Mackenzie Valley Land and Water Board
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Application for:
New Land Use Permit ☒ **Amendment** ☐ **to** _____

1. Applicant's name and mailing address: Carey Ogilvie – Senior Manager Contaminants and Remediation Division Indigenous and Northern Affairs Canada NT Region Box 1500, Yellowknife, NT X1A 2R3	Fax number: (867) 669-2715 Telephone number: (867) 669-2405
2. Head office address: Same as above Field supervisor: To be provided following award of the Phase IIB remediation contract Radiotelephone:	Fax number: Same as above Telephone number: Same as above

3. Other personnel (subcontractor, contractors, company staff etc.)

The camp is currently permitted to have up to 70 people. The actual number of personnel staying on site will vary during the course of remediation operations.

Site personnel will generally include equipment operators, mechanics, site management, departmental representative staff, site services, wildlife monitors, camp operators, water treatment plant operators, geomembrane liner installation crew, and as-need professionals (e.g. electrician, surveyor, etc.). The majority of persons on site will be part of the remediation contractor's team. However, representatives of Indigenous and Northern Affairs Canada (INAC) and/or Public Services and Procurement Canada (PSPC), or other government official, such as Inspectors, can be expected on site as well.

TOTAL: Camp Occupancy is up to 70 personnel

4. Eligibility:
(Refer to section 18 of the *Mackenzie Valley Land Use Regulations*)

a)(i) a)(ii) a)(iii) b) **X**

5. a) Summary of operation (Describe purpose, nature and location of all activities.)

Tundra Mine is a former underground gold mine located approximately 230 km northeast of Yellowknife (Appendix B – Map 1). The mine and mill operated from 1962 until 1968. The mill was used again from 1983 until 1987 to process ore from the nearby Salmita Mine. Since the bankruptcy of its owner in 1998, the site has been the responsibility of INAC-CARD.

INAC – Contaminants and Remediation Division (CARD) currently holds a Type A Land Use Permit MV2009X0019 to conduct the remediation of Tundra Mine. The current Land Use Permit (LUP) is set to expire on December 16, 2016, and a renewal of the LUP is required to complete Phase II of the site remediation. It is important to note that the objectives and scope of the remediation project remain unchanged from the original application. Many of the project components have been substantially completed, and we are nearing our final remediation objectives. This LUP renewal application is intended to address activities associated with the continuation of the Tundra Mine Remediation Project, which includes finalization of the remedial objectives and ultimately site closure.

The purpose of the remediation project is to reduce the environmental impacts associated with the contaminated site, resulting in an overall positive impact on the environment. The Phase II Remedial Action Plan (RAP) (Appendix A) for Tundra Mine was completed by Golder Associates in 2008, which outlines the plan to address the remaining environmental issues of concern, including:

- Potentially acid generating (PAG) waste rock;
- Arsenic rich tailings;
- Arsenic impacted water in the Tailings Containment Area (TCA); and
- Petroleum Hydrocarbon (PHC) contaminated soil and waste rock.

PROJECT BACKGROUND

Table 1. Tundra Mine Remediation Project 4 stage implementation.

Remediation Phase	Contract	Timeline	LUP
Phase I	Phase I	2007	Complete under former LUP
Phase II	Phase IIA	2010 – 2015	Complete under current LUP
	Care & Maintenance	2015 – 2016	In Progress under current LUP
	Phase IIB	**2017 – 2018**	**Requires renewed LUP**
Adaptive Management	**As needed**	**2019 - 2023**	**Requires renewed LUP**
Long Term Monitoring	**LTM Contract**	**2019 - closure**	**Requires renewed LUP**

Phase I Remediation (completed 2007)
Phase I was completed in 2007 under a former Land Use Permit (LUP) and Water Licence (WL). Phase I addressed the removal of the physical site hazards associated with the mine infrastructure. This included the off-site disposal of hazardous materials, sealing of surface openings to the underground workings, demolition and disposal of buildings and equipment, and construction of an engineered landfill facility.

Phase II Progress (2010 -2015)
In 2010, CARD implemented Phase II of the remediation plan under the current LUP #MV2009X0019. Phase II Remediation is designed to address the chemical hazards associated with the tailings, waste rock and PHC contaminated soils. It was originally anticipated that Phase II would finalize the remediation of Tundra Mine in 2015. Due to project delays, final remediation of the site was unable to be completed under the original timeframe for the Phase IIA contract. The Phase IIB contract has been developed to finish the remaining remediation work on site. Phase IIB contract will finalize Phase II of remediation, following the same scope and objectives set out in the original LUP application and the associated LUP amendment.

Phase II progress thus far includes:

1. Tailings Water Treatment & Discharge - 1,545,725 m^3 of tailings water successfully treated and discharged to Hambone Lake
2. Consolidation of ~112,000 m^3 of waste rock into the Tailings Containment Area (TCA) (task ~80% complete).
3. Consolidation of ~290,000 m^3 of tailings into the TCA - (task ~82% completed).
4. TCA Cap Construction - 60% of liner installed and approximately 25% earth cover complete
5. West Lower Pond Borrow Area (WLPBA) – Stockpiles completed with minimal future expansion anticipated

6. Site Stabilization - several berms were constructed throughout the Site to assist with water management to minimize contact with residual tailings. Maintenance of these Site features is included under C&M.
7. Successful treatment of 16,085 m3 of PHC contaminated soil and waste rock

Care and Maintenance (2015-2016)
Following the Phase IIA contract, CARD placed the Site in to a two-year Care and Maintenance (C&M) mode, while details of the Phase IIB Contract could be finalized. The main components of the current C&M phase include annual treatment and discharge of water from the TCA, as well as earthwork repairs to berms, dams and roadways. Some additional works may be completed to better prepare for the remaining remediation works.

Phase II Remaining Remediation (2017-2018)
The Crown anticipates award of the Phase IIB contract in fall of 2016, with operations commencing shortly thereafter. The remaining remediation operations will be conducted under the renewed Type A LUP.

