during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure, and enhance environmental protection. Progressive reclamation may shorten the time for achieving closure objectives and may provide valuable experience in the effectiveness of certain measures that might be implemented during permanent closure.

During the past few years that the previous owner of the site, Avalon, has been conducting mineral exploration activities at the Nechalacho Project, Avalon has undertaken several progressive reclamation activities related to historic mineral exploration programs and more recent exploration drilling undertaken by the company. Avalon reclaimed several historic exploration rock dumps by using this waste rock for the construction of the existing airstrip. In addition, Avalon re-purposed several of the old trailers left behind by other explorers by relocating them to the new airstrip and has cleaned up past exploration materials such as old drums, and scrap metals. Avalon has also progressively reclaimed several of its exploration drill sites and local access trails and is committed to continued progressive reclamation of future drill sites.

For the Bulk Sample Project and Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure, NWT Rare Earths is similarly committed to progressive reclamation wherever this strategy can be successfully employed. Typical short-term reclamation objectives that will be implemented include:

- Progressive reclamation of disturbed areas during operations as soon as they are no longer required for operational purposes.
- Effective implementation of NWT Rare Earths' Erosion and Sediment Control Plan to minimize risks of erosion or sediment loss as a result of on site runoff.
- Stabilization of slopes on structures to maintain safe working conditions and to facilitate progressive reclamation activities (e.g., TMF embankments).
- Removal and disposal or re-purposing of site infrastructure and materials as appropriate, when no longer required.
- Revegetation of previously disturbed terrain to minimize dust generation and to return such areas to self-sustaining ecosystems compatible with a healthy environment.

As opportunities for progressive reclamation are identified, NWT Rare Earths is committed to engaging with the regulators and Affected Parties to seek their input in the implementation of the proposed progressive reclamation activities. The results of future progressive reclamation activities will be reported as required to these parties and lessons learned from progressive reclamation will inform future closure planning at the Nechalacho Project. For the purpose of the financial security, identified progressive reclamation is funded in the security estimate and is not assumed to have been completed.

5.1 Contingencies

The lessons learned from the ongoing progressive reclamation activities that are anticipated to be undertaken throughout the life of the Nechalacho Project will be applied as appropriate to future closure planning at the Nechalacho Project.

In particular, the ongoing experience (successes and failures) expected to be gained related to the progressive revegetation of previously disturbed areas, and the slopes on embankments are expected to generate valuable data that will be very useful and will be applied/adapted to enhance future closure planning.

6.0 TEMPORARY CLOSURE

Temporary closure occurs when a mining operation ceases with the intent of resuming activities in the near future. Temporary closures could last for a period of weeks, months, or even years. It is possible that for reasons of force majeure, prevailing economic conditions, or others unforeseen, the Nechalacho Project operations may need to be suspended or temporarily closed. Temporary closure may also occur in between the Bulk Sample Project, the Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure, and future development.

During such times, the main objectives will be the ongoing protection of the environment, compliance with existing regulatory requirements, and maintaining security and safety of site infrastructure. To meet these objectives measures that will be implemented will include:

- Maintenance of environmental protection systems (e.g., water treatment) and appropriate associated monitoring as required for ongoing compliance with regulations, licences, and permits.
- Implementation of site access controls.
- Securing buildings and openings.
- Securing and monitoring hazardous materials and explosives or removing them as appropriate.
- Regular monitoring and inspection of structures, components, and facilities to maintain their integrity and required function.
- Maintenance of human resources to meet applicable employee needs.
- Maintenance of the financial security deposit up to date as per regulations.

7.0 POST-CLOSURE MONITORING

7.1 Bulk Sample Project

NWT Rare Earths will conduct ongoing monitoring and progressive reclamation during the planned three-year operation of the Bulk Sample Project. Based on monitoring results, NWT Rare Earths will make a decision in

the final year of operations if post-closure monitoring is required following a risk-based assessment. For example, the residual risk post closure for the Bulk Sample Project is considerably lower than the subsequent phases of development, as the process uses physical separation, does not require any process chemicals, does not require a tailings management facility, uses minimal water, and has a smaller disturbance area.

7.2 Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure

It is understood that environmental monitoring will continue through the post-closure phase until such time as it can be established that the overall closure goal has been met, based on discussions with regulatory agencies and Affected Parties. Once this has been achieved, NWT Rare Earths will seek final clearance to permanently abandon the Nechalacho Project.

The amount and frequency of post-closure monitoring required is expected to diminish as reclamation activities near completion and the results of monitoring indicate that environmental performance is meeting the established reclamation objectives. Monitoring will continue after reclamation is complete and will focus on revegetation efforts, geotechnical and surface stabilization efforts, and surface and groundwater quality, and should reflect the degree of risk that remains. Successes will be compared to established targets.

Post closure monitoring will take into consideration the operation's environmental performance in that the better the performance during operations, the less monitoring will be required post closure. Water quality monitoring during the final water treatment phase will be like that established in the SNP.

The recommended general inspections and safety inspections will help identify areas of concern that may require maintenance or more detailed evaluation and allow confirmation of the performance of the closure measures. The required maintenance will be completed in a timely fashion. The general inspections and required maintenance to be performed during the initial period following closure will generally include the following:

- Inspection of areas that have been reclaimed and revegetated for evidence of erosion. An indication of revegetation success is the natural invasion of local species, insects and use by wildlife. Repair of inadequate revegetation cover will be preceded by an assessment of probable reasons for the repair need (e.g., soil pH, nutrients, compaction), followed by revegetation activities as funded in the financial security.
- Inspections of the remaining embankments to look for signs of potential problems, erosion, or instability
- Inspections during and/or following extreme events, including snowmelt and precipitation
- Maintaining access roads and other site maintenance as required.

These general inspections will be formally recorded and will include details of the inspection results. A brief summary following each inspection will be prepared to identify urgent concerns or maintenance measures.

Recommendations for maintenance and suggested changes to the monitoring program will also be included in the reports.

8.0 FINANCIAL SECURITY

Financial security for the Plan is required to be filed in advance of activities on site. To date, there are several forms of financial security for the site. This includes \$13,000 for the existing camp initially held under Land Use Permit MV2011C006 and \$60,000 security for the airstrip extension for existing initially held under Land Use Permit MV2012G005.

As required in the NWT, financial security is calculated utilizing the RECLAIM model initially developed by INAC.

8.1 Bulk Sample Project

Following a review and update to the previously Reclaim model recommended by GNWT, the revised security required for the MV2018C0011 renewal approval is suggested to be \$694,199, this is an increase of \$36,012 from the current amount held in security.

Appendix A shows the output of the RECLAIM model used to calculate the security estimate.

8.2 Preliminary Site Preparation and Construction Phase for the Underground Mine, Concentrator, Camp, TMF, and Supporting Infrastructure

Security for the Preliminary Site Preparation and Construction Phase will be posted in stages. The MVLWB considered the security estimate and RECLAIM model shown in Appendix B, along with a security estimate provided by GNWT Environment and Natural Resources to determine the water liability. A total of \$2,760,000 for water liability is required under the Water Licence (MV2020L2-0010):

- The first installment of the security deposit (\$386,400.00) is required prior to; water withdrawal and use of water from Thor Lake, construction and operation of a camp, and construction and operation of site services infrastructure such as water lines, electrical distribution, site roads, airstrip, sewage treatment, incinerator, and material sorting facilities.
- The second installment of the security deposit (\$800,400.00) is set to be submitted prior to construction of sediment control structures, quarrying material from specified locations and crushing, and the use and storage of explosives.
- The third installment of the security deposit (\$1,573,200.00) is required prior to the construction of the portal and bulk fuel storage.

