PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

ENVIRONMENTAL ASSESSMENT, PROPOSED REMEDIATION OF THE NOTTINGHAM ISLAND WEATHER AND RADIO STATIONS, NUNAVUT

REPORT

MARCH 2013
ISSUED FOR REVIEW
EBA FILE: Y22101291

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EXECUTIVE SUMMARY

Foreword

EBA Engineering Consultants Ltd., operating as EBA, A Tetra Tech Company (EBA) was hired by PWGSC to complete a Phase III Environmental Site Assessment (ESA), a Remedial Action Plan (RAP), and an Environmental Assessment (EA) report for the Nottingham Island remediation project. An Archaeological Impact Assessment (AIA) was also completed by Golder Associates. Fieldwork that was necessary to complete these phases of this project was undertaken in August 2012.

The former weather and radio station on Nottingham Island (the Site) is located in the Qikiqtaaluk region of Nunavut, about 140 kilometers (km) southwest of Cape Dorset, Nunavut or approximately 80 km north of Ivujivik, Quebec. The Site is situated on federal lands located on the southern end of Nottingham Island, on the west shore of a narrow inlet of Hudson Strait. Dilapidated buildings, impacted soil, and hazardous and non-hazardous material are found across the Site. From the Phase III ESA, the Site was ranked as a Class 1 priority site, and remedial action is required.

This EA has been completed to identify potential impacts of the RAP on the environment and propose actions to mitigate such impacts so that the Project can proceed through the licensing, contracting, and remediation phases. The instigation for the submission of this EA is that the proposed RAP for the project is defined as a "project proposal" under the *Nunavut Land Claims Agreement* and therefore must be screened by the Nunavut Impact Review Board.

To complete remediation at the Site, the RAP proposes that unpainted wood be burned on site, organic liquid wastes be incinerated, and all other non-hazardous and hazardous waste as well as impacted soil be removed off-site via barge and sealift to approved off-site facilities. The development of a bedrock quarry and subsequent crushing operations are proposed to upgrade existing trails for the transportation of equipment and for backfilling excavations from the removal of the impacted soil.

Findings and Conclusions

Nottingham Island is located in the Wager Bay Plateau Ecoregion of the Canadian Shield. Drainage on Nottingham Island is controlled primarily by bedrock, with lakes and streams situated between the elevated bedrock outcrops. It lies in the continuous permafrost zone. The low-lying parts of Site are poorly drained and the majority of the Site consists of saturated ground from active melting of surface ice. Drainage from the Site flows southwest into Hudson Strait.

Hudson Strait is ice covered usually from mid-November to early June, although throughout the winter, the channel remains dominated by unconsolidated pack ice and landfast ice surrounds the coastlines.

Nottingham Island lies above the treeline. The vegetation cover in the region is characterized by nearly continuous dwarf shrub tundra vegetation (*e.g.* dwarf willow and *Dryas* species) interspersed with bedrock outcrops covered in lichen. On Site, Wet Sedge and Moist to Dry Non-Tussock Graminoid/Dwarf Shrub vegetation communities dominate.

Nine terrestrial mammals and eleven marine mammals (including polar bear) may be expected to occur on or near Nottingham Island. However, contradictory information exists regarding the presence of caribou on Nottingham Island. One known record dating back to 1884, indicated the presence of caribou on

Nottingham Island (Bell 1884). However, based on a few informal discussions with locals from Ivujivik, no caribou have been seen on the island. Thirty six bird species potentially occur on Nottingham Island, principally in the summer. No mammals or their sign (*e.g.* scat) were detected during the August 2012 field event. Of those species potentially occurring on or near Nottingham Island, nine species have special conservation status (due to their status of "special concern" and "endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and/or the Species At Risk Act (SARA), and/or listed as "sensitive" in Nunavut by the National General Status Working Group 2010), including polar bear, wolverine, Peregrine Falcon, Harlequin Duck, walrus, beluga whale, narwhal, killer whale, and bowhead whale. Of the wildlife with special conservation status potentially occupying Nottingham Island and surrounding area, only Harlequin Ducks were detected at the time of the Phase III ESA.

Two areas, including Fraser Island and Digges Sound have been designated as key biological areas, and are located within 100 km from the Site. These important biological areas support a large number of sea birds and marine mammals, which are sensitive to disturbance.

Both freshwater and marine fish species have the potential to occur near the Site; however, no waterbody within the specific Project boundaries are expected fish habitat, with the exception of Hudson Strait. Arctic Char were reported to occur in nearby freshwater lakes.

Subsistence hunter and gatherer cultures once used Nottingham Island. It is expected Nottingham Island was once occupied as a stopover place when crossing Hudson Strait and when sufficient game was present (Golder 2012). Known heritage resource sites, including an "old Eskimo gravesite" was previously reported on Nottingham Island, likely on the southern tip of the island, and four additional previously unrecorded sites including a stone circle feature, a lithic scatter, a small stone square feature, and a possible stone circle were documented during the August 2012 field investigation (Golder 2012).

More recent evidence of human use of the land (within the past 50 years) were also detected on or near the Site including modern stone circles, possible Artisanal "mine", modern cairn/ Inuksuk, cache, and tent rings/outlines. Traditional based hunting for walrus and ringed seal, fishing for Arctic Char, and gathering for eider down feathers continues today on Nottingham and Fraser islands. These natural resources are used for subsistence and or sold to supplement incomes. The employment rates reported from 2006 at the nearest communities, Cape Dorset, Ivujivik, and Salluit range from 48 to 51%.

Potential Valued Ecosystem Components (VECs) and Valued Socio-Economic Components (VSECs) were identified in a three stage process. Initially, a review of the regulatory responsibilities of government agencies was completed, and then VECs and VSECs identified in similar projects were reviewed. Once these VECs and VSECs were identified, they were confirmed during the community meeting. Identified VECs and VSECs included climate, air quality, terrain, geology, soils, hydrology, vegetation, wildlife, fish, cultural features, employment, traditional land use, community services, and aesthetics. To determine the potential impacts to the various VECs or VSECs, the environmental baseline information and specific RAP activities were reviewed, and using professional judgement, project activities (site preparation and camp operation, remediation and closure) that would impact/interact with a specific VEC or VSEC were identified.

The most common potential impacts to VECs were impacts from spills during refuelling or servicing equipment used in project activities, noise, dust, and erosion from quarry and crushing operations, from remediation activities themselves (such as incinerating waste and barging remedial products off-site), or

direct physical disturbance to the VEC during project activities (such as sedimentation from camp/barge landing construction). Important impacts range from direct mortality of wildlife to noise, dust, spills, erosion/sedimentation, and sensory disturbances. The most important mitigation measures are those that will prevent or limit spills, dust, noise, and erosion/sedimentation such as developing best management practices for each, and those that prevent or limit physical disturbances, such as reducing barge and sealift traffic, and using existing disturbances for access and construction areas. It is anticipated that there will be short-term positive impacts for the communities in business opportunities and employment.

Residual impacts are defined as impacts that remain after mitigation has been applied. Implementation of the mitigation strategies outlined for the remediation of the Nottingham Island former weather and radio station is predicted to result in no negative residual impacts of significance.

Overall, the remediation will have a positive effect on the environment by removing impacted soil and hazardous material from the Site. Cumulative environmental impacts occur when impacts, in particular residual negative impacts, from two or more concurrent project activities combine either additively or synergistically to further exacerbate the impact on a VEC or VSEC. Given that the project will have a positive impact on the environment, the remediation of the Site will not add to the cumulative environmental effects of other land use activities in the local area.

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1.0 INTRODUCTION

EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Aboriginal Affairs and Northern Development Canada (AANDC) to complete an Environmental Assessment (EA) at the former Nottingham Island weather and radio station (the Site), located in Nunavut (NU) (Qikiqtani Region) (Figure 1).

This EA forms part of a comprehensive program that has been carried out at the Site since 2007. The comprehensive program completed to date includes Phase I, II, and III Environmental Site Assessments (ESA), hazardous and non-hazardous material audit, geotechnical evaluation, archaeological investigation, community consultation, and the development of a Remedial Action Plan (RAP) (the Project) for the purposes of evaluating and assessing the Site for possible future remediation of the Site. Field work, completed from August 6 to 16, 2012[1], included a bio-inventory, archaeological assessment, a geotechnical investigation, and a detailed Phase III ESA.

This EA has been completed to identify potential impacts of the proposed RAP on the environment, and propose actions to mitigate these impacts so that the Project can proceed through the licensing, contracting, and remediation phases in future years.

This EA is required because the proposed RAP is defined as a "project proposal" under Article 1 of the *Nunavut Land Claims Agreement* (NCLA) (Nunavut Tunngavik Inc. 1993) and the RAP is not an except "project proposal" from screening as defined by Schedule 12-1 of the NCLA.

1.1 Project Authorization

Federal contaminated sites are a legacy of past land use practices that no longer meet current environmental standards. AANDC are the custodian of most federal lands in the North, and has responsibility, through the Contaminated Sites Program (CSP), to manage a number of contaminated properties that are no longer maintained by the original occupant, such as the Nottingham Island weather and radio station site.

PWGSC Northern Contaminated Sites Group is managing the Project on behalf of AANDC.

1.2 Environmental Assessment (EA) Regulatory Overview

AANDC projects in Nunavut are subject to the territorial environmental impact assessment process which is set out in the NLCA under Section 12.2.4. Under this agreement, the proposed RAP is defined as a "project proposal" under Article 1 of the NLCA, and is subject to review from the Nunavut Impact Review Board (NIRB) based on defined criteria.

In addition, Article 12.12.2 of the NLCA (Nunavut Tunngavik Inc. 1993) indicates that shipping (both on land and marine) associated with project proposals are subject to review by the NIRB. Since hazardous and

[1] Although the fieldwork was completed between August 6th and August 16th, 2012, the actual time on-site was limited to two and a half days due to inclement weather restricting site access. Notably however, due to time restrictions on site, the bio-inventory field work was completed in one day (August 11, 2012).

non-hazardous material may be shipped from the Site using a barge, background information on the marine environment and potential impacts from shipping this material is included in this EA.

According to Section 12.3.5 of Article 12 of the NCLA, all "project proposals" not located in a part of the Nunavut Settlement Area with an approved land use plan, must be submitted directly to NIRB for screening. To date, a "draft" Nunavut Land Use Plan exists that includes Nottingham Island. Once approved, this land use plan will guide and direct resource use and development on site and across Nunavut, and all federal and territorial departments will be required to conduct their activities in accordance with this plan. The draft Land Use Plan currently permits "remediation and reclamation activities" at the Site under the Building Healthier Communities Land Use Designations or Recommendations, and all other incompatible land uses are prohibited. The proposed remedial activities are compatible with the draft Nunavut Land Use Plan.

To ensure the NIRB has the required information to complete the review process, this EA meets the terms of reference (TOR) for the Nottingham remediation project (PWGSC 2012) provided under PWGSC's existing Supply Arrangement (SA) No. EW699-100053/003/NCS with EBA.

1.3 Objectives

As outlined in the TOR (PWGSC 2012), the principal objective of this EA is to:

- Assess the environmental, social, economic, and cultural effects of the proposed remediation of the Site, including identification of potential impacts and development of mitigation measures where necessary.

To achieve this, specific objectives required include:

- Identify project components and development activities which may result in potential impacts to the environment and the effect of these on the receiving physical and/or socio-economic environments.
- Identify existing conditions within the project area, including existing uses of land, resources, and other activities which have the potential, in combination with proposed remediation activities, to affect the physical and/or socio-economic environment.
- Assess cumulative effects associated with this project and other past, present, or proposed projects in the area.
- Determine any follow-up requirements.