The remaining remediation works required to complete the Project include:

1. Treatment of tailings impacted water
2. Transport esker material to complete TCA cover
3. Removal of East Upper Dam and the remaining portion of East Lower Dam
4. Final consolidation of the remaining 5% of tailings and waste rock
5. Install the remaining 40% of the geomembrane liner over the tailings and the overlying protective earth cover.
6. Finalization of the diversion channel that will convey water from Mill Pond through the site to Hambone Lake, thereby reinstating the original flow path that was altered by the historic mining practices at Tundra Mine
7. Complete the stabilization works required in the main borrow area and any additional areas requiring stabilization
8. Install long-term monitoring equipment
9. Demobilize equipment and buildings from the site
10. CARD has carried out maintenance and monitoring activities while concurrently developing a site remediation plan. The site has large volumes of contaminated material that require consolidation, treatment and stabilization.

Adaptive Management Phase (2019-2023)
During the first initial phase following remediation it is anticipated that some additional care and maintenance type work will be required to ensure the site is stable. The objective of monitoring during this phase is to detect changes in site conditions and proactively perform enhancements to maintain site stability.

Long-Term Monitoring Phase (2019-closure)
Long-term monitoring (LTM) will commence during the Adaptive Management Phase, but will continue until sampling results indicate a stable state that is protective of the environment on site and downstream. LTM will focus on water quality, as well as aquatic ecology. A conceptual framework for the LTM phase is provided in the Tundra Mine Construction, Long-Term and Status of the Environment Programs (Appendix E-10). To allow for adaptive management, the LTM Program will be implemented in a phased approach over five-year periods with the first phase beginning after site remediation is complete.

PRINCIPLE ACTIVITIES – Phase II Remediation

Metals-impacted water in the TCA
The consolidation of tailings solids and disposal of waste rock requires that the TCA is first drained of the arsenic-impacted water currently stored within it. In order to prevent significant harm to aquatic life downstream of the TCA, the arsenic-impacted water will require treatment before discharge into the environment. All water discharged from the TCA water treatment facility will continue to meet the effluent requirements as stipulated in the current Water Licence MV2009L8-0008 (Table 2). The initial volume (~1.2 million m3) of arsenic-impacted water has been successfully treated and discharged. The remaining volume of impacted water is much smaller (e.g. ~56,000 m^3 treated in 2015), and is limited to annual inputs from freshet and rain events. Water treatment is not anticipated after 2018.

Table 2. MV2009L8-0008 Water Treatment effluent requirements

Parameter	Monthly Average Concentration (mg/L)	Maximum Concentration of Any Grab Sample (mg/L)
Total Arsenic	0.50	1.00
Total Copper	0.01	0.02
Total Lead	0.01	0.02
Total Nickel	0.05	0.10
Total Zinc	0.02	0.04
Total Ammonia (as N)	5.00	10.0
Nitrate (as N)	5.00	10.0
Nitrite (as N)	0.40	0.80
Total Suspended Solids	15.0	30.0
pH	Between 6.0 and 9.0	

A packaged iron co-precipitation treatment system has been successfully used at Tundra Mine since 2010, and will continue to be the treatment method for future water treatment. This treatment method has the ability to meet the discharge criteria at the projected flow rates (300 m^3/hr) and does not require any form of pre-treatment. Arsenic-containing sludge precipitated during the treatment process is stable and will be separated from the liquid effluent using filter bags known as geotubes. Once the filter bags have reached capacity, they are disconnected from the system and disposed of in the TCA as part of the strategy to manage tailings solids.

Chemicals used for water treatment are primarily stored in seacans at the water treatment facility on a constructed pad. Storage location(s) of the water treatment chemicals will be aligned with the Spill Contingency Plan (Appendix E-16) and approved by the Land Use Inspector.

Tailings Solids and Dam Removal

The remediation approach for the tailings solids is to cap the material with a cover that will limit the upward diffusion of soluble arsenic to the surface, minimize the infiltration of water into the tailings, prevent capillary action and reduce the potential exposure of the tailings to oxygen.

Following the treatment and discharge of water from the TCA, the relocation of tailings generally follows a load, haul, dump and place operation. It is possible that temporary access roads will be required across the soft portions of the consolidated tailings to facilitate placement of the tailings in the TCA. Rock will be spread over the soft working areas of the Lower Pond to permit heavy machinery to operate while limiting disturbance to the surface. Following placement of tailings and waste rock, grading is carried out to provide a flat finished surface at the designed elevation prior to the construction of the engineered TCA cover (for further detail, please refer to Appendix E-9 TCA Cover Design Report).

Currently, ~82% of the tailings have been consolidated in the TCA from Upper Pond and Lower Pond. The remaining Phase II remediation works include consolidation of the remaining tailings on site, located in the remaining portions of East Upper Dam and East Lower Dam. Tailings will be excavated using conventional mechanical methods with heavy equipment. Confirmatory sampling of the tailings removal will be conducted as per the approved Tailings Confirmatory Sampling Plan (Appendix E-4). If confirmatory sampling indicates arsenic levels in the subsoil that are similar from baseline arsenic concentrations from the tailings, then further incremental excavation will be conducted. This process will be repeated until arsenic levels between the subsoil and tailings are no longer similar. All tailings solids will be disposed of in the TCA.

Table 3. Status of tailings and waste rock consolidation

Waste Stream	**Historical Volume (pre-remediation) (m^3)**	**Current Volume Consolidated in TCA (m^3)**	**Remaining Volume to be Consolidated in TCA (m^3)**
Tailings	355,995	289,995	66,000
Waste Rock	140,193	111,993	28,200

Petroleum hydrocarbon (PHC) contaminated soil and waste rock

The remedial objective for PHC contaminated soil and waste rock has been substantially completed with little known volumes remaining. Historic PHC contaminated soil and waste rock from the Mine Site was excavated and treated in situ following the approved methods in the Hydrocarbon Contaminated Materials Treatment Plan (Appendix E-5). As anticipated, the majority of PHC impacted material was comprised of a mix of soil and potentially acid generating (PAG) waste rock, which was treated and placed in the TCA for disposal. Confirmatory sampling was conducted within each PHC excavation to ensure that each impacted area had been successfully excavated to clean parameters prior to backfilling the excavation. All excavations were backfilled with clean bulk fill material and/or graded to match the local topography. An additional 4,400 m^3 of PHC contaminated esker material (i.e. no PAG rock) was discovered at the airstrip and treated in situ to the water licence Far Shore Criteria. It is CARD's intention to use material that is free of waste rock and has been treated to Far Shore Criteria as required on site in areas greater than 30 meters from a waterbody.