An additional \$1,000,000 is required for land liability; however, there is no RECLAIM estimate available for land liability since it was calculated by the MVLWB using the MVLWB Security Worksheet. Security under the Land Use Permit (MV2014D0001) will also be posted in stages:

- The first installment of the security deposit (\$50,000.00) is set cover the liabilities relating to the clearing of the areas and the use of fuel. The first installment is required prior to any site preparation (clearing).
- The second installment of the security deposit (\$250,000.00) is set to cover the liabilities relating to the construction, maintenance, use and upgrading of site roads, laydown areas and pads; sediment erosion control structures; airstrip and apron; temporary power supply; storage of explosives; crushing of mine rock for site preparation; placement of concrete foundations for the project infrastructure; and the development of the portal at surface.
- The third installment of the security deposit (\$100,000.00) is set cover the liabilities relating to the construction of the diesel fuel storage tank.
- The fourth installment of the security deposit (\$300,000.00) cover the liabilities relating to the construction camp.
- The fifth installment of the security deposit (\$300,000.00) cover the liabilities relating to the storage of more than 1,000,000L of fuel.

9.0 REFERENCES

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10.0 GLOSSARY OF TERMS AND DEFINITIONS

Anthropogenic	Relating to or resulting from the influence of humans on nature.
Bedrock	The consolidated rock (harder than 3 Moh's scale of hardness) underlying the Earth's surface. Bedrock can be encountered at depths ranging from the Earth's surface to hundreds of meters below, depending on the level of exposure to erosion.
Carbonate	A salt from carbonic acid, identified by the carbonate ion CO_3^{2-} .
CCME	Canadian Council of Ministers of the Environment is an inter-governmental organization through which members establish national environmental standards for various issues such as waste management, air and water quality.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
Concentrate	Refers to the residue valuable metal from what most of the waste rock has been removed.
Flotation	A process used to extract valuable minerals from ore by selectively separating hydrophobic minerals from hydrophilic minerals.
Groundwater	Water in the saturated zone found below the water table that fills the interconnected pore spaces of the subsurface material.
Hydrogeology	The study of groundwater and its occurrence, flow and effects on earth materials.
Hydrology	The study water and its movement on land and in the atmosphere, and the effects it has on the earth's surface.
Hydrometallurgy	A technology that involves the extraction of metals into an aqueous solution, which are then, recovered using a variety of methods.
Mine rock	The rock surrounding an ore body
Permafrost	Soil that for two or more years has been below the freezing point for water (0°C or 32°F).
Quarry	A type of open-pit mine from which building materials are often extracted.
Reagents	Refers to chemicals used to assist in the flotation process.
Succession	A series of ecological changes by which one group of organisms succeeds another through stages leading to a climax community.
Tailings	Material that is left over after the process of separating the valuable minerals from the uneconomic fraction of an ore.

10.1 LIST OF ACRONYMS, ABBREVIATIONS, UNITS AND SYMBOLS

AANDC Aboriginal Affairs and Northern Development Canada

ABA	Acid Base Accounting
AEMP	Aquatic Effects Monitoring Program
ANFO	Ammonium Nitrate-Fuel Oil
ARD	Acid Rock Drainage
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
Conwest	Conwest Exploration Company Ltd.
CSR	Contaminated Site Regulations
DFO	Department of Fisheries and Oceans
DKFN	Deninu Ku'e First Nation
EC	Environment Canada
EEM	Environmental Effects Monitoring
EHS	Environmental Health and Safety
GNWT	Government of the Northwest Territories
GSC	Geological Survey of Canada
ha	Hectares
Hecla	Hecla Mining Company of Canada Ltd.
HREE	Heavy Rare Earth Elements
INAC	Indian and Northern Affairs Canada
KFN	K'atlodeeche First Nation
km	Kilometres
LKDFM	Lutsel K'e Dene First Nation
LREE	Light Rare Earth Elements
LSA	Local Study Area
m	Metre
M	Million
MAC	Mining Association of Canada

MMER Metal Mining Effluent Regulations

MVEIRB Mackenzie Valley Environmental Impact Review Board

MVLWB Mackenzie Valley Land and Water Board

MVRMA Mackenzie Valley Resource Management Act

MW Megawatt

NAG Net Acid Generation

NORM Naturally Occurring Radioactive Material

NP/AP Neutralisation Potential Ratio (Where NP Is Neutralisation Potential and AP is Acid Potential)

NTCL Northern Transportation Company Limited

NTS National Topographic System

NWT Northwest Territories

PDAC Prospectors and Developers Association of Canada

PDR Project Developer's Report

PFS Pre-feasibility Study

Project Nechalacho Project

REE Rare Earth Elements

TK Traditional Knowledge

TMF Tailings Management Facility

tpa Tonnes Per Annum

tpd Tonnes Per Day

VLF very low frequency

YKDFN Yellowknives Dene First Nation

BULK SAMPLE PROJECT 2025 RECLAIM MODEL OUTPUT

SUMMARY OF COSTS

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
	OPEN PIT	\$71,050	\$71,050	\$0
	UNDERGROUND MINE	\$0	\$0	\$0
	TAILINGS FACILITY	\$0	\$0	\$0
	ROCK PILE	\$55,125	\$55,125	\$0
	BUILDINGS AND EQUIPMENT	\$161,919	\$161,919	\$0
	CHEMICALS AND CONTAMINATED SOIL MANAGEMEN	\$8,090	\$0	\$8,090
	SURFACE AND GROUNDWATER MANAGEMENT	\$10,460	-	\$10,460
	INTERIM CARE AND MAINTENANCE	\$0	-	\$0
	SUBTOTAL: Capital Costs	\$306,644	\$288,094	\$18,550
	PERCENT OF SUBTOTAL		94%	6%
INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
	MOBILIZATION/DEMobilIZATION	\$313,628	\$294,655	\$18,973
	POST-CLOSURE MONITORING AND MAINTENANCE	\$20,500	\$19,260	\$1,240
	ENGINEERING	5% \$15,332	\$14,405	\$928
	PROJECT MANAGEMENT	5% \$15,332	\$14,405	\$928
	HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1% \$3,066	\$2,881	\$186
	BONDING/INSURANCE	1% \$3,066	\$2,881	\$186
	CONTINGENCY	20% \$61,329	\$57,819	\$3,710
	MARKET PRICE FACTOR ADJUSTMENT	\$0	\$0	\$0
	SUBTOTAL: Indirect Costs	\$432,254	\$406,105	\$26,149
TOTAL COSTS		\$738,898	\$694,199	\$44,699

Simplified Summary

CAPITAL COSTS	TOTAL COSTS	LAND LIABILITY	WATER LIABILITY
OPEN PIT	\$71,050	\$71,050	\$0
ROCK PILE	\$55,125	\$55,125	\$0
BUILDINGS AND EQUIPMENT	\$161,919	\$161,919	\$0
CHEMICALS AND CONTAMINATED SOIL MA	\$8,090	\$0	\$8,090
SURFACE AND GROUNDWATER MANAGEMEN	\$10,460	-	\$10,460
INTERIM CARE AND MAINTENANCE	\$0	-	\$0
SUBTOTAL - Capital Costs	\$306,644	\$288,094	\$18,550
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MARKET PRICE FACTOR ADJUSTMENT	\$0	\$0	\$0
SUBTOTAL: Indirect Costs	\$432,254	\$406,105	\$26,149
TOTAL COSTS	\$738,898	\$694,199	\$44,699