2.0 SITE BACKGROUND

2.1 Site Location

The Site (Photo 1) is located on Nottingham Island in the Qikiqtaaluk region of Nunavut, located about 140 kilometers (km) southwest of Cape Dorset, Nunavut (approximately 63.111974 North latitude and 77.938633 West longitude). The nearest community is Ivujivik, Quebec located approximately 80 km to the south of the Site.

The Site is located on the southern end of Nottingham Island, on the west shore of a narrow inlet of Hudson Strait. It is positioned at an elevation of approximately 10 m above sea level.

Nottingham Island is composed of federal and Inuit Owned Lands (surface only); however, the Site and its surrounding local area are situated on federal lands. The buildings present on Site are concentrated in an area roughly 35,000 square meters (m^2) (3.5 ha) (Photo 1). The total Site, including debris, extends to cover an area approximately 589,729 (m^2) (59 ha).

2.2 Site History and Use

Several human cultures have likely occupied Nottingham Island since the receding of the ice sheet, about 5,000 years ago. In later cultures (Baffin Inuit and Quebec Inuit), Nottingham Island was used transitionally as a stopover place when crossing the Hudson Strait (Golder 2012). These historic cultures were subsistence hunters and gatherers, and utilized a variety of marine, terrestrial, avian, and freshwater game (Golder 2012). The main method of travel included dog sled, kayaks, and umiaks. It was with these modes of travel, the Inuit groups pursued game. Therefore, their distribution across the landscape was generally dictated by their target species.

The radio/navigational aid station on Site was constructed in 1927 and the weather station in 1956 by the Department of Transport (DOT). It was used by DOT until it was decommissioned in 1970. However, throughout history, the island has been used for hunting, fishing, and gathering by several historical cultures, and this utilization of resources present on the island continues today (Golder Associates 2012).

During operation, the Site was accessed by boat. Nunatsiaq News (George 2005) reported in the 1940s that several Inuit families worked at Nottingham Island. The article also reported that in the 1930s and 1940s, hunters from Nunavik travelled to Nottingham Island for annual walrus hunts. In 1957 the station was reportedly manned by 12 full time staff members (Dunbar and Greenaway 1956). Its purpose was to provide accurate weather and navigational data to open the Hudson Strait for shipping.

The Site has been abandoned since 1970 with occasional visitors to the island for hunting and fishing from the regional communities. Today, the Site consists of 17 buildings/structures, two empty above-ground storage tanks, a number of antennae, and a large amount of debris scattered around the site. Signs on the buildings indicate the Cape Dorset Co-operative Ltd. (Kinngait Co-op) currently owns the existing buildings[2]. Off-site features include debris piles, a roadway, metal tower, and nearby lakes/surface water features.

3.0 REMEDIATION PROJECT DESCRIPTION

The following is an outline of the project related activities proposed in the RAP. It is this information that will form the basis of the EA, and will influence potential impacts from the RAP and resulting mitigation proposed.

[2] Further discussions were conducted during the community meetings between the Cape Dorset Co-op representative and Department Representatives from AANDC and PWGSC in 2013. Discussions are on-going between the Cape Dorset Co-op and Department Representatives regarding the ownership of the structures on Nottingham Island.

An overview of site features and areas of environmental concern (AECs), as detailed in the Phase III ESA (EBA 2013a) and RAP (EBA 2013b) are provided in Figure 2 and outlined here. Please note that in the Phase III ESA, the AECs were identified as potential areas of environmental concern (APECs). The remediation description provided herein is limited to the recommended remediation options and not all remediation options considered in the RAP have been presented in this EA.

3.1 Purpose of the Nottingham Island Remediation Project

Following a thorough review and evaluation of the Site following the *Abandoned Military Site Remediation Protocol* (AMSRP) (INAC 2009), a CCME National Classification System for Contaminated Sites (NCSCS) (2008) worksheet was completed in the Phase III ESA to qualitatively derive a ranking score to evaluate the potential human health and ecological risks resulting from the presence of contamination on the Site. Results from this classification ranking indicated the Site has as a Class 1 ranking for high priority for action. The detailed NCSCS worksheet is included in Appendix B of this report. Due to the Site being listed as a Class 1 priority site, remedial action is required.

3.2 Inventory of Impacted Soil, Non-Hazardous Waste, and Hazardous Waste

As part of the Phase III ESA, an estimate of impacted soil and an inventory of waste (non-hazardous and hazardous) were determined. Based upon the findings of the Phase III ESA, a summary of impacted soil volume estimates on site include:

- The total estimated volume of petroleum hydrocarbon (PHC) impacted soil is 2,260 cubic meters (m^3);
- The total estimated volume of metal only impacted soil is 264 m^3; and
- The total estimated volume of co-contaminated soil impacted with both metals and PHCs is 215 m^3.

Surface water quality samples collected during the Phase III ESA investigation indicated the chemistry of the water was above applicable criteria. In addition, both hazardous and non-hazardous materials were found throughout the Site. A summary of the materials inventory is:

- Hazardous materials included heating oil, asbestos, total lead paint, leachable lead paint, batteries, compressed gas cylinders, creosote soaked wood, mercury, polychlorinated biphenyls (PCBs), and other miscellaneous materials. The total uncrushed volume of hazardous materials on Site is 779 m^3 and 2,521 litres (L) of hazardous liquids; and
- Non-hazardous materials included wood, metal pieces, brick and brick mortar, cables, concrete, insulations materials, glass, porcelain, rubber, drums, and other miscellaneous materials. The total uncrushed volume of non-hazardous materials on Site is 1,316 m^3 and 77 drums (all drums from site with organic liquid waste removed).

A complete inventory list of the hazardous and non-hazardous materials on Site is provided in Appendix C.

3.3 Remedial Options and Activities

The RAP outlines remedial activities of various waste streams are required at the Site including:

- Removal of soil impacts (PHCs and metals) that are either above federal or territorial guidelines from the Site;
- Removal of hazardous materials from the Site;
- Removal and disposal of non-hazardous materials; and
- Further assessment and monitoring of potential impacted surface waterbodies at the Site.

Within the RAP, a detailed discussion of each waste stream found at the Site, and an outline of the potential remediation options for each waste stream were reported. A summary of this discussion, including the remedial options and recommended remedial actions are provided in Table 1.

Table 1. Summary of Suggested Remedial Options

Waste Stream	Description and Remedial Options	Suggested Remedial Option
Unpainted Wood Waste: Non-Hazardous	Approximately 898 m^3 of wood, primarily from existing intact buildings on the Site. Remedial options include: ▪ Controlled burn on site and the ashes disposed off-site to an approved facility; or ▪ Off-site (intact in manageable pieces) disposal to an approved facility.	Controlled burn on site
Other Waste: Non-Hazardous	Approximately 414 m^3 of metal, black felt, brick and brick mortar, cables, concrete, exterior metal siding, fibreglass insulation, flooring, glass windows, porcelain, rubber, and asphalt shingles, as well as 4 m^3 of Above-ground Storage Tanks (ASTs) (900 L) and 77 empty drums to be cleaned and crushed. Remedial options include: ▪ Off-site disposal to an approved facility.	Removed to an approved off site facility
Liquid Organic Wastes in above-ground storage tanks (ASTs): Hazardous	Approximately 1,400 L of liquid organic wastes in ASTs. Remedial options include: ▪ Incinerated on-site; or ▪ Off-site disposal to an approved facility.	Incinerated on site and remove off site liquids that don't meet incineration guidelines
Aqueous Content in Drums	Approximately 620 L of aqueous content in drums. Remedial options include: ▪ Treated and disposed on-site; or ▪ Off-site disposal to an approved facility.	Removed off site to an approved licensed facility
Asbestos Waste: Hazardous	Approximately 283 m^3 of asbestos containing materials including attic insulation, fibre glass insulation, panels, vinyl floor tiles, light fixture backings, asphalt singles, exterior white siding, and furnace gaskets. Remedial options include: ▪ Off-site disposal to an approved facility (handled by trained personnel).	Removed off site to an approved licensed facility

Table 1. Summary of Suggested Remedial Options

Waste Stream	Description and Remedial Options	Suggested Remedial Option
Total Lead and Leachable Lead Paint on waste: Hazardous	Approximately 259 m^3 of particulate boards, wood, metal, equipment, and generators contains total lead and leachable lead paint. Approximately 8 m^3 of particulate board and wood contains total lead paint. Remedial options include: ▪ Removed paint (very labour intensive) by trained personnel and the material disposed off-site (note, if the paint is removed the paint chips also have to be removed off-site); or ▪ Removed intact to an off-site disposal facility.	Stripped lead painted waste on-site and removed off site to an approved licensed facility
Total Lead and Leachable Lead Paint on ASTs: Hazardous	Approximately 146 m^3 of two large ASTs (73,000 L each) contain total lead paint. Remedial options include: ▪ Removal of appropriate areas of paint in order to dismantle the ASTs and remove to an approved off-site facility (note, if the paint is removed the paint chips also have to be removed off-site); or ▪ Material removed intact to an approved off-site disposal facility.	Removed intact ASTs off site to an approved licensed facility
Total Lead and Leachable Lead Paint on Asbestos Panels: Hazardous	Approximately 48.5 m3 of asbestos panels. Remedial options include: ▪ Removed (very labour intensive and within an asbestos containment) and disposed off-site (note, if the paint is removed the paint chips also have to be removed off-site); or ▪ Waste handled according to asbestos guidelines and removed to an off-site disposal facility.	Removed off site to an approved licensed facility
Compressed Gas Cylinders: Hazardous	Approximately 100 milliliters (mL) of compressed gas cylinders and propane tanks are on Site. Remedial options include: ▪ Off-site disposal to an approved facility. A specialist may be required for venting unknown contents for transportation requirements.	Evacuated and removed off site to an approved licensed facility
Fire Extinguishers: Hazardous	Approximately 0.1 m^3 of fire extinguishers (and potential contents) are at the Site. Remedial options include: ▪ Off-site disposal to an approved facility if it contains materials that cannot be vented.	Evacuated and removed off site to an approved licensed facility
Creosote-Treated Wood: Hazardous	Approximately 5 m^3 of creosote-treated wood. ▪ Off-site disposal to an approved facility.	Removed off site to an approved licensed facility
Other Hazardous Waste	Approximately 8.5 m^3 of miscellaneous solid hazardous waste (batteries, mercury in fluorescent lights, mercury, PCB light ballasts, PCBs, and lead solder in electrical components) and 501 L of miscellaneous equipment contents (anti-freeze, oil, fuel, and other vehicle fluids). Remedial options include: ▪ Off-site disposal to an approved facility.	Removed off site to an approved licensed facility

Table 1. Summary of Suggested Remedial Options

Waste Stream	Description and Remedial Options	Suggested Remedial Option
PHC- Impacted Soil	Approximately 2,352 m^3 of PHC-impacted soils. Remedial options include: ▪ Off-site disposal to an approved facility; ▪ Excavation and treatment on-site in a landfarm treatment unit (LTU) bringing borrow material to Site; ▪ Excavation and treatment on-site in a LTU using a crusher for borrow on-site; and ▪ Excavation and treatment on-site in a staged LTU (2 stage process).	Removed off site to an approved licensed facility
Metal-Impacted Soil	Approximately 165 m^3 of metal-impacted soils. Remedial options include: ▪ Off-site disposal to an approved facility.	Removed off site to an approved licensed facility
Co-contaminated Soil (PHCs and Metals)	Approximately 216 m^3 of co-contaminated soil (PHCs and metals). Remedial options include: ▪ Off-site disposal to an approved facility.	Removed off site to an approved licensed facility
Impacted Water	Impacts were identified in the Phase III ESA but were based on a limited data set and are either related to site activities or are a result of naturally elevated metals in surface waterbodies at the Site, due to elevated regional background conditions. ▪ Continued monitoring.	Monitoring
Physical Hazards	Each hazard will need to be identified and properly mitigated prior to work commencing. Proper personal protective equipment to be worn at all times.	Remove all metal towers and buildings to an approved off-site facility, and develop site-specific safety plans

Further information on the recommended remedial activities is summarized in the subsequent sections below. For the complete detailed recommended process, please consult the RAP (EBA 2013b).