Table 4. Status of PHC contaminated material treatment and disposal

Waste Stream	**Volume successfully treated in situ (m^3)**	**Volume Removed from Site (m^3)**	**Volume Remaining to be treated or removed from site (m^3)**
PHC contaminated material	16,085	310	500

In spring 2015, additional PHC contaminated soil was discovered near the camp and shop area that likely resulted from unknown/ undocumented equipment leaks during Phase II Remediation (i.e. not historic contamination). Approximately 310 m^3 of this material was excavated, containerized, and removed from site. Approximately 500 m^3 remains to be excavated. This material will either be transported off-site for disposal at an approved facility and/or treated on site in the approved Contaminated Materials Treatment Area (CMTA). Please refer to the Hydrocarbon Contaminated Materials Treatment Plan for details of the CMTA and PHC treatment process.

Any new PHC contamination encountered would be a result of new equipment leaks or incidental discovery of historic PHC contamination. Any newly discovered PHC contamination will either be treated on site, or transported for off-site disposal at an approved facility. Any PHC excavation will be conducted using standard excavation techniques and heavy equipment. Standard

erosion, sediment and drainage control procedures will be followed during excavation, as outlined in the Erosion, Sediment and Drainage Control Plan (Appendix E-3). All excavations will receive confirmatory sampling to ensure the remaining material in the excavation meets or exceeds the remedial objectives for PHC concentrations (Table 5), followed by backfilling with clean fill material. Any hydrocarbon free-product that is encountered during the excavation and/or treatment of PHC-impacted soils will be collected, contained and eventually disposed of at an approved facility.

The remedial objectives for PHC contaminated soil and waste rock were principally derived through application of the Canadian Council of Ministers of the Environment (CCME) *Canada-Wide Standards for Petroleum Hydrocarbons in Soil*. In establishing the remedial objectives, the fact that PHC contamination at the Tundra Mine site is mostly located in relatively deep, coarse-grain subsoil layers was taken into account. It was also noted that PHC contamination is often associated with arsenic-impacted PAG waste rock, which was ultimately co-disposed with tailings in the TCA under the engineered cover. Due to the mine's remote location and limited potential for the PHC-impacted areas to support life, consideration of any direct human or ecological exposure pathways was considered unnecessary when establishing remediation criteria for far-shore areas of contamination (i.e., >30 m from a water body). Instead, Tier 1 soil quality levels for a Management Limits exposure pathway were selected as remediation objectives.

For near-shore PHC-impacted soil (< 30 m from a body of water), Tier 1 soil quality levels in respect of the protection of groundwater for aquatic life were chosen. The remedial objectives for F3 and F4 PHCs in near-shore areas can be assumed to be the same as for that in the far shore areas given that such fractions are not soluble in water.

Table 5 provides the remediation criteria that have seen selected for PHC contaminated soil and waste rock at the Tundra Mine site, which is also the criteria stipulated in the current water licence MV2009L8-0008. Soils or waste rock with concentrations above these values will be subject to excavation, treatment and disposal.

Table 5. Remediation Objectives for PHC Concentrations in Soil

Fraction	Near Shore Criteria (<30 metres from shore)	Far Shore Criteria (>30 metres from shore)
F1	970 ppm	700 ppm
F2	380 ppm	1,000 ppm
F3	2,500 ppm	2,500 ppm
F4	10,000 ppm	10,000 ppm

As a precaution to avoid spreading PHC-contaminated material around the mine site, equipment will not be permitted to operate in areas where PHC-impacted soils and waste rock have been excavated until the results of confirmatory testing indicate that no further excavation is required. Heavy equipment operating in the CMTA will be cleaned of PHC-contaminated soil prior to exiting the facility.

Potentially acid generating (PAG) waste rock

Currently ~80% of the total waste rock on site has been excavated and disposed of within the TCA, with ~28,200 m3 remaining to be excavated and disposed of in the TCA (Table 3). It was discovered early in the remediation program that segregation of PAG waste rock and non-PAG waste rock proved to be difficult and inefficient, therefore all waste rock was considered PAG and disposed of accordingly. The remaining waste rock on site will be assumed to be PAG and is located in East Upper Dam, East Lower Dam, and in certain sections of the road leading from the mine site to the airstrip.

The project will continue to follow the same remedial action plan, continuing to encapsulate the waste rock in such a manner as to prevent contact with infiltrated surface water and to minimize the oxidation of minerals and subsequent metal leaching. To do this, waste rock will be co-disposed with tailings in the TCA. This will serve to reduce the waste rock's contact with oxygen and surface water, thus limiting potential long-term impacts. The waste material will be further isolated from the environment placing it under a low permeability bituminous liner.

Standard erosion, sediment and drainage controls will be implemented where necessary during waste rock excavation. Waste rock that is free of PHC contamination will be hauled directly to the Lower Pond for disposal.

TCA - Construction of engineered cover

Approximately 80% of the TCA contents have been consolidated and brought to design grade for the engineered cover. Approximately 60% of the geomembrane liner has been installed, and approximately 25% of the earth cover has been placed over the lined portion. The remediation contractor will complete the consolidation of the remaining waste material within the TCA, followed by completion of the geomembrane liner installation and earth cover.

An engineered cover over the TCA is installed to limit the interaction between the buried contaminated material and the surrounding environment. The tailings cover will be comprised of a bituminous geomembrane liner and granular fill overlay. It is expected that, following completion of the engineered cover, the tailings and other deposited waste material will be semi-submerged in water. Following installation of the cover, it is anticipated that in dry years or in late summer, water will drain or evaporate from the cover surface. However, the underlying consolidated waste material, as well as most of the granular fill overlay, will remain saturated.

The geosynthetic liner consists of a low permeability synthetic membrane composed of bitumen. An earth cover consisting of various

grades of granular borrow material will be installed over the liner for protection of the liner and to create a landform capable of shedding water with non-erosive flows. The resulting TCA landform will be ~250,000 m^2 in size consisting of sub-catchments of up to 62,000 m^2 in size that are required to manage spring runoff and precipitation water by shedding the surface flows in a distributive fashion. The total volume of cover material (Bulk Borrow and Type A material) required to create the landform TCA surface is approximately 290,000 m^3.