Comparison of Estimates

Estimate	Total Costs	Land Liability	Water Liability
Nechalacho	\$738,898	\$694,199	\$44,699
Existing	\$704,748	\$658,187	\$46,561
Difference in estimates	\$34,150	\$36,012	\$1,862

History of Security Amount	Total Held
13-Jul-19 \$15,663 posted	\$15,663
11-Feb-19 \$13,000 Mined 182011 Transfer from M/V2011C0006 to M/V2011C0011	\$28,663
11-Sep-19 \$26,486 Posted by Vital Metals & LOC provided for Bulk Sample	\$55,149
10-Mar-21 \$658,187 Project	\$713,336

Project Name:		Reclaim Model - Overview of Program
ho Bulk Sample All users are urged to read the Reclaim Model User Manual - Scroll down for overview description of program.		
Important! Reclaim 7.0 works better with no other excel files open. If other excel files are open ignore run time error and proceed		
Reclaim Menu	The default Excel menu bar has an additional tab labelled "Add-Ins" that provides options specific to the Reclaim Model.	
Clear	This option deletes all input data, deletes any duplicated elements and blanks out the project name. It also allows for segregation into land costs vs water costs if required.	
Duplicate	This option Duplicates components of the project. E.g. if there is more than one Open Pit, use duplicate to add a second Open Pit. Quantities for the new Open Pit are erased, but the Activities and Cost Codes are carried over from the original Open Pit. The new Open Pit subtotal is added to the Summary page.	
Unit Costs	This option opens a window of unit costs to provide easy reference. NOTE: the unit cost table has a filter in the 'UNITS' column. You can select to only see a particular unit (eg km) or multiple units (km and m3) or all units.	
Print All	This option prints the Summary Worksheet, Unit Cost Worksheet, and the individual component worksheets having non-zero balances. Individual worksheets can be printed directly using standard printing methods, such as Ctl - P.	
Quit	Select Quit to exit the program	
Help	Redirects user to Instructions worksheet.	
Worksheets		
Summary	This worksheet contains a cumulative summary of costs for each component of the project. Associated costs such as engineering and project management are added as a percentage of the component costs.	
Components	Costs are derived for individual closure and reclamation activities by multiplying a "quantity" of activity by a "unit cost". An activity can be edited, added, or deleted from worksheet. However, care should be taken not to modify cells that are defined and used elsewhere in the program. Do not change the content or column width of the first column of each component worksheet.	
Unit Costs	This worksheet contains a look up table with costs for typical work associated with each closure and reclamation activity	
Limitations		
The Reclaim Program will NOT work if the worksheets are changed such that the following requirements are not met. Please review the following prior to modifying worksheets.		
Worksheet Names	The names of the worksheets must not be changed.	
Defined Names	Certain cells have defined names, which must not be changed. Where the cell is named, the name will appear in the "Name Box" to the left of the formula bar.	
First line of data	The first line of data for any component worksheet starts on line 4. Do not change the first line of a component worksheet, ie the component name.	
Cell A1	Cell A1 on the component sheet MUST always contain the count of that component for the duplicate function to operate. DO NOT CHANGE.	
Adding Lines	You can add lines to components and the unit cost table, as long as they are not the last lines. The last line might fall outside the named ranges. You can check the size of the named range by selecting the name from the drop down box at the top left of the sheet. Usually this box has a cell reference, or a name.	
Printing	A component will only be printed if its sub-total is greater than zero. In addition, a component and the summary sheet cannot be printed if there is an error. Printing has been set to print 1 page per component.	
Conditions of Use		
The Reclamation Cost Estimating Model was prepared to serve as a guide for Government Agencies, mining companies, and others to estimate the cost of mine reclamation. This model is not intended to replace reclamation planning or to be used to determine the activities required to reclaim a site or to dictate how much should be spent on reclamation. Reclaim was prepared by Brodie Consulting Ltd. on behalf of AANDC. AANDC and Brodie Consulting Ltd. are not responsible for the completeness or accuracy of any reclamation estimate made using this model. The user agrees to check and take responsibility for all aspects of any cost estimate made using this model.		

The following table provides guidance as to whether water management and treatment is considered short term or long term. Short term closure activities may be costed within a component (eg 'Open Pit' or 'Rock Pile') or 'Water Management'. Long term or post-closure water treatment is costed in 'Water Treatment' and included in "Post-closure Monitoring and Maintenance".

		Short Term/ Capital Ex.	Long term
Open Pit	flood pit - install/operate pumping system	x	
	construct diversion ditches	x	
	treat 1st filling	x	
	install pump/decant system	x	
	passive/biological treatment	x	
	overflow treatment		x
Rock Pile/Heap Leach Facility	construct diversion ditches	x	
	install groundwater collection system	x	
	install toe seepage collection system	x	
	collect and treat groundwater		x
	collect and treat seepage (ARD/ML)		x
	install passive treatment system	x	
Tailings Facility	operate and maintain passive treatment system	x	x
	operate pump and detoxify heap leach pile (cyanide destruction)	x	
	construct diversion ditches	x	
	pump supernatant (to pit, U/G)	x	
	treat supernatant	x	
	install toe seepage collection system	x	
U/G Mine	collect and treat seepage (ARD/ML)		x
	install passive treatment system	x	
	operate and maintain passive treatment system	x	x
	accelerate flooding	x	
	install seepage collection system	x	
	install dewatering/pumping system	x	
Water Management	operate seepage/dewatering system (ARD/ML)		x
	refill lakes		
	redirect creeks/streams	x	
	stabilize water management ponds	x	
	stabilize/close sediment ponds	x	
	fresh water supply - breach embankment	x	
	fresh water supply - remove piping system	x	
	construct water treatment plant	x	
	construct sludge pond	x	
	water control in reclamation quarry	x	
operate/maintain water treatment plant		x	

1

Open Pit Name:

Pit # 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost Land	Land Cost	Water Cost
CONTROL ACCESS								
Fence		m	350	fnc	\$203.00	\$71,050 100%	\$71,050	\$0
Signs		each		#N/A	\$0.00	\$0	\$0	\$0
Berm at crest		m3		#N/A	\$0.00	\$0	\$0	\$0
Block roads		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
STABILITY STUDY								
Conduct stability and setback study		allow		#N/A	\$0.00	\$0	\$0	\$0
STABILIZE SLOPES								
Off-load crest, soil A		m3		#N/A	\$0.00	\$0	\$0	\$0
Off-load crest, soil B		m3		#N/A	\$0.00	\$0	\$0	\$0
Doze/trim overburden at crest		m3		#N/A	\$0.00	\$0	\$0	\$0
Drill & blast pit crest		m3		#N/A	\$0.00	\$0	\$0	\$0
Buttress slope		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
COVER/CONTOUR SLOPES								
Place fill, soil A		m3		#N/A	\$0.00	\$0	\$0	\$0
Place fill, soil B		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate slopes		ha		#N/A	\$0.00	\$0	\$0	\$0
Vegetate pit floor		ha		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
CONSTRUCT DIVERSION DITCHES								
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0	\$0
CONSTRUCT SPILLWAY								
Excavate channel		m3		#N/A	\$0.00	\$0	\$0	\$0
Concrete		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
RECLAIM QUARRIES								
Contour slopes		m3		#N/A	\$0.00	\$0	\$0	\$0
Place overburden		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate		m3		#N/A	\$0.00	\$0	\$0	\$0
FLOOD PIT-Captital								
Remove stationary equipment (sump pumps)		each		#N/A	\$0.00	\$0	\$0	\$0
Remove dewatering pipeline		m		#N/A	\$0.00	\$0	\$0	\$0
Remove power lines		each		#N/A	\$0.00	\$0	\$0	\$0
Construct diversion ditches		m3		#N/A	\$0.00	\$0	\$0	\$0
-Ditch, mat'l A		m3		#N/A	\$0.00	\$0	\$0	\$0
-Ditch, mat'l B		m3		#N/A	\$0.00	\$0	\$0	\$0
Construct embankment/dam		m3		#N/A	\$0.00	\$0	\$0	\$0
Supply/install pump station		each		#N/A	\$0.00	\$0	\$0	\$0
Supply/install piping system		m		#N/A	\$0.00	\$0	\$0	\$0
Remove pump post-closure		each		#N/A	\$0.00	\$0	\$0	\$0
Remove pipeline post-closure		m		#N/A	\$0.00	\$0	\$0	\$0
FLOOD PIT-Annual Cost								
Operate pumps (power)		m3		#N/A	\$0.00	\$0	\$0	\$0
Maintain pump/pipeline		allow		#N/A	\$0.00	\$0	\$0	\$0
Labour:fuel management, comissioning/decom		\$/h		#N/A	\$0.00	\$0	\$0	\$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	\$0.00	\$0	\$0	\$0
Chemicals, purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0	\$0
Passive/biological additives		\$/ha		#N/A	\$0.00	\$0	\$0	\$0
Passive additives purchase and shipping		tonne		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
						Annual pumping costs		\$0
Number of years of pump flooding		years				Total pumping costs		\$0
						Total		\$71,050
						% of Total		100%
								\$0
								0%

1

Rock Pile Name:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost Land	Land Cost	Water Cost
STABILIZE SLOPES								
	Assuming a perfect cone with a slope angle of 37 degrees will be flattened to a perfect cone with a slope angle of 17 degrees.							
Flatten slopes with dozer		m3	52500	DR	\$1.05	\$55,125 100%	\$55,125	\$0
Flatten "bubble dump" areas		m3		#N/A	\$0.00	\$0	\$0	\$0
Divert runoff, ditch mat'l A		m3		#N/A	\$0.00	\$0	\$0	\$0
Divert runoff, ditch mat'l B		m3		#N/A	\$0.00	\$0	\$0	\$0
Toe buttress, drain mat'l		m3		#N/A	\$0.00	\$0	\$0	\$0
Toe buttress, fill mat'l A		m3		#N/A	\$0.00	\$0	\$0	\$0
Toe buttress, fill mat'l B		m3		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
COVER ROCK PILE								
Subgrade preparation - doze surface		m3		#N/A	\$0.00	\$0	\$0	\$0
Soil cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0	\$0	\$0
Rock cover - excavate,haul & spread		m3		#N/A	\$0.00	\$0	\$0	\$0
Excavate downslope drainage channel & chute		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap drainage channel and chute		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate		ha		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
VERY LOW PERMEABILITY COVER (in addition to above)								
Liner subgrade preparation - compact		m2		#N/A	\$0.00	\$0	\$0	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate		ha		#N/A	\$0.00	\$0	\$0	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0	\$0	\$0
CONSTRUCT DIVERSION DITCHES								
Excavate ditches -soil		m3		#N/A	\$0.00	\$0	\$0	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0	\$0	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0	\$0	\$0
CONSTRUCT SEEPAGE COLLECTION POND								
Excavate seepage collection pond		m3		#N/A	\$0.00	\$0	\$0	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0	\$0	\$0
Bedding layer		m3		#N/A	\$0.00	\$0	\$0	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0	\$0	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0	\$0	\$0
INSTALL GROUNDWATER COLLECTION SYSTEM								
Excavate/install sumps		m3		#N/A	\$0.00	\$0	\$0	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0	\$0	\$0
Install pumps/pipelines/power supply		allow		#N/A	\$0.00	\$0	\$0	\$0
RELOCATE DUMPS								
Load, haul, dump or doze		m3		#N/A	\$0.00	\$0	\$0	\$0
Add lime		tonne		#N/A	\$0.00	\$0	\$0	\$0
Contour reclaimed area		ha		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
SPECIALIZED ITEMS								
Install permanent instrumentation		each		#N/A	\$0.00	\$0	\$0	\$0
Install permanent instrumentation, drilling		each		#N/A	\$0.00	\$0	\$0	\$0
TREAT ROCK PILE SEEPAGE - see "Water Treatment"								
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox								
Cyanide destruction water treatment pumping		m3		#N/A	\$0.00	\$0	\$0	\$0
Reagents		tonnes		#N/A	\$0.00	\$0	\$0	\$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	\$0.00	\$0	\$0	\$0
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0	\$0	\$0
						Annual treatment costs	\$0	
Number of years of treatment						years		
						Total treatment costs	\$0	\$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**								
Upgrade/modify pumping system - report to WTP		allow		#N/A	\$0.00	\$0		\$0
						Total	\$55,125	\$55,125
						% of Total	100%	0%

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

1 Chemicals/Soil Area Name:

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT								
Hazardous materials audit		mandays		#N/A	\$0.00	\$0	\$0	\$0
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS								
Environmental technician/coordinator		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate: oil, fuel		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate maintenance shop		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate power plant		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate bulk fuel storage		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate ANFO plant		mandays		#N/A	\$0.00	\$0	\$0	\$0
Decontaminate offices/warehouse/accom		mandays		#N/A	\$0.00	\$0	\$0	\$0
Removal of asbestos siding on buildings		m2		#N/A	\$0.00	\$0	\$0	\$0
Removal of friable asbestos on equipment		m2		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
HAZARDOUS MATERIALS REMOVAL								
Waste oils		litre	100 ORH		\$1.20	\$120	\$0	\$120
Waste fuel		litre	4000 ORL		\$0.43	\$1,720	\$0	\$1,720
Waste batteries		kg		#N/A	\$0.00	\$0	\$0	\$0
Assay & environmental lab reagents		kg		#N/A	\$0.00	\$0	\$0	\$0
Machine shop paints, solvents etc		litre		#N/A	\$0.00	\$0	\$0	\$0
Glycol		litre		#N/A	\$0.00	\$0	\$0	\$0
Process reagents		kg		#N/A	\$0.00	\$0	\$0	\$0
Nuclear sources		allow		#N/A	\$0.00	\$0	\$0	\$0
Other hazardous materials		allow		#N/A	\$0.00	\$0	\$0	\$0
HAZARDOUS MATERIALS								
Transportation to disposal facility		allow	1	#N/A	\$1,000.00	\$1,000	\$0	\$1,000
Disposal fees	fees - waste oils, fuel and building decominate	allow	1	#N/A	\$1,000.00	\$1,000	\$0	\$1,000
Diposal Fees	allocation for contaminated soil generated during reclamation	allow	0.5	#N/A	\$1,000.00	\$500	\$0	\$500
CONTAMINATED SOILS								
	Assumed - Limited site assessment work to assess site for contamination resulting from the reclamation activities							
Contam. soil investigation - Phase 1		each	0.5 CS1		\$7,500.00	\$3,750	\$0	\$3,750
Contam. soil investigation - Phase 2		each		#N/A	\$0.00	\$0	\$0	\$0
CONTAMINATED SOIL REMOVAL								
Excavate and transport to onsite facility		m3		#N/A	\$0.00	\$0	\$0	\$0
Manage hydrocarbon remediation at facility		m3		#N/A	\$0.00	\$0	\$0	\$0
Reagents/stabilizing agent		m2		#N/A	\$0.00	\$0	\$0	\$0
Excavate and transport to offsite facility		m3		#N/A	\$0.00	\$0	\$0	\$0
Contour decontaminated area		m3		#N/A	\$0.00	\$0	\$0	\$0
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER								
Supply geomembrane, HDPE, ES3, GCL		m2		#N/A	\$0.00	\$0	\$0	\$0
Upper and lower bedding layers		m3		#N/A	\$0.00	\$0	\$0	\$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	\$0.00	\$0	\$0	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0	\$0	\$0
Vegetate		m2		#N/A	\$0.00	\$0	\$0	\$0
Install infiltration/seepage instrumentation		allow		#N/A	\$0.00	\$0	\$0	\$0
Other				#N/A	\$0.00	\$0	\$0	\$0
OTHER								
				#N/A	\$0.00	\$0	\$0	\$0
Total						\$8,090	\$0	\$8,090
% of Total							0%	100%