3.3.1 Non-Hazardous Waste

Non-hazardous waste includes wood waste, metal, black felt, brick and brick mortar, cables, concrete, exterior metal siding, fibreglass insulation, flooring, glass windows, porcelain, rubber, asphalt shingles, ASTs, empty and unpainted drums, and other inert items in various locations at the Site. These items are considered an aesthetic concern and a safety hazard. The buildings and machinery have little to no historical value, could not be put to use, and have little to no recoverable value.

- For **non-hazardous wood waste**, the RAP recommends:
  - Remove all hazardous materials from the buildings on site. Asbestos abatement and handling should be conducted by trained professionals following safe work procedures;
  - Remove all non-wood waste and move to the staging area for transport off site;

- Demolish buildings, photograph, and document;
- Remove wood to an area, ideally where there is sparse to no vegetation; and
- Conduct a controlled burn within an approved container, under careful supervision, and at a time of year when moisture conditions are higher and there is a low likelihood of causing a tundra fire. Fire suppression equipment should be at hand when the controlled burn takes place and air monitoring should be conducted. Conduct the burn according to the applicable guideline (GN 2012).

- For **other solid non-hazardous waste**, the RAP recommends:
  - Conduct the separation of non-hazardous materials from buildings and removal from debris areas;
  - Clean drums and ASTs and remove residual fluids/fuels from machinery;
  - Cut up the ASTs; crush the metal debris, drums and machinery; and
  - Haul materials to the staging area for transport off site.

3.3.2 Hazardous Waste

Hazardous wastes are considered hazardous due to their toxicity, flammability, corrosiveness, or other properties and fall within the definition of hazardous materials under most federal, provincial, or territorial legislation under transportation of dangerous goods regulations. Asbestos is an inhalation hazard and is more of a human health hazard than a hazardous waste, but due to special handling, precautions and disposal, it is similar in nature to hazardous waste and needs to be dealt with appropriately.

- For **asbestos waste**, the RAP recommends:
  - Follow appropriate work procedures as outlined in *Alberta Asbestos Abatement Manual* (GA 2012) when the risk level has been identified, i.e., low risk, moderate risk, or high risk;
  - Mould impacts were observed on the floor and walls in the Old Radio Building, the Chicken Coop, and in the attic of the House. Most of these materials will already be within containment, due to the asbestos abatement, but the proper mould work procedures and personal protection equipment (PPE) shall be adhered to with or without the asbestos containment (GA 2009);
  - Abate ACM at the sites using trained abatement workers utilizing the appropriate risk level, according to applicable asbestos guidelines;
  - ACMs must be wetted and double bagged in approved asbestos disposal bags and sealed with duct tape. The exterior of the bags must be cleaned with a damp cloth or HEPA vacuum prior to removing from work area;
  - Haul materials to staging area and transport off site, according to the applicable guideline (GN 2011a); and
  - Conduct the required inspections and air monitoring during and post abatement. Ensure asbestos removal has been completed in full, prior to any demolition being carried out.

- For **aqueous liquid waste in ASTs**, the RAP recommends:
  - Consolidate aqueous liquid waste into containers for marine transport (following TDG 1992); and
  - Remove the waste to an off-site facility for hazardous waste (following TDG 1992, GC 2006).
- For **organic liquid waste in ASTs (e.g. heating oil)**, the RAP recommends:
  - Incinerate on-site following approved procedures for all wastes that cannot be removed off site. Waste that does not meet incineration criteria will be removed off-site to an approved disposal facility;
  - Complete air quality monitoring while this process is occurring, for predetermined parameters according to the applicable guideline; and
  - Analyze the remaining ash to classify the waste for off-site transport and disposal at an approved facility.
- For **total and leachable lead paint on waste**, the RAP recommends:
  - Separate the particulate boards, wood, metal, equipment, and generators from buildings and debris areas and place the materials in one area;
  - Drain any remaining fuel/fluids from the equipment (note liquid from cleaning activities would need to be treated/tested for disposal);
  - Construct an enclosure over and around the materials that will sufficiently collect the paint chips and prevent them from contaminating adjacent areas;
  - Remove paint by sandblasting or scrapping and collect the sand/paint for disposal off site to an approved disposal facility for hazardous waste. If lead based paint waste is to be stored on-site awaiting transport, it should be contained in sealed containers to reduce the potential for unauthorized access;
  - Dismantle, cut apart, crush, and compact materials in such a way that they can be transported off site;
  - Sample the surrounding soil to determine that the paint did not contaminate the soil; and
  - Wrap the painted substrates intact with 6 mil polyethylene sheets and remove, along with the lead paint chips generated from disturbing the paint to an off-site facility for hazardous waste (following TDG 1992, GC 2006).
- For **total and leachable lead paint on ASTs**, the RAP recommends:
  - Haul the two ASTs to the staging area for transport off-site; and
  - Dispose of the ASTs in an approved disposal facility for hazardous waste (following TDG 1992, GC 2006).
- For **leachable lead paint on drums**, the RAP recommends:
  - Clean the inside and crush the drums; and

  - Remove to an off-site approved disposal facility for hazardous waste (following TDG 1992, GC 2006).

- For **total and leachable lead paint on asbestos panels**, the RAP recommends:
  - Conduct removal of asbestos waste materials from the building or substrate following safe work procedures as per applicable regulations. Asbestos and lead-painted waste is handled and removed by trained personnel and properly bagged; and
  - Haul to staging area for removal to an off-site disposal facility(following TDG 1992, GC 2006).
- For **compressed gas cylinders and fire extinguishers**, the RAP recommends:
  - A specialist to vent the known or unknown contents on site;
  - Haul to the staging area for transport off site; and
  - Known contents that cannot be safely vented on-site (containing ozone-depleting substances) will be removed in an approved container as per TDG by air regulations to an off-site approved disposal facility for hazardous waste (following TDG 1992, GC 2006).
- For **creosote treated wood**, the RAP recommends:
  - Conduct the separation of creosote treated wood from buildings and removal from debris areas;
  - Wrap the wood securely in 6 mil polyethylene sheets; and
  - Haul materials to the staging area for transport off site.
- For **other solid and liquid hazardous waste**, the RAP recommends:
  - Collect solid and liquid hazardous waste and remove to an off-site approved disposal facility for hazardous waste (following TDG 1992, GC 2006).

3.3.3 Petroleum Hydrocarbon and Metal Impacted Soil

- For remediation of **PHC**, **metal, and co-contaminated soils** the RAP recommends:
  - Excavate all PHC impacted soils and store in containers for transporting off-site;
  - Conduct confirmatory sampling of base and walls of open excavations/adjacent soil boundaries to ensure all impacted soil has been removed; and
  - Backfill open excavation with crushed rock and regrade/revegetate relevant areas to pre-remedial conditions.

3.3.4 Surface Water

- Due to uncertainty regarding elevated surface water concentrations at the Site, the RAP recommends:
  - Develop a monitoring and sampling program to determine if surface water exceedances are due to site activities or naturally elevated conditions at the Site.

3.4 Remediation Schedule, Project Components, and Activities

Site features include buildings, towers, fuel drums, fuel tanks, and debris. To remediate the Site, a camp and other temporary site facilities, including a temporary shoreline barge staging area and roads will need to be constructed or upgraded as part of the remedial work program. A large amount of supplies and equipment will be brought to site.

The recommended remedial activities are to be completed over approximately three field seasons (each field season is considered dependent on suitable barging conditions between mid-July to mid-November). In the first season, all required equipment and personnel will be mobilized to Site, temporary camp and barge landing area development, and the majority of the remedial activities including blasting, crushing, and stockpiling of bedrock materials, road/trail upgrading, hazardous material abatement, building demolition, and packaging debris, and the on-site control burn will be completed. By the second field season, all hazardous and non-hazardous waste and debris will be packaged, impacted soil excavated and packaged, excavations backfilled, and debris, hazardous waste, and equipment removed off site. The final field season will include site re-contouring, as required, and the removal of all remaining equipment, impacted soil, temporary camp, and personnel. The entire second season would include several barge in-and-out events (from the sealift to Nottingham Island) to remove Site materials and the majority of the equipment off site.

A summary of construction equipment, mobilization and site access (including blasting and crushing), camp and staging area set-up, remedial activities, and site closure is presented below.

3.4.1 Construction and Remediation Equipment

The following major equipment needs are anticipated based on the RAP:

- Rock drill and blast pads for blasting bedrock source material;
- Excavator(s) to remove blast rock, impacted soils, and for use in trail and/or road improvements;
- Front end loader(s) to consolidate materials, crushing operations, and for trail and or road improvements;
- Haul truck(s) to move materials and blast rock to staging and treatment areas;
- Rock crusher to reduce boulders to suitably sized crush rock for backfill;
- Waste incinerator(s) (both for the camp waste and for incineration of certain materials currently located on site);
- Dozer(s) to be used for the road improvements;
- Water truck to haul water to camp if required and for dust suppression;
- Rubber tracked or skidsteer;
- Waste compactor;
- Drum crusher;

- All-terrain vehicle(s) with trailers;
- Packer to ensure compaction is appropriate with the natural terrain;
- Generators (for remedial equipment);
- Sea lift containers to contain debris and impacted soils; and
- Other miscellaneous equipment determined by contractor.

3.4.2 Mobilization and Site Access

During operation of the Site, access was made by boat. On the beach immediately south of the Site, is a former boat landing area consisting of a metal-framed crib that is currently non-functional. The beach landing area will first need to be assessed by the selected contractor to determine suitability of landing upgrades, if required. This will determine if ships or barges are able to load and unload required materials and equipment needed for remediation activities to be completed at the Site. Figure 3 and Photo 2 indicates the area of the beach, directly south of the Site that is recommended for a possible beach landing and staging area. Potential upgrades to accommodate the barge landing area are generally unknown at this time until the assessment by the selected contractor is completed. However, no in-water works (*e.g.* dredging) and infrastructure are anticipated for the barge landing. It is assumed that barges were previously used to access the Site while it was in operation, and therefore, the current water depth and other site conditions are anticipated to be appropriate for current barge use. If barges will be used, equipment, personnel, and Site hazardous and non-hazardous waste will be transferred from Site to the sealift (anchored off-shore in deep water) via a small barge/landing crafts. A total of two sealift trips are assumed each year.

There may also be potential for floatplane access via the beach should it be required, however suitability of this area for landing a floatplane would also need to be assessed by the contractor. The Site can be also be accessed by helicopter when weather conditions permit. EBA accessed the site in August 2012 using a Bell 212 helicopter operated by the Canadian Coast Guard.