O'Kane consultants modelled the impact of rain storm and freshet events on the landform morphology (OKC 2015) and the TCA cover material landform and erosion protection layer design was refined to meet or exceed erosion modelling requirements. The results of the modelling work implemented into the TCA design include:

1. Surface water drainage channels are to have a gradient of approximately 0.5%
2. TCA landform slope gradients vary from 0.3% to 1.5% and slope lengths are limited to less than 200 m and generally less than 100 m
3. WEPP erosion modelling showed that all slopes are suitably erosion resistant (Rate <1.2 Mg/ha/yr) with a TCA cover profile comprising a minimum 0.4 m Type A caped with 0.3 m Type D
4. Where the TCA far north end incorporates a 4% slope gradient with lengths up to 75 m, modelling showed acceptable erosion rates
5. A west to east flowing surface water drainage channel across backfill in the north end of Lower Pond that connects with the Diversion Ditch and directs flows to the discharge channel to Hambone Lake
6. TCA surface channel widths have been optimized to match O'Kane modelled channel widths.

The TCA cover will be capped with a 0.3 m thick layer of erosion resistant material comprised of esker derived Type D borrow material, with additional Type E/F (i.e. rip-rap) crush borrow material in channels and side slope areas. In typical, non-channel portions of the TCA cover, erosion protection will consist of 0.3 m of Type D borrow material.

Numerical modelling (OKC 2015) shows that 0.15 m Type E riprap in channel areas will provide sufficient resistance to erosion under the 100 yr. 24 hr. storm (55.4 mm in 24 hrs.) storm event. When the storm event modelling was updated to include effects of climate change (61.4 mm in 24 hrs.) based on Environment Canada climate projections, the Type E riprap was still considered sufficient. Type E/F armoured channels all have a base width of 3 m, and a channel gradient of 0.45%. The total volume of erosion protection (Type D and E/F) material required is anticipated to be approximately 80,000 m3.

The engineered cover is expected to substantially limit the potential upward diffusion of soluble arsenic to the surface water. It will also provide a largely impermeable barrier that will substantially reduce infiltration of surface water and air. The cover will serve as a hydraulic break to limit hydrostatic pressure on the tailings pore water, which is currently believed to be a contributing factor in the groundwater transport of contaminants away from the TCA to neighbouring lakes.

The majority of water that is shed from the TCA will be collected in a constructed diversion ditch that will be lined with a geomembrane and armoured with rip-rap. The diversion ditch will convey water towards a discharge channel. Water will also be shed from the TCA off the north facing slope, which will convey water to the adjacent north basin, then ultimately to the discharge channel. This northern basin is the former base of the remediated Lower Pond (tailings pond), formerly Russel Lake, making it a natural low point. This north basin will be backfilled as need to ensure water is directed toward the discharge channel, however this will be a low gradient area and water may pool at times. Ponded water in the basin north of the TCA could be a benefit for sediment control and could also aid in the revegetation of the area. A discharge channel, armoured with rip-rap, will be constructed between the restored Lower Pond and Hambone Lake to facilitate surface drainage from the engineered cover.

More complete details of the TCA engineered cover can be found in the TCA Cover Design Report (Appendix E-9).

Restoration of Natural Drainage

During the active mining period, dams were constructed around the tailings ponds in order to contain the tailings and associated contact water from being released. These dams altered the natural drainage of surface water through the site between Mill Pond (upstream) and Hambone Lake (downstream). The East Upper Dam closed the natural northern drainage point for Mill Pond, causing the Mill Pond water level to rise and drain south towards Bulldog Lake.

As stated above, the East Upper Dam contains tailings and will be removed as part of remediation. The water level of Mill Pond will need to be lowered by approximately 1.5m in order to remove East Upper Dam. Following removal of the East Upper Dam, a defined armoured channel will be constructed at Mill Pond's historic water level, and will convey water from Mill Pond to the restored Upper Pond. From Upper Pond, water will flow north toward Lower Pond and the TCA. To prevent any interference with the engineered TCA structure, a diversion channel will be constructed to divert water along the eastern edge of the TCA. The diversion channel will be lined with geomembrane and armoured with rip-rap. The diversion ditch will accept water from Upper Pond, as well as any drainage from the TCA, and will convey it towards the armoured discharge channel to Hambone Lake.

The restored Upper Pond is a natural low point, and will be backfilled and graded as needed to restore the natural flow from Mill Pond to Hambone Lake. Upper Pond is a low gradient area and it is anticipated that water will pool in areas, which could aid in sediment control and revegetation of the area.

Complete details of the Mill Pond drawdown were presented in the Water Licence MV2009L8-0008 amendment application and

associated mitigation table, which can be found in Appendix F. The MV2009L8-0008 amendment (approved by the MVLWB on August 28, 2013) specified that 132,000 m^3 would need to be dewatered from Mill Pond, representing a 1.5 m drop in water level, in order to remove East Upper Dam and restore the natural drainage pathway. INAC-CARD would like to clarify that the 132,000 m^3 represents the initial volume of water required to achieve the water level in Mill Pond that is required to remove East Upper Dam, however due to uncontrolled natural inputs of water in to Mill Pond, additional dewatering of Mill Pond may be required to maintain the required water level as outlined in the MV2009L8-0008 approved amendment. Maintaining the lowered water level may be necessary to prevent water from entering the site water conveyance network until it has been completely constructed and operational. Once the water conveyance network is operational, Mill Pond water level will be allowed to return to the historic water level.

ANCILLARY ACTIVITIES
In order to support the key remediation activities, the following ancillary activities are required:

Winter road access (spur off Tibbitt to Contwoyto Winter Road)
The majority of equipment, fuel and materials used during Phase II activities will be transported to site by winter road from Yellowknife. Personnel and some supplies will be flown to the site. A winter road spur will be developed to connect the Tundra Mine site to the Tibbitt to Contwoyto Winter Road (Appendix B – Map 5).

The following conditions regarding construction and use of the ice road spur will be followed to ensure environmental protection:

1. No new areas will be cleared
2. No camps will be erected along the winter road route, except in cases of emergency
3. The winter road will be constructed and maintained with a minimum of 10 cm packed snow at all times of its use. If this cannot be met, additional water will be placed to create an ice surface to protect underlying vegetation
4. Only water will be used in the construction of ice bridges
5. Any ice bridge created will not hinder the flow of water
6. No stream banks will be cut
7. Approach grades on all lake and stream crossings will be minimized
8. All ice bridges and snow fills will be removed prior to break-up
9. A spill contingency plan will be in place and spill kits available during construction and maintenance

Camp Facilities
The camp will house up to 70 persons. It is anticipated that the camp location will remain in its current location. The MVLWB and Land Use Inspector will be notified if the location of the camp and its supporting facilities are modified. The camp facilities must adhere to all applicable codes, regulations and requirements governing camp facilities.