Building / Equip Name:		Bldg / Equip #: 1						
ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT								
Decontaminate and ship off-site		allow	19	#NA	\$4,200.00	\$79,800 100%	\$79,800	\$0
Decontaminate and dispose offsite - seaso	This equipment may only be on site when	allow	3	#NA	\$4,200.00	\$12,600 100%	\$12,600	\$0
Remove light duty vehicle	and if winter trail s are needed	allow	6	#NA	\$1,100.00	\$6,600 100%	\$6,600	\$0
Removal of Sea Cans	Sea cans to be removed using onsite trucks, assumed 6 hour return trip for each Sea can using onsite trucks (\$75 per	allow	20	#NA	\$450.00	\$9,000 100%	\$9,000	\$0
REMOVE BUILDINGS - see note below								
Accommodation Complex	Camp dry - trailer	m2	1	#NA	\$4,200.00	\$4,200 100%	\$4,200	\$0
Process Facilities	Sorting Facility (Sea Container) haul via winter road*	m2	2	#NA	\$4,200.00	\$8,400 100%	\$8,400	\$0
Offices, Repair, Lab, Warehouse		m2	2	#NA	\$4,200.00	\$8,400 100%	\$8,400	\$0
Storage Facilities		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Water and Wastewater Treatment Facilities		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
U/G Heating Plant		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Emulsion Plant		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
AN Storage Facility		m2	25	BRWL	\$27.50	\$688 100%	\$688	\$0
Warehouse, Shops and Other		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Storage Facility at Laydown/Airstrip		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Fuel tanks	Haul via winter road*	m2	6	#NA	\$4,200.00	\$25,200 100%	\$25,200	\$0
Fuel Tanks		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Freshwater intake		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Reclaim pumps		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Outfall & Diffuser		m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Airstrip lighting, navigation, electrician		mandays	#NA	#NA	\$0.00	\$0	\$0	\$0
Airstrip lighting, navigation, mechanical		mandays	#NA	#NA	\$0.00	\$0	\$0	\$0
Break foundation slabs	total of all buildings	m2	#NA	#NA	\$0.00	\$0	\$0	\$0
Consolidate & dump boneyard debris		m3	#NA	#NA	\$0.00	\$0	\$0	\$0
Decominate and remove fluids from Structures		mandays	12	lab-sh	\$49.60	\$595 100%	\$595	\$0
LANDFILL FOR DEMOLITION WASTE								
Offsite - tipping fee		m3	1	#NA	\$1,536.00	\$1,536 100%	\$1,536	\$0
Place soil cover	Soil Cap - Landfill and Septic Field	m3	#NA	#NA	\$0.00	\$0	\$0	\$0
Vegetate		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
GRADE AND CONTOUR PADS								
Accommodation Complex		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Process Facilities		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Offices, Repair, Lab, Warehouse		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Storage Facilities		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Water and Wastewater Treatment Facilities		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
U/G Heating Plant		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Emulsion Plant		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Warehouse, Shops and Other		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Place rock cover		m3	#NA	#NA	\$0.00	\$0	\$0	\$0
Vegetate		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Other	general site grading/contouring or scarifying of disturbed area	ha	10	dozer1	\$490.00	\$4,900 100%	\$4,900	\$0
PUNCTURE LINED SUMPS								
Puncture liner and place soil cover		m3	#NA	#NA	\$0.00	\$0	\$0	\$0
RECLAIM ROADS								
Remove culverts		each	#NA	#NA	\$0.00	\$0	\$0	\$0
Remove bridges		each	#NA	#NA	\$0.00	\$0	\$0	\$0
Scarify and install water breaks		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Scarify airstrip		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Scarify laydown areas		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Vegetate		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
Other		ha	#NA	#NA	\$0.00	\$0	\$0	\$0
SPECIALIZED ITEMS								
Dispose of misc. debris and laydown area refuse			#NA	#NA	\$0.00	\$0	\$0	\$0
Total						\$161,919	\$161,919	\$0
% of Total							100%	0%

deliver on winter road to Yellowknife/Hay River

Note: Unit costs are based on 3m high, single storey building. Scale larger building areas accordingly. E.g. 10m high building multiply area by 3.3 (10/3)

same assumptions per ARKTis model

Type/Description	Number	Line	*Equipment to be removed from site by transport truck, 14hr round trip for trucking including loading/unloading at \$300/hr						
Seasonal Mobile fleet			Landfill disposal volume calculation						
Grader	1		Item	Notes	Quantit	Dimension	Assumed Weight	Tipping fee (City of Yellowknife) per tonne	Total
SnowCat	1		Accommodation C Trailer - wood s		1	40'x24'x12'	6 at	\$128	\$768
Water Truck	1		Process Facility Sea Container -		1	40'x6'x6.5'	4 at	assume sold or metal recycling, no value recovered	
Diamond Drill Rigs	2		Offices, Repair, L Trailer - wood s		2	20'x24'x12'	6 at	\$128	\$768
Sea Can Haul Truck	2		Fuel tank	Steel	6	34'x10'x10'	81 at	assume sold or recycled, no value recovered	
Dozer/Cat D3 (previously accepted)	1		AN Storage Faci	Wood structure	1	5m x 5m x 2m			
Front-end Loader/Cat 924 or equiv	1		TOTALS						\$1,536
Excavator/Cat 345 (one 36 tonne)	2								
Jaw Crusher	1								
Cone Crusher	1								
Articulated Truck/Cat 740 (one 32 t)	3								
Drill/Atlas Copco D9 (one 23 tonne)	2								
Front-end Loader/Cat 950 (one 21 t)	2								
Dozer/Cat D6 (one 21 tonne loader)	1								
Boom Truck/TBD	1								
Open Top Sea Cans	20		Equipment on-site for Demonstration Project (Table 3 of application Cover Letter)						
Generator/30 kW (onsite)	1		Type	Quantity	Assumed Weight	Tipping fee (City of Yellowknife) per tonne	Total		
Generator/27 kW (onsite)	2		250 kw generatc	1					
Incinerator/Fire Lake A400X (onsite)	2		30 kw generatc	1					
Vibrating Screen	2		27 kw generatc	2					
Double deck Wilfley Table	1		Diamond Drill Rg	2					
Ore Sorter/Tomra (on site,	1		Sea Can Haul Tr	2					
			Dozer/Cat D3 (p	1					
			Front-end Loadc	1				assume sold, no value recovered	
			Excavator/Cat 3	2					
			Jaw Crusher	1					
			Cone Crusher	1					
			Articulated Truck	3					
			Drill/Atlas Copco	2					
			Front-end Loadc	2					
			Dozer/Cat D6 (o	1					
			Boom Truck/TBc	1					