Most of the trails surrounding the buildings on site have subsided and are overgrown with moss. Additional upgrading of these trails will be required to support larger equipment. An existing trail also runs in an east-west direction along the north end of the Site (from the old kitchen building) and continues for at approximately 600 m northeast to an unnamed lake (Figure 3). The trail is approximately 2.7 m wide and there is no embankment. Beyond this lake (on the east side of the lake), the trail continues, but is in poor condition with ruts and subsidence in poorly-drained areas. The trail in its present condition is only accessible by ATVs, and may not be trafficable by ATV along some sections. For the purposes of this assessment, this existing trail will not require upgrading since all known remedial activities will remain at or immediately adjacent to the Site. In general, road/trail upgrading and development will be kept to a minimum to minimize site disturbances.

Mobilization and site-access required for the proposed RAP will consist of the following activities:

- Mobilizing the necessary equipment to Site in the summer via barge;
- Constructing a temporary shoreline docking area;

- Blasting bedrock immediately surrounding the Site for source material; and
- Crushing of blasted bedrock material on-site to upgrade trails/roads and backfill excavations.

Blasting and crushing bedrock is required on site to extract and provide suitable borrow material for trail upgrades and as possible backfill into the soil excavations. At the time of the August 2012 field program, suitable bedrock for source material was not investigated. Bedrock material near the Site must first be evaluated for its intended use by an AANDC Representative following the *Northern Land Use Guideline for Pits and Quarries* (INAC 2010). However, for the purposes of this report, possible blasting and crushing areas are anticipated to remain close to the Site, and are expected to be restricted in size since little borrow material is anticipated.

After remedial activities are complete, former and recently disturbed areas (including upgraded roads, remediated areas, and the camp area) will be re-contoured to promote natural revegetation. Demobilization will involve packing all materials remaining on-site into appropriate containers for barging off-site following completion of the remedial activities.

3.4.3 Temporary Camp and Staging Areas

For the remediation at Nottingham Island, a camp will need to be set up sufficient distance away from the Site to ensure workers are not affected by hazards and waste materials. A 24-person camp is anticipated for this project. This camp size is typical of other similar remote northern remediation projects. There are two options available for camp locations:

- Anchored ship off-shore; or
- On-site camp.

Three areas were identified as potential locations for construction of the on-site camp (Figure 3). All three recommended camp locations are situated along the beach south and southeast of the Site (Photo 3). The camp will need to house workers and will need to meet the specifications laid out by PWGSC and Workers Safety and Compensation Committee. Facilities that will be required include the following:

- Tent style sleeping quarters;
- Tent style office (also contains communications area);
- Tent style kitchen and dining area;
- Tent style bathroom and showers;
- Tent style laundry facilities;
- Tent style first aid facilities (may depend on the number of workers);
- Sewage lagoon or water treatment system;
- Incinerator;
- Mechanics and equipment area that would also have a petroleum and lube containment area, tanks and drums;

- Water supply and pumps;
- Water treatment system;
- Diesel powered generator and back-up; and
- Emergency shelter.

Three lakes near Site have been pre-selected for raw water locations for potential potable water supply (Figure 3). These lakes have been pre-selected based on their proximity to possible on-site camp locations. All three lakes are relatively small and shallow waterbodies. Two of these potential raw water sources are located on bedrock outcrops, and the third is located in an undulating low-relief area. However, a detailed study for bacteria (faecal and total coliforms with *E.coli*) is required prior to final selection of a potable water source. A potable water treatment system and polishing unit capable of supporting camp activities is recommended, and drinking water should also be brought to Site in the event that a failure occurs in the potable water treatment system.

3.4.4 Demolition

Dilapidated and intact buildings have little historic value and can be an extreme hazard to occasional visitors. The buildings will be demolished or dismantled and the wood separated. Approximately 898 m^3 of wood from buildings will be adequately disposed of. Some of the wood is painted with total lead and leachable lead paint components.

3.4.5 On-Site Incineration

On-site incineration is recommended for liquid organic wastes that are in poor condition and cannot be shipped off-site. Wastes must be tested to ensure they meet incineration guidelines; should they meet the applicable criteria, an incinerator designed to meet air quality guidelines will be brought to site, and wastes can be incinerated. Air quality monitoring must be performed during the incineration to ensure compliance with applicable air emission standards. In addition, following incineration, residual ashes must be analyzed in order to classify the material for off-site disposal.

3.4.6 Monitoring Program

Verification and monitoring of construction works, environmental clean-up, verification of quantities, and quality of work will need to be carried out during the remediation works of this project (INAC 2009). Skill sets needed include resident engineering experience, hazardous materials testing and abatement, environmental health and safety monitoring, soil sampling, and geotechnical and materials testing.

If the preferred remedial options for all the waste streams are implemented, short-term monitoring will be required in those areas were hazardous materials are being abated, handled, packaged and stored.

4.0 PROJECT APPROVAL AND PERMITS REQUIREMENTS

The NLCA provides the regulatory context for completing this EA for the proposed project for NIRB. However, both the federal and Nunavut governments have other necessary or potential legislative requirements related to this project. Through the environmental assessment process, NIRB informs all

authorizing regulatory bodies specific to each project of the screening submission, and considers advice and recommendations from these regulatory bodies in making their decisions. A list of authorizing regulatory bodies that will be advised of this project and those from which additional approvals and/or licences may be required are listed in Table 2.

Table 2: Regulatory Agencies, Legislative Requirements and Contact Information

Agency	Legislative Requirements	Contact Information
Federal Agencies		
AANDC	*Land Claims Settlement Act* Notes: Permits for land use and potential bedrock quarry may be required based on the Project as proposed.	Project Manager, Lands and Contaminated Sites Directorate Aboriginal Affairs and Northern Development Canada (AANDC) Nunavut Region P.O. Box 2200 Iqaluit, NU X0A 0H0 Phone: 867.975.4577 Fax: 867.975.4736
AANDC	*Land Use Permit* *Quarry Permit* Notes: road upgrades may be required for transport of bedrock materials to crushing operations; bedrock quarry will be required for road upgrades and backfilling excavations.	Land Administration Specialist, Land Administration Office Aboriginal Affairs and Northern Development Canada P.O. Box 2200 Iqaluit, NU X0A 0H0 Phone: 867.975.4283 landsmining@ainc-inac.gc.ca
PWGSC	*Federal Real Property Act* and *Regulations*	Public Works and Government Services Canada 5th Floor, Telus Tower, 10025 Jasper Avenue Edmonton, Alberta T5J 1S6 Telephone: 780. 497.3786
Fisheries and Oceans Canada (DFO)	*Fisheries Act* Notes: Authorizations or letter of advice may be required if project impacts fish habitat. Based on the current project, a letter of advice may be required for the barge landing on the Hudson Strait shoreline, depending on the contractors' assessment of the barge landing area and required structures.	Iqaluit District Office PO Box 358 Iqaluit, Nunavut X0A 0H0 Telephone: 867 979-8019
Transport Canada (TC)	*Navigable Waters Protection Act* Notes: Authorization will be required for any temporary works and if any structures are built within or on navigable waters (such as Hudson Strait). Based on the current project proposal, an authorization for navigable waters may be expected depending on the contractors' assessment of the barge landing	Prairie and Northern Region Transport Canada 9700 Jasper Avenue NW Edmonton, Alberta T5J 4E6 Telephone: 780.495.8215

Table 2: Regulatory Agencies, Legislative Requirements and Contact Information

Agency	Legislative Requirements	Contact Information
	area and required structures. *Transportation of Dangerous Goods Act* *Transportation Act*	
Environment Canada (EC)	*Species at Risk Act* *Migratory Birds Act* and *Regulations* Notes: Authorizations not anticipated, but a list of species at risk and migratory birds, potential impacts to these species and mitigation strategies has been compiled as part of this EA.	Environment Canada Eastern Arctic Unit Qimugjuk Building, PO Box 1870 Iqaluit, Nunavut X0A 0H0 Telephone: 867.975.4633 Fax: 867.975.4645 Environment Canada Contaminated Sites 4999 - 98 Avenue Edmonton, Alberta T6B 2X3 Telephone: 780.951.8746
Territorial Agencies		
Nunavut Water Board	*Nunavut Waters Act* *Nunavut Surface Rights Tribunal Act* Notes: Authorizations for freshwater use and deposit of waste into water. Based on the current project description, a water license will be required.	PO Box 119 Gjoa Haven, Nunavut XOB 1JO Telephone: 867.360.6338
Department of Environment (Government of Nunavut)	*Environmental Protection Act* *Wildlife Act* Notes: Based on the current project proposal, spill response plans and waste management guidelines must be followed and waste manifest documents will be required for moving hazardous waste. Regulatory requirements related to land use, incineration, and disturbing wildlife must also be met. Authorizations related to the *Wildlife Act* requirement are not anticipated, but a list of wildlife species, potential impacts to these species, and mitigation strategies has been compiled.	PO Box 1000, Stn. 1300 Iqaluit, Nunavut X0A 0H0 Telephone: 867.975.7732
Department of Culture, Language, Elders and Youth (Government of Nunavut)	*Nunavut Act (Nunavut Archaeological and Palaeontological Sites Regulations)* Notes: All archaeological sites identified in the Archaeological Impact Assessment for this project will be avoided. If any new sites are identified, the Department will be contacted.	PO Box 1000, Stn. 800 Iqaluit, Nunavut X0A 0H0 Telephone: 867.975.5524

Table 2: Regulatory Agencies, Legislative Requirements and Contact Information

Agency	Legislative Requirements	Contact Information
Department of Health and Social Services (Government of Nunavut)	*Public Health Act* and *Regulations* Notes: The criteria outlined in the Act and Regulations for any camps associated with the Project must meet requirement for sanitation, waste disposal, drinking water quality, and medical facilities.	PO Box 1000 Iqaluit, Nunavut X0A 0H0 Telephone: 867.975.5782
NIRB	*Review of the Environmental Assessment*	PO Box 1360 Cambridge Bay, Nu X0B 0C0 Phone 1-866-233-3033 Fax 1-867-983-2594

EBA assumes that AANDC and/or PWGSC will contact the agencies with regulations applicable to this project and secure the required permits, including completing Part 1 Form - Project Proposal Information Requirements (NIRB) and Screening Part 2 Form - Project Specific Information Requirements (NIRB) when submitting this Environmental Assessment report to the NIRB.

5.0 SITE DESCRIPTION

The sections below describe the ecological and socio-economic conditions at the project site. Included in this section is a description of the regional geology, topography, hydrology and groundwater, climate and air quality, soils, vegetation, fish and wildlife, and recognized sensitive environmental areas, and cultural features.

5.1 Regional Geology and Terrain

Nottingham Island lies in the Churchill Province of the Canadian Shield, and is composed of Proterozoic quartz-feldspar gneiss. During the last glacial maximum, ice flowed to the east along the Hudson Strait, and the resulting glacial retreat covered the southwestern half of Nottingham Island by glacial drift composed of sand, silt, gravel, and often marine shells (Blackadar 1970).

Nottingham Island lies in the continuous permafrost zone and ground ice is expected to be low (Heginbottom *et al*. 1995). The seasonally thawed layer above permafrost, known as the active layer, ranges in thickness due to vegetation, moisture, and geology.

Nottingham Island slopes gently to the southwest from the north. The northeast coast is rugged with steep slopes and elevations exceeding 180 m above sea level (masl). The southeast and southwest coasts are low relief, with innumerable off-shore shoals. Within a 5 km radius of the Site, the elevation relief is 40 m. Specifically at the Site, the relief slopes gently from the beach and terminates at a bedrock outcrop reaching 30 m in height. The rock outcrops to the east and west of Site are lower, rising 5 to 10 m above the surrounding terrain. The northeast corner of the site opens up into a wide flat-bottomed valley of glacial marine sediment that extends in a northeast direction.