The selected Remediation Contractor supplying and operating the camps will establish camp operations and rules to ensure the camp is operated in an orderly manner. Fishing, hunting, or harassment of wildlife will be prohibited on site. The contract will be managed through PSPC and the Departmental Representative will ensure these measures are adhered to and that there is compliance with all regulatory approvals and legislation.

The camp will be serviced with drinking water that meets Health Canada Guidelines for Canadian Drinking Water Quality. Camp water will be drawn from Matthews Lake to the camp via truck or temporary direct line. Water quality testing of all source waters will be conducted prior to opening the camp facilities. It is most likely that pre-packaged potable water will also be brought to site for personnel.

Waste Management and Incineration
This section is focused on the management of wastes expected to be generated on-site, which will require off-site disposal or on-site incineration. Management of historic mining wastes can be found in previous sections on tailings, waste rock, and PHC contaminated materials.

Generated waste will be managed in accordance with the Off-site Waste Disposal Management Plan (Appendix E-14). The site will be kept free of waste materials and debris accumulation. All suitable wastes will continue to be incinerated on a daily basis as per the Incineration Management Plan (Appendix E-11). Only combustible non-hazardous waste (organic, household garbage, paper and cardboard) will be burned in the double chamber incinerator currently located at the site (incinerator specifications available in Appendix E-11). The incinerator is adequately sized for a camp size of 70 persons. During operations thus far, the incinerator was averagely run at 56% capacity during periods of full camp occupancy (n = 60 to 70 occupants). The resulting ash from incineration will be sealed in salvage drums to prevent access by wildlife and transported off-site for final disposal at an approved facility. Plastics and recyclable wastes will be packaged and transported off-site to an approved waste management/recycling facility.

Sewage and greywater will continue to be managed in accordance with the Sewage Facility Design Report (Appendix E-12) and the Sewage Disposal Facility Operation and Maintenance Plan (Appendix E-13). The current sewage treatment system has the capability to accommodate up to 70 persons if operated as originally designed whereby the system has suitable holding capacity to give the required residency time for treatment so that wastewater would meet discharge criteria. However, in its current configuration the facility does not retain wastewater and discharge from the lagoon has never needed to occur. This configuration has been acceptable to the Land Use Inspector, and has worked without issue during Phase II Remediation (up to 70 people). The design takes into consideration that it will be used at a remote site which will be operational during temperatures ranging from -30 to 30 degrees Celsius. The operation and

maintenance of the system will be straight forward and simple to prevent any major malfunctions. The system is designed to process grey and black water.

The sewage treatment system design for the Tundra Mine Remediation project consists of a recessed storage tank and lift station. Produced waste water from the camp operations will be transferred through the existing plumbing network into the lift station. Stored waste water within the tank will be transferred to a facultative lagoon. The lagoon system consists of three cells with the first two cells having a usable capacity of 675m3 and the third cell having a usable capacity of approximately 1,000m3, for a total storage capacity of 1,675m3. The reported volumes of each cell are based on an 85% maximum usable capacity. Waste water will be collected and stored within the lagoon. Treatment of the waste water will be through natural bio-chemical degradation with dissolved oxygen provided through natural aeration, wave action and biological production. Disinfection within the lagoon system will be provided by natural UV penetration. Design criteria and details are provided in the subsequent sections.

All waste petroleum products (fuel, lubricants, oils) or materials contaminated with petroleum products (e.g. filters, rags) will be stored in sealed barrels within the lined and bermed Hazardous Materials Storage Area. All hazardous wastes will be removed from site at the end of the project and transported for disposal at a licensed hazardous waste facility.

Fuel supply and storage
Project activities will require the storage of a considerable quantity of fuel on site (more details are provided in Section 11 of this application). Diesel for heavy equipment, gasoline for small engines, compressed gases, and potential Jet B fuel is required to complete the Tundra Mine Remediation Project. All fuel tanks will be certified installments that meet the requirements of Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME, 2003). Diesel is stored in large double-walled above-ground storage tanks within the upper and lower tank farms. The tank farms are lined and bermed with a minimum capacity of 110% of the largest fuel tank. There are two fuel dispensing areas located immediately adjacent to each of the tank farms. The fuel dispensing areas are lined and bermed to collect any spills that may occur during fuel transfer. Gasoline will be stored in approved containers with secondary containment. All fuel storage areas are located a minimum of 100 metres from any fish-bearing water body. Please refer to the Spill Contingency Plan for additional details on fuel supply and storage. Bermed fuel storage areas will be kept free of significant volumes of water that can compromise their ability to contain a spill.

Fuel transfers are monitored continuously to ensure any potential spill is immediately noticed and responded to accordingly. Spill response equipment will be kept at the storage facilities and will include fuel pumps, empty waste storage barrels and absorbent material sufficient to clean up a 1000 litre spill. The fuel storage and dispensing facilities will be inspected on a daily basis. Complete details for spill response are available in the Tundra Mine Remediation Spill Contingency Plan (Appendix E-16).

Use of roads and existing infrastructure such as the airstrip
The existing road network at the site will continue to be used to transport equipment and personnel and to haul clean and contaminated materials. During Phase II Remediation, three additional vehicle turnouts were constructed along the main road between the airstrip and the mine site. Should additional esker material be required from the Treeline Lodge area, the existing route will be upgraded by the Contractor in consultation with the appropriate authorities having jurisdiction (AHJs) to meet applicable legislative requirements.

The airstrip will be used to transport personnel and supplies to site. Roads and the airstrip will be regularly maintained to ensure safety. Such maintenance will be done in accordance with standard erosion, sediment and drainage controls. Dust control on the airstrip and road network will be undertaken as necessary using a water truck. The Remediation Contractor may choose to apply a dust suppressant to better control dust. Application of an appropriate dust suppressant would reduce the frequency of water application and water withdrawal from Bulldog Lake. The site is currently approved to use the following dust suppressants: NEWTROL™; and Soil Sement®. Additional details of these dust suppressants, including Material Safety Data Sheets, are available in the Tundra Mine Remediation Spill Contingency Plan (Appendix E-16) and the Erosion, Sediment and Drainage Plan (Appendix E-3).