1 Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
BREACH DYKE EMBANKMENT						
Remove fill		m3		#N/A	\$0.00	\$0
Contour water intake area		m3		#N/A	\$0.00	\$0
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS						
Place soil cover		m3		#N/A	\$0.00	\$0
Doze & spread excavated material	Flatten settling pond	m3	12	dozerh	\$565.00	\$6,780
Vegetate spread material		ha		#N/A	\$0.00	\$0
Rip rap in channel base		each		#N/A	\$0.00	\$0
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES						
Excavate ditches -soil		m3		#N/A	\$0.00	\$0
Excavate ditches -rock		m3		#N/A	\$0.00	\$0
Stabilize side slopes		m3		#N/A	\$0.00	\$0
Rip rap in channel base		m3		#N/A	\$0.00	\$0
BREACH DITCHES						
Excavate breaches		m3		#N/A	\$0.00	\$0
Backfill/recontour		m3		#N/A	\$0.00	\$0
Install flow dissipation		m3		#N/A	\$0.00	\$0
Vegetate remainder of ditch		m2		#N/A	\$0.00	\$0
DECOMMISSION FRESH WATER SUPPLY						
Pump water out of management pond prior to assumed volume of 14000 m3		m	14000	POCI	\$0.12	\$1,680
Pump nd hose rental/capital		LS	1	#N/A	\$1,000.00	\$1,000
Confirm water quality/Remove pipeline	2 samples	m	2	#N/A	\$500.00	\$1,000
WATER CONTROL IN RECLAMATION QUARRY						
Install pumping system		LS		#N/A	\$0.00	\$0
Remove pumping system		LS		#N/A	\$0.00	\$0
REMOVE PIPELINES						
Remove pipes		m		#N/A	\$0.00	\$0
Concrete plug deep pipes		m3		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
GROUNDWATER COLLECTION SYSTEM						
Excavate/install sumps		m3		#N/A	\$0.00	\$0
Install pumping wells		m3		#N/A	\$0.00	\$0
Install pumps/pipelines/power supply		LS		#N/A	\$0.00	\$0
CONSTRUCT CONTAMINATED WATER STORAGE POND						
Excavate pond		m3		#N/A	\$0.00	\$0
Doze & spread excavated material		m3		#N/A	\$0.00	\$0
Vegetate spread material		ha		#N/A	\$0.00	\$0
Bedding layer		m3		#N/A	\$0.00	\$0
Supply geomembrane		m2		#N/A	\$0.00	\$0
Install geomembrane		m2		#N/A	\$0.00	\$0
Erosion protection layer		m3		#N/A	\$0.00	\$0
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)						
Construct access roads		km		#N/A	\$0.00	\$0
Install HDPE piping system from collection pond		m		#N/A	\$0.00	\$0
Inter-cell flow structures		allow		#N/A	\$0.00	\$0
Install liners		m2		#N/A	\$0.00	\$0
Install growth media		m3		#N/A	\$0.00	\$0
Wetland vegetation		ha		#N/A	\$0.00	\$0
CONSTRUCT WATER TREATMENT PLANT						
Build treatment plant		LS		#N/A	\$0.00	\$0
Build sludge containment facility		LS		#N/A	\$0.00	\$0
SHORT TERM WATER TREATMENT*						
Annual water treatment cost, from "Water Treatment"						\$0
Total						\$10,460

*Note: include water treatment cost from "Water Treatment" worksheet if treatment is considered short term and is not included in a particular component worksheet.

1 Water Treatment

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
ADDITION OF REAGENTS						
H2O2		kg		#N/A	\$0.00	\$0
lime		kg		#N/A	\$0.00	\$0
ferric sulphate		kg		#N/A	\$0.00	\$0
ferrous sulphate		kg		#N/A	\$0.00	\$0
flocculents		kg		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
LABOUR AND SUPPLIES						
Annual fuel		litres		#N/A	\$0.00	\$0
Annual power		kW-h		#N/A	\$0.00	\$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	\$0.00	\$0
Equipment maintenance and parts		allow		#N/A	\$0.00	\$0
Misc. supplies, hoses, tools		allow		#N/A	\$0.00	\$0
Communications		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
WATER SAMPLING AND ANALYSES						
Sampling equipment		allow		#N/A	\$0.00	\$0
Analyses		allow		#N/A	\$0.00	\$0
Shipping to laboratory		allow		#N/A	\$0.00	\$0
Reporting		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
SITE ACCESS						
Road maintenance (incl. snow removal)		allow		#N/A	\$0.00	\$0
Winter road tariff		allow		#N/A	\$0.00	\$0
Truck rental		allow		#N/A	\$0.00	\$0
Air support		allow		#N/A	\$0.00	\$0
Annual water treatment costs						\$0
Number of years of water treatment		years				
Total						\$0

Note: Short term water treatment is intended to be included in "Water Management", whereas long term, or post-closure, water treatment is included in "Post-Closure Monitoring and Maintenance"

1 Post-Closure Monitoring & Maintenance:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MONITORING & INSPECTIONS						
Annual geotechnical inspection	assumed annually for 3 years - scaled to proj	each	0	rptl	\$10,000.00	\$0
Survey inspection		each		#N/A	\$0.00	\$0
Regulatory costs*	assumed annually - 3 years	each	1	rptl	\$10,000.00	\$10,000
Site water monitoring (AEMP and SNP)		each		#N/A	\$0.00	\$0
- Active closure and flooding		each	1.5	wsl	\$7,000.00	\$10,500
- Post pit flooding		each		#N/A	\$0.00	\$0
Air Quality Monitoring Program (AQMP)		each		#N/A	\$0.00	\$0
Wildlife Effects Monitoring Program (WEMP)		each		#N/A	\$0.00	\$0
Vegetation Monitoring		each		#N/A	\$0.00	\$0
Transport to site	cost covered in current WL			#N/A	\$0.00	\$0
COVER MAINTENANCE						
Repair erosion - infill gullies		allow		#N/A	\$0.00	\$0
Repair erosion - upgrade diversion ditches		allow		#N/A	\$0.00	\$0
Remove problem vegetation		allow		#N/A	\$0.00	\$0
Repair animal damage		allow		#N/A	\$0.00	\$0
Repair/upgrade access controls		allow		#N/A	\$0.00	\$0
Other				#N/A	\$0.00	\$0
SPILLWAY MAINTENANCE						
Repair erosion		m3		#N/A	\$0.00	\$0
Clear spillway		each		#N/A	\$0.00	\$0
CWTS MAINTENANCE						
Maintain flow, restore vegetation		allow		#N/A	\$0.00	\$0
POST-CLOSURE WATER TREATMENT**						
Annual water treatment cost, from "Water Treatment"						\$0
Subtotal, Annual post-closure costs						\$20,500
Discount rate for calculation of net present value of post-closure cost, %				0.00%		
Number of years of post-closure activity				1	years	
Present Value of payment stream						\$20,500

*Regulatory costs - annual reporting, management plans, progress reports etc.
 Include water treatment cost from "Water Treatment" worksheet if treatment is considered long term, such as ARD/ML.