5.2 Hydrology

Drainage on Nottingham Island is controlled primarily by bedrock, with lakes and streams situated between the elevated bedrock outcrops. The low-lying parts of Site are poorly drained and the majority of the Site consists of saturated ground. During the Phase III ESA, all the testpits at the Site encountered water except two, and there were several areas of ponded water. Active melting of surface ice and pooled surface water were prevalent on the Site. However, water did not accumulate in the testpits at the east of the Site because the terrain was elevated and well-drained.

There are many isolated melt-water ponds throughout the Site, during high water periods it is anticipated that drainage will flow toward Hudson Strait. During the Phase III ESA in August 2012, the active layer was saturated and late-lying snow banks were still observed. Groundwater was not encountered at the Site during the site assessment.

Hudson Strait is approximately 700 km in length and connects Hudson Bay to the Atlantic. At its greatest known water depth, Hudson Strait is approximately 874 m and has a swift tidal current (Bailey and Hachey 1950). The main current through Hudson Strait flows east, and the mean tidal range is approximately 5 to 9 m throughout its length.

Hudson Strait becomes ice covered usually by mid-November, although the ice remains unconsolidated with mobile pack ice most dominant in the channel and landfast ice around the coastlines (Stewart and Lockhart 2004; Mallory and Fontaine 2004). By April, ice leads begin to open and by May large open patches of water occur along Hudson Strait. Shorelines, including along Nottingham and Fraser islands begin to open by early June (Latour *et al.* 2008). The median ice break-up date near Nottingham Island is July 25 (data includes from 1981 – 2010); however, in recent history, the date of ice break-up has been earlier and the eastern Hudson Strait barge route near Nottingham Island is frequently open by mid-July (Environment Canada 2012a).

No reoccurring polynyas are known to occur near Nottingham Island (Mallory and Fontaine 2004). These are areas of open water that consistently occur during the winter, and are important to overwintering species as well as early spring migrants.

5.3 Climate and Air Quality

Climate data is available for Nottingham Island from 1927 to 1970 when the weather station was abandoned (Environment Canada 2012b). The mean annual air temperature over this period was -8.8°C. July is the warmest month with average temperatures between 4 and 13 °C. February is the coldest month with average temperatures between -22 and -29 °C. The annual total precipitation ranged from 107 mm to 509 mm over the period of record and averaged 290 mm. Rainfall occurs between May and October with July, August, and September receiving between 30 mm to 40 mm per month on average. Snowfall was observed every month of the year but was rare in July and August. On average, the last three months of the year received between 20 cm and 35 cm of snow per month, and the first three months of the year received about 12 cm of snow per month. Snow depth at the end of April varied from 13 cm to 163 cm and averaged 70 cm.

Wind data is not available for Nottingham Island, but the climate normal (1971-2000) for Cape Dorset, NU, approximately 140 km to the northeast, has a prevailing wind direction from the west. Fog is common in late summer and autumn in this region.

No direct measurements or observations specific to the local air quality is available for the Project site. The nearest description of the local Air Quality Health Index Conditions are located in southern Canada (e.g. the nearest being Montreal and Quebec City, Quebec and Sault Ste. Marie, Ontario). However, Environment Canada has recently installed air quality monitoring equipment in Iqaluit, NU. Data from the Iqaluit air quality monitoring program is presently not available.

Although few pollution sources exist across Nunavut and Nunavik, this region receives air emissions from southern sources (principally from the United States of America) by the prevailing air currents (Commoner *et al.* 2000). For example, only a small fraction of dioxins that are deposited in Nunavut are from sources within Nunavut, and almost entirely due to outside sources (Commoner *et al.* 2000). Nonetheless, activities in Nunavut can have an impact on air quality.

5.4 Soils

The Site predominately consists of a thin veneer of surficial soil covering bedrock within a continuous permafrost (90-100%) zone. A total of 64 soil testpits were advanced to refusal on-site to a maximum depth of 0.5 meters below ground surface (mbgs). Refusal was at bedrock or cobbles; no permafrost was encountered during the soil assessment. At the time of the site investigation, testpits were dug to determine general soil conditions at the site. Based on these testpits on Site, an organic layer about 0.10 m thick overlies mineral soil.

The testpits from across the region show that the soil consists primarily of coarse grained calcareous sand or gravel overlying bedrock. Occasional clay and silt was encountered overlying bedrock underneath the coarse grained sand.

EBA conducted particle size analysis (PSA) through Maxxam Analytics and it was determined that the PSA of samples was coarse grained. This information corroborated the EBA geotechnical evaluation at various locations across the Site, which determined the majority of the samples were considered to be coarse grained.

5.5 Vegetation

Nottingham Island lies in the Wager Bay Plateau Ecoregion. Vegetation cover in this region is characterized by nearly continuous shrub tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, *Dryas* spp., and *Vaccinium* spp. Dwarf birch, willow, and alder occur on warm microsites; wet sites are dominated by willow and sedge. Rock outcrops are covered in lichen (Ecological Stratification Working Group 1995).

Based on the Northern Land Cover classification of Canada (Olthof *et al.* 2008), the Site and local area consist of a mosaic of generally small sized land cover units. Most prominent across the regional area (8 km radius from the Site) is Sparsely Vegetated Bedrock with linear Wetland land cover units and Wet Sedge units in the lowlands (Figure 4). Within the Site, Wet Sedge and Moist to Dry Non-Tussock

Graminoid/Dwarf Shrub dominates with small inclusions of Tussock Graminoid Tundra, Prostrate Dwarf Shrub, Wetland, Sparsely Vegetated Till-Colluvium Bare Soil, and Barren units (Figure 4).

A brief description of each land cover unit, as outlined by Olthof *et al.* 2008 and described during the Phase III ESA, reported within or near the Site is provided below.

Barren – Barren area with less than 2% vegetation cover over parent material. This land cover unit exists primarily at the proposed barge landing area and within the intertidal zone (Photo 4). This area consists primarily of unvegetated sand, boulder, and cobbles with seaweed near the high tide.

Bare Soil with Crypotgam Crust – Frost Boils – Unconsolidated barren surface with 2 – 10% vegetation cover. These predominantly barren surfaces have experienced significant cryoturbation, and consist of graminoids and lichen and/or moss cover. This land cover unit was not observed at the Site or immediate surrounding area at the time of the Phase III ESA.

Moist to Dry Non-Tussock Graminoid/Dwarf Shrub – Moist to dry tundra with 50-70% vegetation cover principally consisting of a mixture of graminoids (grasses, sedges, and rushes), dwarf shrubs, and possibly trace amounts of moss and lichen. This land cover unit was frequently encountered on the Site, primarily in dry upland areas, including surrounding the old kitchen, storage shed, bunkhouse, helipad, and food cache storage areas (Figure 2) (Photo 5). Plant species detected include snow willow (*Salix reticulate*) (and other willow species), polar grass (*Arctagrostis latifolia*), sea lyme grass (*Leymus mollis*), sedge species (*Carex* species), rush species (*Juncas* species), alpine bistort (*Polygonum viviparum*), long-stalked chickweed (*Stellaria longpipes*), river beauty (*Chamerion latifolium*), lichen, and moss.

Prostrate Dwarf Shrub – Dry areas on bedrock or till with greater than 50% vegetation cover, consisting of prostrate dwarf shrubs (e.g. *dryas*), graminoids, and possibly less than 10% lichen and moss. This land cover unit was primarily a located along the northern edge of the Site near the bedrock outcrop (Photo 6). Dominant plant species identified in this unit includes lichen (including crustose lichen), crowberry (*Empetrum nigrum*), mountain avens (*Dryas* species), and snow willow; however, other species such as large-flowered wintergreen (*Pyrola grandiflora*), three-toothed saxifrage (*Saxifraga tricuspidata*), Arctic white heather (*Cassiope tetragona*), and long-stalked chickweed were also noted.

Sparsely Vegetated Bedrock – Barren surfaces on bedrock with 2 – 10% vegetation cover primarily located within bedrock crevices (Photo 7). Vegetation cover generally consists of graminoids and prostrate dwarf shrubs. This land cover unit occurs on exposed bedrock outcrops, including the bedrock outcrop directly north of the Site. During the Phase III ESA, vegetation cover was less than 2% and plant species detected included: lichen, moss, willow, polar grass, river beauty, mountain sorrel (*Oxyria digyna*), alpine chickweed (*Cerastium alpinum*), snow cinquefoil (*Potentilla nivea*), and cliff fern species.

Sparsely Vegetated Till-Colluvium Bare Soil – Barren area with 2 – 10% vegetation cover over bedrock, till and/or colluvium. Of the vegetation present, graminoids and prostrate dwarf shrubs dominate. This land cover unit is mapped primarily along the marine shoreline in the location of the proposed camp (Photo 8). At the time of the Phase III ESA, this area supported primarily lichen, moss, willow species, and mountain avens, salt grass (*Puccinellia* species), sea lyme-grass, saxifrage species, and river beauty.

Tussock Graminoid Tundra – Moist tussock tundra dominated by graminoid vegetation (grasses, sedges, and rushes) with moss, possibly lichen, and less than 25% dwarf shrub cover that are less than 40 cm tall. This land cover unit is mapped within the Site; however, it was not identified at the time of the site investigation. This unit may exist on site as small isolated pockets; however, it is not characteristic of the site.

Wetland – Vegetated areas where the water table intersects with the land surface all or part of the year with moss dwarf shrub vegetation compositions. Plant species within this land cover unit were not recorded due to time restrictions on site during the investigation.

Wet Sedge – Vegetated areas that are saturated for a significant part of the growing season. This land cover unit is dominated by grasses, sedges, rushes, cottongrass, and moss; and may include less than 10% cover of dwarf shrubs (less than 40 cm tall). This land cover unit was most common near the former house, garage, shed, radio buildings, and chicken coop, and much of the southern half of the Site (Figure 2) (Photo 9). At the time of the Phase III ESA, the dominant vegetation species identified were water sedge (C*arex aquatilis*), rush species, sheathed cottongrass (Eriophorum vaginatum), snow willow and other willow species, polar grass, river beauty, and flame-tipped lousewort (*Pedicularis flammea*).

In general, the vegetation on site appeared healthy at the time of the Phase III ESA, and no observable signs of stress were noted except in a few debris areas. Vegetation covers 90 to 97% of the Site, except in areas dominated by bedrock and along the beach south of the Site.

5.6 Wildlife

Wildlife on Nottingham Island has not been widely studied, therefore this wildlife section is limited to Site observations recorded during the Phase III ESA and other third party contractors (if available), as well information recorded during informal consultation with locals, published species range maps, field guides, and online sources.

At the time of the Phase III ESA, informal interviews were conducted to identify wildlife known or expected to be present on Nottingham Island. Characteristic wildlife occupying Nottingham Island (and surrounding region) includes predominantly birds and marine mammals. Nine terrestrial mammals and eleven marine mammals (including Polar Bear) may be expected to occur on or near Nottingham Island (Table 3). Thirty six bird species potentially occur on Nottingham Island, principally in the summer (Table 3). Nottingham Islands' isolation in Hudson Strait and the duration of winter conditions, including sea ice cover is an important determinant of the annual/seasonal distribution of wildlife species occurring on or near Nottingham Island. Of those species potentially occurring on or near Nottingham Island, nine species have special conservation status (Table 3).