Construction of access bridges
In the event that the Project requires granular materials from the Treeline Lodge area esker to meet the remedial objectives, the existing access route would require a bridge upgrade. This work would be conducted by the Contractor in consultation with the appropriate AHJs to meet the applicable legislative requirements. A similar bridge was constructed at the Sandy Lake stream crossing, which was done in consultation with the Department of Fisheries and Oceans Canada (DFO).

Borrow Development
The Tundra Mine Remediation Project continues to require a considerable volume of borrow material, the majority of which will be used in the construction of the TCA cover. Borrow material may also be required for maintenance and upgrade of access roads and the airstrip, berm, swale and diversion ditch construction, backfill of excavations, sediment and erosion control, and other various operational requirements. There are four borrow sources identified for use in the Tundra Mine Remediation Project as listed in Table 6 and identified in Appendix B – Map 6. The areas adjacent to the airstrip and the stockpiled material within the West Lower Pond Borrow Area have been identified as the primary borrow sources for the remediation activities. Primary borrow sources have been selected based on the available volume of borrow material, the proximity to the Tundra Mine Site, as well as the ability to minimize the borrow development footprint. The two primary borrow sources have been assessed and calculated to show that they contain sufficient volumes of borrow required the remaining remedial operations (Table 6). However, contingency borrow sources have also been identified and assessed, and will be utilized if required.

Quarry permits will be obtained on an annual basis to ensure access to borrow materials.

Table 6. Sources, locations and estimated volumes of borrow material

Primary Borrow					
	Location	**Type A (m^3)**	**Bulk Fill**	**Type D (m^3)**	**Type E/F (m^3)**
Airstrip	5 km north of Tundra Mine Site	-	41,000	~270,000	-
West Lower Pond Borrow Area (developed area)	150 m west of Lower Pond	62,468	71,250	-	25,868
Contingency Borrow					
	Location	**Type A (m^3)**	**Bulk Fill**	**Type D (m^3)**	**Type E/F (m^3)**
West Lower Pond Borrow Area (undeveloped area)	150 m west of Lower Pond	>50,000	>50,000	-	~30,000
Treeline Lodge Area	8 km northwest of Tundra Mine Site	-	-	~45,000	-

Table 7. Borrow Material Budget for remaining remediation works

	Type A (m^3)	**Bulk Fill**	**Type D (m^3)**	**Type E/F (m^3)**
Primary Borrow Volume	62,468	112,250	~270,000	25,868
Volume required for Tailings Cap Completion	62,468	34,386	62,254	13,616
Remaining Volume for additional tasks	0	77,864	208,000	12,252
Available Contingency Borrow Volume	>50,000	>50,000	~45,000	~30,000

The contractor will be responsible for implementing erosion and sedimentation control measures when extracting borrow materials. Any stripped topsoil will be stockpiled in such a way that it will not have deleterious effects on adjacent water bodies. During excavation, there will be no obstruction of natural watercourses. No explosives are expected to be used during the extraction of borrow material.

At closure, the borrow areas will be graded to blend in with surrounding topography to the extent feasible. The reclamation of borrow pits will be done in a way to re-establish natural drainage and reduce ponding of water. Stockpiled organics will be redistributed as a final surface veneer to promote revegetation of the borrow areas.

West Lower Pond Borrow Area Stabilization

During Phase II remediation operations, the West Lower Pond Borrow Area (WLPBA) was developed and has served as the primary borrow area. During closure of the Phase IIA contract, stripped vegetation and organic materials were backfilled into low excavated areas to meet Land Use Permit and Quarry Permit conditions, which required prevention of water ponding. The current aerial extent of the WLPBA comprises approximately 346,000 m^2 of exposed, un-vegetated natural ground. Natural soil in this location consists of glacial till silt with minor sand and some gravels, cobbles and boulders. The silt-rich nature of the native till deposit makes it at high risk to erosion and generation of sediment-laden run off during times of freshet or heavy rain. To prevent sediment-laden surface water flows from exiting the WLPBA and entering surrounding waterbodies, CARD has implemented interim mitigation measures which will be monitored and managed during freshet and rain events to prevent sediment release.

WLPBA final closure will include the progressive implementation of the final WLPBA stabilization plan. The final WLPBA stabilization plan is currently in development by AECOM, and will be provided to the Land Use Inspector for review and approval.

As part of the WLPBA stabilization plan, a soil augmentation program may be implemented to encourage faster recolonization of local plant communities in areas that lack the soil qualities necessary to promote plant growth. INAC-CARD is currently working with Wilfrid Laurier University to develop an appropriate revegetation strategy for Tundra Mine. Soil augmentations could require the selective harvesting of peat and organic material from nearby areas and disbursing these materials as required to promote faster vegetation recovery. If peat and organic material harvesting is required, the selection of areas for harvesting will be done in consultation with the Land Use Inspector.

b) Please indicate if a camp is to be set up. (Please provide details on a separate page, if necessary.)

A camp will be set up. Please see details in Camp section above.

6. Summary of potential environmental and resource impacts (Describe the effects of the proposed land-use operation on land, water, flora & fauna and related socio-economic impacts. Use separate page if necessary.)

Potential environmental and resource impacts have not changed from the original Phase II Remediation Land Use Permit application, however some impacts have been reduced through the remediation progress of Phase II.

The overall impact to the environment resulting from the implementation of remediation activities is expected to be positive in the long term as its goal is the prevention or mitigation of current and future adverse impacts caused by the abandoned mine. The current or baseline situation is one where contaminants, particularly arsenic, are migrating untreated from the site in quantities and concentrations that degrade, and if left untreated, will continue to degrade, the local environment.

Despite the overall benefits of the project, some short-term adverse impacts may occur during the implementation of remediation. These potential impacts include increased erosion/sedimentation from excavated areas, possible spills of hydrocarbons, increased noise and generation of various solid and liquid wastes. Most of these impacts are expected to be either insignificant or easily mitigated using standard prevention techniques. CARD will monitor the remedial work being completed by the contractor and a resident engineer/site manager will be on site at all times to oversee the remedial work.

The short-term potential environment and resource impacts to land, water, flora and fauna and the socio-economic environment are discussed below. For further details regarding potential environment impacts please refer to the Human Health and Ecological Risk Assessment (Appendix C).