1 Interim Care and Maintenance

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
INTERIM CARE & MAINTENANCE						
on-site caretaker		manmonths		#N/A	0	\$0
extra personnel		manmonths		#N/A	0	\$0
-electrician		manmonths		#N/A	0	\$0
-mechanic		manmonths		#N/A	0	\$0
annual fuel		litre		#N/A	0	\$0
misc. supplies		allow		#N/A	0	\$0
pick-up truck		each		#N/A	0	\$0
small dozer		allow		#N/A	0	\$0
small excavator		allow		#N/A	0	\$0
snow machine		allow		#N/A	0	\$0
communications		allow		#N/A	0	\$0
SNP/AEMP water sampling & reporting		each		#N/A	0	\$0
geotechnical assessment		each		#N/A	0	\$0
interim water treatment				#N/A		\$0
other		each		#N/A	0	\$0
					Annual Interim C&M Cost	\$0
Number of years of ICM		years			Total	\$0

1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
Excavators		each		#N/A	0	\$0
Dump trucks		each		#N/A	0	\$0
Dozers		each	1	#N/A	4200	\$4,200
Demolition shears		each		#N/A	0	\$0
Crane		each		#N/A	0	\$0
Loader		each	1	#N/A	4200	\$4,200
Compactor		each		#N/A	0	\$0
Light duty vehicles		each	2	#N/A	1100	\$2,200
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	0	\$0
Pipe shipping		m		#N/A	0	\$0
Minor tools and equipment		allow		#N/A	0	\$0
Truck tires		allow		#N/A	0	\$0
Other				#N/A	0	\$0
MOBILIZE CAMP						
Reclamation activities		allow	1	#N/A	1000	\$1,000
Long term reclamation activities (eg pump flooding)		allow		#N/A	0	\$0
MOBILIZE WORKERS						
Reclamation activities - transport		each		#N/A	0	\$0
Reclamation activities - travel time		manhours	18	#N/A	473	\$8,514
Long term reclamation activities (eg pump flooding) - transport		each		#N/A	0	\$0
Long term reclamation activities (eg pump flooding) - travel time		each		#N/A	0	\$0
Monitoring Airfare		each	1 mwl		4500	\$4,500
WORKER ACCOMODATIONS						
Reclamation activities	6 workers for 10 days	months	60 accmh		175	\$10,500
Long term reclamation activities (eg pump flooding)		manmonths		#N/A	0	\$0
MOBILIZE FUEL						
Fuel freight - reclamation activities	assumed 10000L	litre	2	#N/A	4200	\$8,400
Fuel freight - long term reclamation activities		litre		#N/A	0	\$0
Fuel freight accomodations		litre		#N/A	0	\$0
WINTER ROAD						
Construction and operation		km		#N/A	0	\$0
Limited winter use		km		#N/A	0	\$0
Winter road tarriff		km		#N/A	0	\$0
DEMOBILIZE HEAVY EQUIPMENT						
Excavators		km		#N/A	0	\$0
Dump trucks		km		#N/A	0	\$0
Dozers		km	1	#N/A	4200	\$4,200
Demolition shears		km		#N/A	0	\$0
Crane		km		#N/A	0	\$0
Loader		km	1	#N/A	4200	\$4,200
Compactor		each		#N/A	0	\$0
Light duty vehicles		km		#N/A	0	\$0
Other		km	2	#N/A	1100	\$2,200
DEMOBILIZE CAMP						
reclamation activities	small tent camp	allow	1	#N/A	1000	\$1,000
DEMOBILIZE WORKERS						
crew travel time		mandays	18	#N/A	473	\$8,514
crew transportation		each		#N/A	0	\$0
WINTER ROAD						
Construction and operation		km	125 wrcl		2000	\$250,000
Limited winter use		km		#N/A	0	\$0
Winter road tarriff		km		#N/A	0	\$0
Total						\$313,628

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

ITEM	Detail	COS1 CODE	UNITS	LOW \$	HIGH \$	SPECIFIED \$	COMMENTS	
Accommodation								
		ACCM	manday	100.00	175.00			
Buildings - Decontaminate								
	Asbestos	BDA	m2	25.60	51.20		Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos	
Buildings - Remove								
	Wood	BRW	m2	27.50	41.00		Unit costs are based on 3m high, single storey building. Scale areas accordingly.	
	Concrete	BRC	m2	40.00	65.00	6.00		Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	45.00	65.00			
	Steel - for salvage	BRS2	m2	67.00	100.00			
Concrete work								
	Small pour	CSF	m3	426.50	639.75		Low: YK; High=1.5xLow	
	Large pour	CLF	m3	353.50	530.25	2,130.00	Specified: concrete crown pillar	
Contaminated Soils								
	ESA Phase 1	CS1	each	7500.00			Low: small, "clean" site	
	ESA Phase 1	CS2	each	50000.00			Low: small, "clean" site	
	Remediate on site	CSR	m3	47.00	146.00			
Dozing								
	doze rock piles	DR	m3	1.05	2.40		Low cost: doze crest off dump	
	doze overburden/soil piles	DS	m3	0.95	3.80		High cost: push up to 300 m	
Excavate Rock; Low Spec's and QA/QC								
	drill/blast/load/short haul	RB1	m3	11.40	17.05		Low:quarry operations for bulk fill	
	drill/blast/load/long haul	RB2	m3	12.05	17.80			
	RB1 + spread and compact	RB3	m3	12.05	17.80			
	RB2 + spread and compact	RB4	m3	12.50	30.75			
	Specified activity	RBS	m3					
Excavate Rock; High Spec's and QA/QC								
	drill/blast/load/short haul	RC1	m3	12.05	17.80		(e.g. ditch/spillway excavation)	
	drill/blast/load/long haul	RC2	m3	12.70	18.40		Low:foundation excavation;High:spillway excavation	
	RC1 + spread and compact	RC3	m3	12.70	18.40		e.g. cover construction	
	RC2 + spread and compact	RC4	m3	13.50	19.20		e.g. cover construction	
	Specified activity	RCS	m3			175.00	Specified-drift excavation	
Excavate Rip Rap								
	drill/blast/load/short haul/place	RR1	m3	13.50	17.75		High: quarry & place rip rap in channel	
	drill/blast/load/long haul/place	RR2	m3	14.20	20.65			
	source is waste dump/short haul	RR3	m3	7.00			cost includes sorting	
	source is waste dump/long haul	RR4	m3	7.60				
	Specified activity	RRS	m3					
Excavate Soil; Low Spec's and QA/QC								
	clear & grub	SBC	m2	3.40	5.00			
	excavate/load/short haul	SB1	m3	4.30	5.90			
	excavate/load/long haul	SB2	m3	4.60	7.30			
	SB1 + spread and compact	SB3	m3	5.10	8.90		Low: non-engineered; High:engineered	
	SB2 + spread and compact	SB4	m3	5.50	11.00		Low: non-engineered; High:engineered	
	Specified activity	SBS	m3	3.20	6.30		Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling	
	Tailings	SBT	m3	1.35	3.70	15.50	High:contour surface - wet or frozen; Specified:haul/place wet infill	
Excavate Soil, High Spec's and QA/QC								
	excavate/load/short haul	SC1	m3	6.80	9.30			
	excavate/load/long haul	SC2	m3	7.10	11.75			
	SC1 + spread and compact	SC3	m3	8.90	14.20		Low: non-engineered; High:engineered	
	SC2 + spread and compact	SC4	m3	9.30	23.20		Low: non-engineered; High:engineered (e.g. complex covers, low volume dam construction)	
	Specified activity	SCS	m3			18.80	Backfill adit with waste rock	
Fence								
		FNC	m	13.55	203.00			
Fuel and Electricity								
	Fuel cost - gas	FCG	litre	1.05	1.40			
	Fuel cost - diesel	FCD	litre	0.99	1.39			
	Fuel mobilization	FCM	litre	0.22	0.42		High: winter road usage	
	Electricity	FCE	kW-h	0.17	0.19	0.49	Low and High:Yellowknife; Specified:diesel generator	
Geo-Synthetics								
	geotextile	GST	m2	3.44			Supply and install	
	geogrid	GSG	m2	5.75				
	liner, HDPE	GSHDPE	m2	7.95			Supply and install; large quantity	
	liner, ES3	GSES3	m2	20.20			FOB Yellowknife	
	geosynthetic installation	GSI	m2	3.16	14.00		Low:geotextile; High:ES3 or HDPE	
	bentonite soil ammendment	GSBA	tonne	308.30	348.50		FOB Edmonton, add shipping & mixing	
Grouting (/m3 of rock grouted)								
		grout	m3	236.55	286.75		High: cement, FOB Yellowknife	
Labour & Equipment Rates								
	Site manager	sman	\$/hr	125.00	152.00			
	Supervisor	super	\$/hr	52.00	91.84			
	Registered engineer	eng	\$/hr	95.00	220.00			
	Environmental coordinator	envco	\$/hr	74.16	130.00			
	Environmental technologist	envtech	\$/hr	36.00				
	Electrician	elec	\$/hr	74.00	95.00			
	Journeyman - various	journey	\$/hr	44.00	71.79			
	Labour - skilled	lab-s	\$/hr	41.00	49.60			