Table 3. Wildlife Species Occurring or Potentially Occurring on Nottingham Island or in Local Area

Common Name	Scientific Name	Conservation Status		
		NU[1]	SARA	COSEWIC
Mammals				
Arctic Hare	*Lepus arcticus*	Secure	-	Not Assessed
Neoarctic Brown Lemming	*Lemmus trimucronatus*	Secure	-	Not Assessed

Table 3. Wildlife Species Occurring or Potentially Occurring on Nottingham Island or in Local Area

Common Name	Scientific Name	Conservation Status		
		NU[1]	SARA	COSEWIC
Neoarctic Collared Lemming	*Dicrostonyx groenlandicus*	Secure	-	Not Assessed
Gray Wolf*	*Canis lupus arctos*	Secure	-	Not At Risk
Arctic Fox	*Vulpes lagopus*	Secure	-	Not Assessed
Red Fox	*Vulpes vulpes*	Secure	-	Not Assessed
Ermine	*Mustela erminea*	Secure	-	Not Assessed
Polar Bear	*Ursus maritimus*	Sensitive	Special Concern	Special Concern
Wolverine	*Gulo gulo*	Secure	No Status	Special Concern
Barren-ground Caribou**	*Rangifer tarandus groenlandicus*	Secure	-	Not Assessed
Orca (Killer Whale)	*Orcinus orca*	Sensitive	No Status	Special Concern
Bowhead Whale	*Balaena mysticetus*	Not Assessed	No Status	Special Concern (Eastern Canada-West Greenland population)
Minke Whale	*Balaenoptera acutorostrata*	Not Assessed	-	Not At Risk
Narwhal	*Monodon monoceros*	Not Assessed	No Status	Special Concern
Beluga	*Delphinapterus leucas*	Not Assessed	No Status	Endangered (Eastern Hudson Bay population) and Special Concern (Western Hudson Bay population)
Walrus	*Odobenus rosmarus*	Not Assessed	No Status	Special Concern
Ringed Seal	*Pusa hispida*	Not Assessed	-	Not At Risk
Bearded Seal	*Erignathus barbatus*	Not Assessed	-	Not Assessed
Harp Seal	*Phoca groenlandica*	Not Assessed	-	Not Assessed
Harbour Seal	*Phoca vitulina*	Not Assessed	-	Not At Risk
Birds*				
Snow Goose	*Chen caerulescens*	Secure	-	Not Assessed
Canada Goose	*Branta canadensis*	Secure	-	Not Assessed
Tundra Swan	*Cygnus columbianus*	Secure	-	Not Assessed
Harlequin Duck	*Histrionicus histrionicus*	Sensitive	Special Concern (Schedule 1)	Special Concern
Long-tailed Duck	*Clangula hyemalis*	Secure	-	Not Assessed
Red-breasted Merganser	*Mergus serrator*	Secure	-	Not Assessed
Rock Ptarmigan	*Lagopus muta*	Secure	-	Not Assessed
Red-throated Loon	*Gavia stellata*	Secure	-	Not Assessed
Pacific Loon	*Gavia pacifica*	Secure	-	Not Assessed
Common Loon	*Gavia immer*	Secure	-	Not At Risk

Table 3. Wildlife Species Occurring or Potentially Occurring on Nottingham Island or in Local Area

Common Name	Scientific Name	Conservation Status		
		NU[1]	SARA	COSEWIC
Rough-legged Hawk	*Buteo lagopus*	Secure	-	Not At Risk
Gyrfalcon	*Falco rusticolus*	Secure	-	Not At Risk
Peregrine Falcon	*Falco peregrinus anatum/tundrius*	Secure	Special Concern (Schedule 1)	Special Concern
Semipalmated Plover	*Charadrius semipalmatus*	Secure	-	Not Assessed
Semipalmated Sandpiper	*Calidris pusilla*	Sensitive	-	Not Assessed
White-rumped Sandpiper	*Calidris fuscicollis*	Secure	-	Not Assessed
Baird's Sandpiper	*Calidris bairdii*	Secure	-	Not Assessed
Purple Sandpiper	*Calidris maritima*	Secure	-	Not Assessed
Red-necked Phalarope	*Phalaropus lobatus*	Secure	-	Not Assessed
Red Phalarope	*Phalaropus fulicaria*	Sensitive	-	Not Assessed
Pomarine Jaeger	*Stercorarius pomarinus*	Secure	-	Not Assessed
Parasitic Jaeger	*Stercorarius parasiticus*	Secure	-	Not Assessed
Long-tailed Jaeger	*Stercorarius longicaudus*	Secure	-	Not Assessed
Herring Gull	*Larus argentatus*	Secure	-	Not Assessed
Iceland Gull	*Larus glaucoides*	Secure	-	Not Assessed
Glaucous Gull	*Larus hyperboreus*	Secure	-	Not Assessed
Arctic Tern	*Sterna paradisaea*	Secure	-	Not Assessed
Snowy Owl	*Bubo scandiacus*	Secure	-	Not At Risk
Common Raven	*Corvus corax*	Secure	-	Not Assessed
Horned Lark	*Eremophila alpestris*	Secure	-	Not Assessed
Northern Wheatear	*Oenanthe oenanthe*	Undetermined	-	Not Assessed
American Pipit	*Anthus rubescens*	Secure	-	Not Assessed
Lapland Longspur	*Calcarius lapponicus*	Secure	-	Not Assessed
Snow Bunting	*Plectrophenax nivalis*	Sensitive	-	Not Assessed
Common Redpoll	*Carduelis flammea*	Secure	-	Not Assessed
Hoary Redpoll	*Carduelis hornemanni*	Secure	-	Not Assessed

SARA = *Species at Risk Act*

COSEWIC = Committee on the Status of Endangered Wildlife in Canada

1. (National General Status Working Group 2010).

* Local knowledge from Ivujivik indicated that no wolves occur on Nottingham Island. For the purposes of this report, wolves are considered possible occupants, and may occur if suitable prey species exist (*e.g.* caribou).

** Local knowledge from Ivujivik indicated that caribou are not know occur on Nottingham Island, but they have been seen on Mansel (approximately 70 km west of Ivujivik) and Digges (approximately 14 km northeast of Ivujivik) islands. However, a single published report indicated caribou were historically observed on Nottingham Island.

5.6.1 Terrestrial Mammals

Few terrestrial mammals are expected to be found in the vicinity of the Site due to limited access to the island and available habitat. EBA did not observe terrestrial mammals or their sign during the Phase III ESA, however lemming and arctic fox were observed on Nottingham Island during WESA's 2010 Phase II ESA field program.

Most characteristic species that may be observed on Notthingham Island include small mammals, such as Arctic hare, red and Arctic fox, short-tailed weasel (or ermine), and several lemming species. Terrestrial mammals expected to occur on the island are likely year round residents, and have the potential to occupy the Site during all life history stages including breeding/denning.

Arctic and red foxes require suitable substrate to establish their dens, and commonly reuse den sites in subsequent years. Fox dens are commonly found on eskers, riverbanks, and other areas with sandy or gravelly soils free of permafrost. No dens were detected during the Phase III ESA; however, denning may occur throughout the island wherever suitable habitat exists. Arctic fox pups are born in the den between mid-April and June; whereas, red fox pups are born between April and May (Department of Environment 2013). Family groups focus much of their activity around dens until midsummer, until juvenile Red foxes disperse in the fall and juvenile Arctic foxes disperse in the spring. Foxes are sensitive to disturbance during the denning and pup rearing periods. Population estimates for both fox species in the Nunavut are generally unknown; however, they are considered common. Fox populations may cycle every 3 to 4 years in response to changes in small mammal densities (*e.g.* lemmings).

Gray wolves have the potential to occur if available prey exists; however, local knowledge from Ivujivik indicated wolves and muskox are not known to occur on the island. As well, contradictory information exists regarding the presence of caribou on Nottingham Island. One known record dating back to 1884, indicated the presence of caribou on Nottingham Island (Bell 1884). However, based on a few informal discussions with locals from Ivujivik, no caribou have been seen on the island. Although caribou have the potential to occur on the island, their presence on the Site during the remedial activities is unlikely.

5.6.2 Marine Mammals

A number of marine mammal species have the potential to be found on or near the Site, including polar bear. Stephenson and Hartwig (2010) report Hudson Strait near Nottingham Island is an important overwintering area for many marine mammals including narwhal, beluga whale, and walrus. This area is considered a highly productive area due to mixing and flow of water (Stephenson and Hartwig 2010).

Polar Bears with the potential to be found on Nottingham Island are part of the Foxe Basin population, which consists of approximately 2,300 individuals (circa 2004) (Nunami Jacques Whitford Limited 2008; Department of Environment 2007). Although the Foxe Basin population is one of the largest polar bear populations in Nunavut, it is believed to have decreased from approximately 3,000 individuals in the 1970's to near 2,100 individuals in 1996 (a 30% decrease) (Department of Environment 2007). The current population suggests a slight recovery since 1996 numbers due to reduced harvest levels. Polar bears are currently listed by the *Species at Risk Act* (SARA) as Schedule 1 Special Concern (Government of Canada 2002). Threats to the Foxe Basin population are not widely known or studied, however it is

predicted that human-caused mortality and climate change are likely having negative effects on the population (COSEWIC 2008).

Polar bears have diverse habitat requirements including ice, open water, coastal areas and inland areas; dens for hibernation and giving birth are also an important habitat requirement for pregnant female polar bears in particular. Polar bears disperse across the sea ice up to approximately 200 km from the coast; however their distribution is closely dependent on sea ice and ringed seal distributions. During the ice-free season (mid-July to mid-November), the Foxe Basin polar bear population is forced onto land and tend to concentrate particularly on Southampton Island and along the Wager Bay coast; few polar bears have been found along the Quebec shores during this time (Crete *et al.* 1991). During this time, polar bears may also occur on Nottingham Island. They remain on land for several months until the formation of new ice (COSEWIC 2008). When on land during the ice-free months, females and cubs tend to move further inland, while males will occupy closer to the coasts. If food is not readily available, they may rely entirely on fat supplies; however they are also known to feed on blueberries, crowberries, waterfowl eggs/young, whale carcasses, caribou, and human garbage (COSEWIC 2008).

Once the sea ice forms in the late fall (approximately mid-November), polar bears (all but the pregnant females) redistribute across the ice and pregnant females excavate maternity dens. Non-pregnant females may also den for 0.5 – 4 months of the winter (Harington 1968) and fast, entering a state of near-torpor physiological conditions (Watts and Hansen 1987). Maternal denning occurs from late October to late February or early March in snowbanks along the banks of creeks and lakes or along slopes of hills and valleys. Females and their families are sensitive to disturbance during denning and rearing periods.

Polar bears are known to exist on Nottingham Island, likely on a year-round basis. Stewart and Lockhart (2004) indicated polar bears occupy Nottingham Island primarily as a summer retreat and denning area, and may occupy the off-shore area around Nottingham Island in the winter wherever suitable prey exist. Polar bear maternity dens may occur on Nottingham Island in valleys and other areas that accumulate a suitable amount of snow. During the traditional knowledge interviews, interviewees indicated that no known polar bear dens have been documented on Nottingham Island, yet it was advised that they likely occur.