Land
The main impacts to land will be associated with the various excavation activities. All excavations will be backfilled with clean borrow material and graded as necessary.

Other potential impacts to land are associated with camp operation, fuel storage and transfer, road maintenance, excavation of borrow material, and potential establishment of a bridge crossing. Other than the excavation of borrow material, most potential impacts to land will occur on previously disturbed land.

Water
The main impact to water associated with Phase II activities will result from the discharge of treated, tailings-impacted water from the TCA. The potential effect of this discharge, of which there is a physical (quantity of water) and chemical (quality of water) component, is discussed in detail in the associated water licence renewal application. Other anticipated impacts to water may occur from sedimentation or erosion as a result of excavations near water bodies. Impacts to water may also occur due to spills of hydrocarbons.

The following actions will be implemented to prevent or mitigate impacts to water:

- When carrying out excavation activities in the vicinity of a drainage course or a body of water, silt fences, floating silt curtains and/or containment berms will be used, as appropriate, to prevent the release of sediment into water
- Erosion, sediment and drainage controls are to be maintained during all stages of work
- Regular inspections of the fuel storage facilities and hazardous waste storage facility
- Drip trays will be placed under vehicles when parked for extended periods

- Leaking equipment will be taken out of service until repaired
- Equipment fluid leaks will be excavated as soon as possible, with contaminated material stored in lined mega-bags
- Best practices for fuel transfer procedures will be followed
- Spill response training will be required for staff
- Spill response equipment will be stored strategically on site in higher risk areas: fuel storage facilities, water treatment plant, vehicles

The west lower pond borrow area (WLPBA) has the highest sediment and erosion risk on site. A long-term stabilization plan for the WLPBA is currently in development, and will be implemented by the remediation contractor. Temporary stabilization strategies are currently in place in the WLPBA.

Flora and Fauna
Due to the scale of operations and the industrial nature of mine remediation, there may be increased impacts to wildlife with additional noise or visual disturbance. Such impacts will be limited to the work season and for the duration of the remediation activities. The following mitigations will be in place to reduce impacts on wildlife:

- It is forbidden of site personnel to harass wildlife
- Care will be taken to minimize damage to wildlife habitat during the land use operation portions of the work
- Standard noise suppression devices will be used on heavy equipment
- A Wildlife Management Plan will be in place to guide the activities of the contractors to avoid negative impacts to local wildlife
- Wildlife monitors will be hired to prevent incidents between workers and wildlife
- All garbage waste will be incinerated to avoid attracting wildlife to the sites. Waste will be transported off-site for disposal if the incinerator is down for an extended period of maintenance.

Additional impacts to vegetation are expected to be minimal, as most vegetation clearing has already occurred. Typically, the majority of vegetation clearing has occurred on previously disturbed land, with the exception of borrow area development. Vegetation clearing associated with the remaining borrow development is anticipated to be limited to the airstrip area. The airstrip borrow area is located on the local esker, which is composed of nutrient poor granular material that supports limited amounts of vegetation compared to the surrounding tundra landscape. Any clearing of vegetation will be kept to a minimum. Stockpiled local organics will be redistributed over cleared areas at the end of Phase II to help promote revegetation of the site. Site revegetation is also anticipated to be part of the long-term stabilization strategy for the site. Revegetation options are currently being reviewed.

Socio-Economic
The socio-economic impacts accruing from the remediation program are expected to be largely positive. To enhance regional socio-economic benefits, all contractors bidding on the remediation project will be required to submit Aboriginal Opportunity Considerations (AOCs) with their bids. Each AOC will specify the commitment of the contractor to Aboriginal employment, sub-contracting and training. Bids containing AOCs with greater commitments to Aboriginal content will receive higher scores. These scores will then be combined with the technical and cost evaluations to determine the successful contractor. AOC commitments will be enforced through contractual obligations.

In addition to Aboriginal benefits, the project is anticipated to continue providing significant contracting and employment opportunities for northerners.

Consultation and Community Engagement
The remediation plan for Tundra Mine was developed in a manner that is intended to address the preferences and expectations of the affected aboriginal groups. To that end, consultations were held with community members to discuss the remedial options available and to identify the ways that the public could participate in and influence the planning and remediation processes.

During the Tundra Mine Remediation Project, INAC has continued to engage with aboriginal groups at important milestones in the Project, which will continue for the remainder of the project.
The Tundra Mine Community Engagement Plan, including engagement log, can be found in Appendix D of the supporting appendices to this application.

7. Proposed restoration plan (please use a separate page if necessary).

The overall project is a restoration/remediation project, intended to restore the site to a safe and stable condition. However, some remediation activities will cause some additional temporary impacts, which will be mitigated through final site reclamation. Activities requiring reclamation include:

- Reclamation of roads and camp area
- Reclamation of drainages
- Reclamation of exposed areas

Reclamation plans will be submitted to the MVLWB for approval prior to final site closure.

8. Other rights, licences or permits related to this permit application (mineral rights, timber permits, water licences, etc.)

- Land Reserves - The federal government has established land withdrawal under the Devolution Process on the Tundra Mine site and airstrip to facilitate site remediation.
- LUP and WL - CARD currently holds Type A Land Use Permit (LUP) MV2009X0019 and Type A Water Licence (WL) MV2009L8-0008 to conduct the remediation of Tundra Mine. Both the current LUP and WL expire on December 16, 2016.
- Burn Permit GNWT ENR – proposed activities typically require annual burning of non-hazardous site waste and combustible camp generated garbage that is not suitable for incineration (e.g. large items of clean wood).
- Annual Quarry Permits – quarry permits will be acquired annually to ensure access to the required borrow material.

Seabridge Gold Inc., a mineral exploration company, has staked mineral claims and holds mineral leases covering the existing Tundra Mine footprint and adjacent areas. Seabridge carries out exploratory work under the authority of Land Use Permit (MV2012C0025).

Det'on Cho RTL Construction has approval under their land use permit (MV2011F0013) to build a winter road to the Tundra Mine site.

Roads: Is this to be a pioneered road? **NO** Has the route been laid out or ground truthed? **YES**

A winter road spur will be developed to connect the Tundra Mine site to the Tibbitt to Contwoyto Winter Road. A map depicting the existing alignment of the winter road spur is appended to this application (Appendix B – Map 5). The construction and use of the winter road spur will adhere to the proposed measures listed under section 5 of this application and will conform to best practices guidance material available, such as the Guidelines for Safe Ice Construction 2015 [prepared for the GNWT Department of Transportation].