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

Labour - unskilled	lab-us	\$/hr	31.00	43.98	
Equipment operator	oper	\$/hr	41.00	65.00	
Heavy duty mechanic	mech	\$/hr	49.00	72.85	
Water treatment plant operator	oper-wt	\$/hr	41.00	59.86	
Security / first aid	safety	\$/hr	36.00	66.97	
Administrative staff	admin	\$/hr	38.00	57.89	
Equipment rates include operator and fuel					
Loader - 4 cu.yd (3.06m3)	load-s	\$/hr	175.00		
Loader - 7 cu.yd (5.35m3)	load-l	\$/hr	315.00		
Excavator - 26.76-30.84 tonnes	exc-s	\$/hr	190.00		
Excavator - 68.95+tonnes	exc-l	\$/hr	420.00		
Grader	grad	\$/hr	190.00		
Dump truck off hwy 30-50 tonnes	truck-s	\$/hr	225.00		
Dump truck off hwy 55-75 tonnes	truck-l	\$/hr	300.00		
dozer, small	dozers	\$/hr	205.00	260.00	
dozer, large	dozerl	\$/hr	490.00	565.00	
smooth drum compactor	comp	\$/hr	155.00		
scooptram, 6 yd3 bucket	scoop	\$/hr	170.00		
flat bed truck with hiab	hiab	\$/hr	155.00		
fuel truck	ftruck	\$/hr	150.00		
water truck	wtruck	\$/hr	58.00	150.00	
Mobilize Heavy Equipment					
Road access	MHER	kmtonne	3.40	10.25	
Air access	MHEA	kmtonne	12.00		cargo rate>500lb
Mobilize Camp					
Road access	MCR	each	50000.00		refurbish existing camp
Mobilize Workers					
flight	MW	each	4500.00	9100.00	Low:e.g. 8 passenger; High: Dash 7
Oil Removal					
oil removal	OR	litre	0.43	1.20	Low:waste oil heater; High: ship offsite
PCB Removal					
Remove from site	PCBR	litre	40.20	46.90	Low: shipping, handling & disposal from Yellowknife
Pipes, small (<6in dia.)					
remove/dispose on site	PSR	m	1.00	24.00	Low: remove/dispose on site; High: remove/re-use
supply	PSS	m	6.10	11.10	Low:supply; High:supply and ship
install	PSI	m	25.00		
Pipes, large (>6in dia.)					
remove/dispose on site	PLR	m	22.00	72.00	Low: remove/dispose on site; High: remove/re-use
supply	PLS	m	129.00	143.00	Low:supply; High:supply and ship
install	PLI	m	50.00		
Power Lines					
remove/dispose on site	POWR	m	25.50		
Process Chemicals					
Remove from site	PCR	kg	0.45	2.50	Low: shipping, handling & disposal from Yellowknife
Pumps					
Pump capital cost	PC	each	#####		
Pump shipping	PS	each	2500.00		
Pump operating cost	POC	m3	0.12		pump operating costs should be calculated based on pump capacity, fuel costs, etc.
Pump maintenance	PM	allow	25000.00		
Pump sand BackFill					
	PBF	m3	85.00	300.00	
Scarify - road/mine site					
	SCFY	ha	4300	6030	2150
Shaft, Raise & Portal Closures					
Shaft & Raises	SR	m2	645.00	2132.00	Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
Portals	POR	m3	18.80	250.00	1200.00
Site Inspection Report					
	RPT	each	10000.00	20000.00	
SpillWay - Clear					
	SW	each	3000.00	7000.00	
Survey/Instrumentation					
	SI	each	1800.00	3600.00	2 person crew
Treatment Plant - Construct					
Small (< 1000 m3/d)	TPS	lump sum	9000000	15000000	
Large (> 1000 m3/d)	TPL	lump sum	1.5E+07	46000000	
Constructed Wetland	CWTS	ha	200000	300000	
Treatment Plant - Operate					
	TPO	m3	0.35	2.00	
Treatment Chemicals					
ferric sulphate	ferric	kg	1.19		
ferrous sulphate	ferrous	kg	1.32		
lime	lime	kg	0.56		
hydrogen peroxide, 35%	hperox	kg	1.50		
Sodium Metabisulfate	Nametab	kg	1.18		
Caustic soda, 50%	caustic	kg	0.74		
Sulfuric acid, 93%	sulfuric	kg	0.31		
floculant	flocc	kg	6.00		

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

copper sulphate	copper	kg			
shipping	shipping	kg	0.20		
Vegetation					
Hydroseed, Flat	VHF	ha	4000.00		
Hydroseed, Sloped	VHS	ha	4500.00		
Veg. blanket/erosion mat	VB	ha	13000.00		
Tree planting	VT	ha	2600.00	6000.00	
Wetland species	VW	ha			47.72
Water Sampling/Analysis/Reporting					
	WS	each	7000.00	10000.00	
Winter Road					
Construction	WRC	km	2000.00	11500.00	
Usage	WRU	kmtone	0.29		

Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand, biochar and fertilizer, woodchips)