Walruses found at Nottingham Island are part of the North Hudson Bay-Davis Strait population, which is estimated to contain 6,000 individuals (circa 1995). Populations between Nottingham and Salisbury islands have been reported in herds of between 500 and 1,000 individuals (COSEWIC 2006). Some populations are known to move westward toward Nottingham Island during the summer, concentrate on the shores of Nottingham Island during the fall (along with other areas), and return eastward for the winter. However some walruses may congregate year-round near Nottingham and Salisbury Islands, in the mobile pack ice (COSEWIC 2006). In particular, walruses are reportedly common in the winter within the near shore ocean area around Nottingham Island (Stephenson and Hartwig 2010). This area was greatly hunted in the 1970's, often in September and October; however, it is seldom visited now. A total of 461 walruses were counted in the Nottingham Island area during an aerial survey of August 1990 (Richard 1993). Walruses in Nunavut are considered Special Concern by COSEWIC, however they have no status or schedule under SARA (Species at Risk Public Registry 2013).

Suitable walrus habitat includes large areas of shallow water (80 m or less), an area that supports a productive bivalve mollusc community and nearby ice or land (COSEWIC 2006). Preferred land habitat is

characterized by low, rocky shores with easy access to the ocean. Breeding season occurs on the ice from February through April, implantation occurs around June or July, and young are born in late-May or early-June. There are several shallow water and beach-type habitats located near the Site, including the proposed barge landing area, which is likely suitable for walruses. Based on local knowledge, walruses commonly occur on or near Nottingham Island, including the shorelines near Site year round.

Ringed seals are one of the most widely distributed and abundant seals in eastern and northern Canada. They are common in summer near Nottingham Island, but tend to use larger and more sheltered shorelines during the winter and for pupping (Nunami Stantec 2012). One special adaptation of ringed seals that allows them to occupy areas unavailable to other marine mammals is their ability to maintain breathing holes in ice. Ringed seals are an important food source for polar bears. Ringed seals do not depend on land for any part of their life cycle (Nunami Stantec 2012).

Harp seals are thought to be numerous (estimated 8.1 million individuals in 2008), however potentially at some risk according to the Aboriginal Traditional Knowledge Subcommittee and are scheduled for assessment by COSEWIC. They are thought to be common in the summers around Nottingham Island (Nunami Stantec 2012). Harp seals are another food source for polar bears, however industrial activities, shipping, hunting, commercial fisheries and climate change pose potential threats to their populations in Nunavut. (Nunami Stantec 2012)

Bearded seals are not considered to be a species of concern in Nunavut although the data used to determine population status is considered insufficient. Bearded seals are widely spread throughout Nunavut but are much less abundant than ringed seals. They are thought to be common around Nottingham Island potentially year-round. Bearded seals are also an important food source for polar bears, as well as a source of nutrition for the Inuit of Nunavut (Nunami Stantec 2012).

Killer whales are distributed worldwide; however the Canadian population sizes and migratory patterns are not clearly understood. Their presence is considered uncommon near Nottingham Island, however their presence in the Arctic, including in Hudson Bay, is increasing with decreasing sea ice (Nunami Stantec 2012). Based on the local interviews, killer whales are reported migrants and are observed twice each year (likely immediately following ice-out and prior to ice-in). They are a top-level predator, as they feed on a variety of marine mammals and fish species. The largest source of mortality in the Canadian Arctic is thought to be hunting (Nunami Stantec 2012).

Beluga whales near Nottingham Island belong to two sub-populations, including the Western Hudson Bay and Eastern Hudson Bay sub-populations. Belugas from both sub-populations likely occur near Nottingham Island while on their spring and fall migrations (Stewart and Lockhart 2004). Belugas are believed to remain close to the shoreline of Hudson Strait while on their spring migration towards Hudson Bay where they remain through the summer, and travel along the shoreline and offshore near Nottingham Island while on their fall migration (Stewart and Lockhart 2004) to their wintering area in the North Atlantic and eastern Hudson Strait. The Eastern Hudson Bay population returns to the inshore and offshore areas from Inukuak to Kuujjuaraapik, in Hudson Bay, in the summer. In particular, Nastapoka River and Little Whale River are the main areas frequented by concentrations of belugas from mid-July to the end of August (COSEWIC 2004). They remain in their summer area until October, until they begin their migration to their wintering area near Ungava Bay. In the winter, these sub-populations are thought to reside primarily in Ungava Bay and northern coast of Labrador until the ice edge recedes in the spring.

Habitat requirements of beluga whales are seasonal; during the summer months they reside along shallow coastal areas to avoid predation. In the winter, beluga whales occupy the pack ice and polynyas in Hudson Strait, and follow ice leads. Threats to beluga whales include predation, environmental contamination, industrial activities, shipping, hunting, and commercial fisheries.

Narwhals are a species of whale that lack a dorsal fin and have a spiral tusk, which extends straight forward up to over 3 m (COSEWIC 2004). Nottingham Island is within their known range; however, outside their known concentration areas. Narwhals prefer deep fjords and continental slopes (Nunami Stantec 2012), suggesting they are not highly likely to be found close to the island. Narwhals likely pass by Nottingham Island during their spring and fall migrations. Threats to their populations include ice entrapment, predation, climate change, industrial activities, shipping, hunting, and commercial fisheries (COSEWIC 2004).

Bowhead whales near Nottingham Island are part of the Eastern Canada-West Greenland population, and they occur in a variety of marine habitats including open water, leads, polynyas, and heavy pack ice. They are thought to be common near Nottingham Island during the winter (Nunami Stantec 2012), and may also pass Nottingham Island during their spring and fall migrations. Bowhead whale populations were severely depleted by commercial whaling; however their numbers have begun to increase since protection from commercial fishing and are estimated to be in the thousands (COSEWIC 2009).

5.6.3 Birds

During the informal traditional knowledge interviews, a total of 27 bird species were identified as occurring or expected to occur on Nottingham Island. All bird species potentially occupying the Site are migratory, with only the Common Raven, Gyrfalcon, and Rock Ptarmigan occurring year round. Birds occupy all habitat types within the region for nesting, feeding, and or staging. As with breeding territories, the migration routes between wintering and breeding grounds are generally traditional and are used each year. Migration is influenced and governed by weather. Birds advance northward as the weather warms and return south when the weather cools. The speed of migration varies among species and is influenced by the annual prevailing weather patterns.

Many waterfowl and shorebird species migrate to the local area for the purposes of breeding and summer feeding, and for staging before continuing on with migration. Within the local area, waterfowl and shorebirds breed throughout the area in varying densities, and can be expected to breed in any habitat type that meets their nesting requirements. Known, is a colony of Common Eiders that nest off the east end of Nottingham Island (Latour *et al.* 2008) (approximately 3 km from the Site). Many waterfowl species show fidelity to nesting territories. By mid- to late May many of the waterfowl are occupying their nesting areas, and can be expected to depart sometime in September (Latour *et al.* 2008). The Hudson Strait, lakes, ponds, and watercourses in the area, as well as the low-lying tundra habitats are considered waterfowl habitat. Waterfowl habitat specifically at the Site and immediate surrounding area support waterfowl feeding habitat. Shorebirds may be expected to occupy the Site and proposed remedial activity sites for nesting and feeding during remedial activities.

Evidence of Canada and Snow geese occupying the Site was reported during the Phase III ESA. In particular, scat, feathers, and evidence of grazing was common. Tundra Swans and Canada Geese were also detected on inland lakes and a Pacific Loon was seen flying over the Site. Long-tailed Ducks (, Canada

Geese, and Herring Gulls were also seen in or near Hudson Strait. Notably, an unconfirmed sighting of six Harlequin Ducks was reported during the Phase III ESA approximately 3 km from the Site. These ducks were considered juveniles and were in a single group occupying a fast flowing stream and waterfall cascading from a bedrock outcrop. The sighting of Harlequin Ducks on Nottingham Island is considered uncommon. Although Harlequin Ducks are known to occur in Nunavut, their distributions and abundance are relatively unknown. Several Harlequin Duck surveys were conducted in Nunavut over five years (1998-2002), covering more than 2,000 km of coastline; however only three Harlequin Ducks were sited during those surveys (Mallory *et al.* 2008). A molting group of approximately 80 Harlequin Ducks was subsequently observed east of Cape Dorset in July 2004 (Mallory *et al.* 2008). Harlequin Ducks are listed as Special Concern (Schedule 1) under SARA (Species at Risk Public Registry 2013).

Raptors, such as Peregrine Falcons and Rough-legged Hawks may also occur on Nottingham Island during the summer nesting season, ranging from April to October. Gyrfalcons may occur on Nottingham Island year round. These species prefer to nest on cliff sites, usually near water. Possible nesting habitat for these species may occur along the bedrock ridges throughout the area, including the bedrock ridge directly north of the Site. However, at the time of the Phase III ESA, no nest sites were detected. In addition, the Site and local area would also support appropriate hunting habitat for these species. Raptors may be expected to occur at the Site and areas of remedial activity from May to October (Bechard and Swem 2002; White *et al.* 2002). No raptors were observed on Site during the Phase III ESA.

Few other bird species from small, migratory passerines to Rock Ptarmigan can be expected to use all available habitats within the project area predominantly in the summer. During the Phase III ESA, Snow Buntings were commonly observed occupying the Site and surrounding area.

5.6.4 Fish

Both freshwater and marine fish species have the potential to occur near the Site; however, no waterbody within the specific project boundaries are expected fish habitat, with the exception of Hudson Strait. Many seasonal, shallow pools and drainages exist in and immediately around the Site. Many of the watercourses in the vicinity of the Site are ephemeral to intermittent and flow in direct response to precipitation and/or runoff. Several permanent but shallow lakes also exist in the local area including the three optional potable water source lakes.

Fish and fish habitat exist throughout the local region. Permanent water bodies may support fish on a year round basis, whereas, intermittent watercourses may periodically support fish at different life stages. Based on the DFO Nunavut Operational Statement for In-Water Construction Timing Windows, water bodies and watercourses on Nottingham Island lie within Zone 1, which includes restrictions for fall spawning fish species (in water activities not permitted from September 1 to June 30). Fall spawners such as Arctic Char, may use waterbodies and watercourses in the regional area for all life history stages.

Across their range in Nunavut, Arctic Char are considered abundant (Nunami 2008), and are ranked by CESCC (2011) as Sensitive in Nunavut. Arctic Char are found in inshore marine waters, and freshwater lakes and rivers, and can be found far inland via larger river systems (Nunami 2008). Arctic Char may either remain permanently in freshwater or undertake an annual migration to the ocean in the spring (before or during ice breakup in June) and return to freshwater lakes/rivers in the fall to spawn and overwinter (Scott and Crossman 1979).

Arctic Char spawn in the fall over gravel or cobble shoals in shallow lakes or calm river pools (with waters less than 2 m deep). Over the winter, eggs develop in the gravel/cobble bottom substrates and emerge at ice breakup (Nunami 2008; Scott and Crossman 1979). Fry remain in the freshwater lakes, rivers, and smaller watercourses until approximately 5-7 years of age, then migrate to the ocean during the summer (Scott and Crossman 1979).

Marine fish, such as Arctic Cod, Greenland Cod, as well as Striped Shrimp may be expected to occur in Hudson Strait. Notably, Stephenson and Hartwig (2010) report the Hudson Strait near Nottingham Island is an important area for shrimp production.

Spawning, rearing and overwintering habitats that are critical to char populations may occur in deeper lakes neighbouring the Site and remedial activity areas, as well as in Hudson Strait. It is understood that people from Ivujivik have fished for char in an unidentified lake north of the Site.