9. Proposed disposal methods.

To complete this section of the application form, a Waste Management Plan for the proposed activities is to be developed in accordance with the Board's *Guidelines for Developing a Waste Management Plan* (click here to access) and submitted as an attachment to the application form. A template for this Plan is provided in the *Guidelines*.

a) Garbage:

Off-Site Waste Management Plan – Appendix E-14
Incineration Management Plan – Appendix E-11

b) Sewage (Sanitary & Grey Water):

Sewage Facility Design Report – Appendix E-12
Sewage Disposal Facility O&M Plan – Appendix E-13

c) Brush & trees:

Given its location above the tree line, clearing of brush and trees is not anticipated. However, there may be some low-lying "shrubs"/willows, particularly in the vicinity of borrow areas. Should this shrub material be removed, it is anticipated that it will be managed as organic overburden (see section 9d below for Overburden management details).

d) Overburden (Organic soils, waste material, etc.):

No substantial removal of overburden is anticipated. However if some clean overburden is removed as a result of excavating contaminated material or acquiring borrow materials, any stripped soil will be stockpiled in such a way that it will not have deleterious effects on adjacent water bodies. After the work is finished the material will be returned to source to help contour and revegetate the excavations.

10. Equipment (includes drills, pumps, etc.) (Please use separate page if necessary.)

The following listed equipment is proposed to be used during Phase II activities, however some of the items on this list may change once a contractor is selected. A more accurate equipment list will be provided to the Land Use Inspector.

Type & number Size Proposed use

Type & number	Size	Proposed use
D7LGP Dozer	22 700 kg	• TCA cap construction • Road upgrades • Re-grading of site Moving waste rock and tailings
336 DL Excavator	33 700 kg	• Excavation of contaminated and borrow material • Road upgrade Demolition of dams
345B Excavator	45 400 kg	• Excavation of contaminated and borrow material • Road upgrade Demolition of dams
D9 Dozer	49 600 kg	• TCA cap construction • Road upgrades • Re-grading of site Moving waste rock and tailings
740 Truck (6)	33 100 kg	• Hauling waste rock and tailings • Hauling borrow material Road upgrades
972 Loader	25 150 kg	• Loading of contaminated and borrow material TCA cap construction
930 Loader	13 000 kg	• Materials handling Road maintenance
16H Grader	23 900 kg	• Road upgrades TCA cap construction
CP74 Compactor	15 300 kg	• Road upgrades TCA cap construction
TL642 Telehandler	9 200 kg	Moving materials
Mechanics truck		Support service
Pickup (5)		Transportation of personnel, small goods, and small equipment around site
Water truck		Transport of potable water
Other water truck		Provision of water for other uses, ex: dust control
Ambulance vehicle		Emergency response
Packaged Water Treatment Plant		Arsenic-impacted water treatment
Bus		Transportation of personnel from airstrip to camp and worksites
Hazmat vehicle washer		Equipment decontamination
Incinerator		Waste management
ATVs		• Personnel transportation Wildlife monitoring

50/60 kw camp generator		Electricity generation
Pumps		• Provision of potable camp water Dewatering of excavations
Screening deck		Soil grading and separating
Snow plough		
Lighting plants		Workplace illumination
200 cfm drill rig		Installation of instruments in the tailings and tailings cover

11. Fuels	**Total quantity**	**Number of containers**	**Capacity of containers**	**Location**
Diesel	950,000 L (over project lifespan)	To be determined by contractor	Typically 90,000 L capacity double-walled enviro-tank	Fuel Storage facility
Diesel	1000 L	1	Typically 1000 L capacity double-	Adjacent to camp generator
Gasoline	10,000 L (over project lifespan)	To be determined by contractor	Type of container to be determined by contractor	Fuel Storage facility
Aviation fuel	450 gallons (1700 L)	10 barrels	45 gallon drum	Adjacent to airstrip
Propane	20 000 gallons (over project lifespan)	Approximately 20	1,000 gallon c/w skids	Camp

12. Containment fuel spill contingency plans.

A spill contingency plan for the proposed activities is to be developed in accordance with INAC's *Guidelines for Spill Contingency Planning, April 2007* (accessible here). This plan is to be submitted as an attachment to the application form.

Please see Appendix E-16 – Tundra Mine Remediation Spill Contingency Plan (revision 11)

13. Methods of fuel transfer (to other tanks, vehicles, etc.)

Refueling will be done by trained personnel in accordance with the Spill Contingency Plan (Appendix E-16). The Remediation Contractor will comply with the Federal Petroleum Products and Allied Petroleum Products Storage Tank Systems Regulations in managing fuel and other hydrocarbons on site.

14. Period of operation (includes time to cover all phases of project work applied for, including restoration)

Please refer to Table 2 on page 2 of this application for a list of project phases and anticipated timelines.

15. Period of permit (up to five years, with maximum of two years of extension).

Effective Date of Permit: December 17, 2016

Period of Licence: 5 years

It is anticipated that the Tundra Mine Remediation Project will be complete no later than 2019, however it is possible that minor additional works may be required on site (e.g. site stabilization work) during Long Term Monitoring and Adaptive Management phases. Therefore, a 5 year LUP is being requested.

16. Location of activities by map co-ordinates (attach maps and sketches) - NAD83

Minimum Latitude: 63°59'27" N	Maximum Latitude: 64°06'26" N
Minimum Longitude: 111°07'22" W	Maximum Longitude: 111°16'00" W

Map Sheet no. 076D03

Maps and Sketches attached in Appendix B

17. Applicant
Print name in full

Carey Ogilvie
Senior Manager
INAC – Contaminants and Remediation Division

Signature _____ Date MAY 4/16

18. Fees Type A - $150.00 ** Type B - $150.00 ** (**Application Fees are Non-Refundable**)

Land use fee:_____hectares @ $50.00/hectare $ _____
Assignment fee $50.00 $ _____

Total application and land use fees $ n/a*

* The Government of Canada is exempt from paying these fees as stipulated in section 20 of the *Mackenzie Valley Land Use Regulations* and section 6.64 of the *Final Devolution Agreement.*

Please make all cheques payable to "Receiver General for Canada"