5.6.5 Species of Concern

A total of nine wildlife species that have special conservation status may occur on or near Nottingham Island if suitable habitat exists (Table 4). These species may occur year round, and during their sensitive life history stages, such as breeding, nesting, and denning. Specific life history accounts for these species are described in the previous sections above and summarized in Table 4.

Of the wildlife of special conservation status potentially occupying Nottingham Island and surrounding area, only Harlequin Ducks were detected at the time of the field event (see Section 5.6.3).

Table 4: Species with Special Conservation Status Potentially at Nottingham Island

Common Name	Scientific Name	Conservation Status	NU Status	General Habitat and Season of Use
Polar Bear	*Ursus maritimus*	Special Concern (SARA Schedule 1)	Sensitive	Arctic coastal areas and islands, sea ice. Suitable habitat near Project year round.
Wolverine	*Gulo gulo*	Special Concern (COSEWIC)	Secure	Habitat generalist. Suitable habitat near Project year round.
Peregrine Falcon	*Falco peregrinus anatum/tundrius*	Special Concern (SARA Schedule 1)	Secure	Arctic tundra and coastal areas. Nests on cliff-ledges. Suitable habitat near Project during the summer.
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Sensitive	Coastal marine areas, fast-flowing rivers, islands and rocky coastlines during winter. Suitable habitat near Project during the summer.
Atlantic Walrus	*Odobenus rosmarus rosmarus*	Special Concern (COSEWIC)	Not Assessed	Areas of shallow, open marine water and nearby ice or land. Suitable habitat near Project year round.

Table 4: Species with Special Conservation Status Potentially at Nottingham Island

Common Name	Scientific Name	Conservation Status	NU Status	General Habitat and Season of Use
Beluga Whale	*Delphinapterus leucas*	Endangered/Special Concern (subpopulation dependent) (COSEWIC)	Not Assessed	In winter, found in polynyas and at the ice edge. In summer occurs in both coastal and deep marine waters. Suitable habitat near Project principally in the spring and fall.
Narwhal	*Monodon monoceros*	Special Concern (COSEWIC)	Not Assessed	Deep fjords and continental slopes. Suitable habitat likely exist well off-shore of Project in the spring and fall.
Killer Whale	*Orcinus orca*	Special Concern (COSEWIC)	Sensitive	Habitat generalist, marine areas without pack ice. Suitable habitat near Project during open water conditions.
Bowhead Whale	*Balaena mysticetus*	Special Concern (COSEWIC)	Not Assessed	Ice edges in Arctic bays, straits, and estuaries. Suitable habitat near Project in the spring, fall, and winter.

5.7 Cultural Features and Special Places

Two areas, including Fraser Island and Digges Sound have been designated as key biological areas, and are located within 100 km from the Site. These important biological areas support a large number of sea birds and marine mammals, which are sensitive to disturbance.

Fraser Island, approximately 45 km northwest of the Site, is designated as an Important Bird Area (IBA) in Canada (Latour *et al.* 2008). This small island, of variable topography and sparse vegetation, provides habitat for 1,000 to 3,000 pairs of nesting Common Eiders (*S. m. borealis*), equating to approximately 1 to 3% of the Canadian population. Both Fraser and Nottingham islands (where suitable habitat exists) are also considered important staging area for Common Eiders, particularly during the fall migration, as well as moulting areas (Latour *et al.* 2008). Common Eiders are sensitive to disturbance during the nesting and moulting life stages. Notably, eiders are known to abandon nesting sites in response to persistent disturbances (Latour *et al.* 2008).

Digges Sound, another area in the region designated as an Important Bird Area, an International Biological Programme Site, and a Key Marine Habitat Site in Nunavut (Latour *et al.* 2008). It is located between the Digges Islands and the Quebec coastline, approximately 65 km south of Site, and includes the neighbouring Cape Wolstenholme on mainland Quebec. Together these areas support approximately 20% of Canada's nesting population of Thick-billed Murres (Latour *et al.* 2008). Seabirds may be expected in this IBA from late April through September. Other species, such as Black Guillemots, Iceland, Herring, and Glaucous gulls, Arctic Terns, Atlantic Puffins, and Gyrfalcons also nest in this area. In addition, Digges Sound supports various sea mammal populations including beluga, bearded seal, ringed seal, and polar bear.

In addition to sensitive biological areas, known heritage resource sites have been documented on Nottingham Island. Notably, "old Eskimo graves" have been reported on the south end of Nottingham Island; however, there are no human remains associated with the collection (Golder 2012). During the archaeological survey in August 2012, this possible grave site was not confirmed, but rather considered to be located further south along the island from the Site area. However, four additional unrecorded sites were found, including a stone circle feature, a lithic scatter, a small stone square feature, and a possible stone circle (Golder 2012). The first three of these sites are considered to be of moderate significance. Whereas, the latter, the possible stone circle, is considered to be of low cultural significance (Golder 2012). These recognized sites are located at least 200 m from the Site and the proposed remedial activity areas. A detailed description of the heritage resource sites and a full summary of past cultures are provided in the Archaeological Impact Assessment (AIA) report provided under separate cover (Golder 2012).

During the AIA investigation, nine land use sites that represent evidence of human (typically but not exclusively Inuit) use of the land within the past 50 years were found. These land use sites include modern stone circles, possible Artisanal "mine", modern carin/ Inuksuk, cache, and tent rings/outlines. The majority of these land use sites are located near the Hudson Strait shoreline, particularly near the proposed RAP temporary camp option locations. These sites are not afforded protection under law, and there is no requirement to make accommodations for them during land use planning activities (Golder 2012).

6.0 SOCIO-ECONOMIC SETTING

The nearest communities to the Site are Ivujivik and Salluit, Quebec and Cape Dorset, Nunavut. Ivujivik is the closest of these communities and is located approximately 80 km south of the Site. Whereas, Cape Dorset and Salluit are located approximately 140 km northeast and 155 km southeast of the Site, respectively. Access to Ivujivik, Cape Dorset, and Salluit is by air, boat, or snowmobile. Like other Arctic coastal communities there is an annual sealift to bring supplies to each community during the open water season.

Ivujivik is Quebec's northernmost community, and is the smallest of the communities near Nottingham Island. A total of 68 private dwellings exist in the community of Ivujivik; supporting a population of approximately 349 (data from 2006) (Statistics Canada 2007a). The median age of the population is 19.1 years old (Statistics Canada 2007a).

Salluit is situated approximately 10 km inland from Hudson Strait along the narrow Sugluk Inlet, Quebec. A total of 264 private dwellings exist in the community. The population of Salluit is approximately 1,240, and the median age is 20.2 (data from 2006; Statistics Canada 2007b).

Cape Dorset, located in Nunavut, has a population approximately 1,236 individuals (data from 2006; Statistics Canada 2007c). A total of 356 private dwellings are known in the hamlet. The median age of the population was 22.1 (Statistics Canada 2007c).

All three communities are primarily comprised of people identifying themselves as aboriginal (Inuit).

Implementation of the remediation project would primarily create economic and social benefits for the three communities. The project would provide direct employment (and training) for community members who work on the proposed project, and spin-off employment and economic benefits the hospitality sector

and equipment operations in Ivujivik or other neighbouring communities in the north. If the Site is not remediated then no economic or social benefits (besides what currently exists) would be created.

6.1 Traditional Land Use

Subsistence hunting, fishing, and gathering are traditional land uses that continue today. Traditionally, people harvested wildlife, fished, and gathered berries and other natural materials for subsistence, survival materials, and trade. This not only provided basic life requisites, but also helped maintain their cultural identity and tied them to the land and their heritage. Traditional based hunting, fishing, and gathering of eider down feathers continues today on Nottingham and Fraser islands.

During the Phase III ESA, locals from Ivujivik indicated that they have been involved with hunting, fishing, and gathering activities on Nottingham Island and the adjacent Fraser Island sporadically throughout their lifetime. Local hunting, fishing, and gathering occur on Nottingham Island, particularly for walrus, ringed seal, Arctic char, and eider duck feathers. Trapping is not known to occur.

Nottingham Island was identified as being a particularly important area to hunt walrus. Walrus hunting occurs primarily in the fall even though walrus are reported to occupy the shorelines along Nottingham Island year round. Walrus hunting may occur wherever walrus occur; however, known hunts focus primarily on the southeast shoreline of Nottingham Island. Similarly, seal hunting may occur year round wherever seals occur.

In addition, gathering eider feathers, to later sell for profit, was also identified as being particularly important on Fraser Island, approximately 45 km northwest of the Site.

Lakes north of the Site are reportedly fished for Arctic Char. Specific lake locations where Arctic char fishing occurs are not known; however, Arctic char may be expected to occur in all lake of suitable habitat. Fishing may be expected to occur on Nottingham Island year round.

6.2 Employment

One of the major obstacles in small remote communities is the limited access to employment. Nunavut as a whole comprises a total of 27 communities spanning across nearly two million square kilometers (km^2) (Terriplan 2008). Similarly, Nunavik spans nearly 450,000 km^2, and includes 14 communities. No communities in Nunavut and Nunavik have road linkages connecting them to the rest of Canada. The communities of Ivujivik, Cape Dorset, and Salluit are appropriate examples of such issues. All three communities have populations less than 1,500, and are accessible only by air.

Skill sets needed to complete the proposed RAP include resident engineering experience, hazardous materials testing and abatement, environmental health and safety monitoring, soil sampling, geotechnical and materials testing, equipment operators, and labourers.

In Ivujivik, the median income of selected families reported in 2005 was $43,904 (Statistics Canada 2007a). Statistics Canada (2007a) indicated the existing labour force market for Ivujivik was dominated by sales and service occupations followed by social sciences, education, and government services. The employment rate in Ivujivik (circa 2006) was 51.2% (Statistics Canada 2007a).

Statistics Canada (2007b) reported the 2006 employment rate in Salluit was 50.3%, with the majority of the labour force in sales/services, social science, education, government services, or religion occupations. The median income reported in 2005 was $18,400, and the majority of the population (64%) do not have a high school certificate, diploma, or degree, 12% have an apprenticeship or trades certificate, 10% have a high school diploma, and 12% have a college diploma or higher (Statistics Canada 2007b).

Similarly, the 2006 employment rate in Cape Dorset was 48.1%, with the majority of the labour force occupying jobs in sales/services, social science, education, government services, or religion occupations, trades, and equipment operators, and arts and culture (Statistics Canada 2007c). Cape Dorset's' economy is supported by arts and crafts, particularly carving and print-making for which they are particularly known for. Other sales and services occupations, clothing manufacturing, government and government-related agencies (education, healthcare, and municipal services), and the trades/transport/contracting, and tourism-related occupations exist (Cape Dorset 2013). Sixty-four percent of the population aged 15 years and older have no high school certificate, diploma, or degree; 7% have an apprenticeship or trades certificate, and 13% have a college diploma or higher (Statistics Canada 2007c). The median income of persons 15 years of age and older was reported at $15,008 (Statistics Canada 2007c).

6.3 Community Services

Although the population of Nunavut as a whole remains low (total census population of less than 30,000 in 2006), it is the fastest growing population in Canada (Terriplan Consultants 2008). To meet the demands of this growing population, available community services are also growing.

The communities of Cape Dorset and Salluit have a wide variety of community and tourist services. In general, both communities have a school, community hall, hotels/inn/bed and breakfasts, tour operators, restaurant, building contracting, general retail stores, and outfitters. In contrast, fewer community services are known to exist in Ivujivik; however a pool hall, hotel, and retail stores are present. Cape Dorset has the nearest known health centre.

All three communities have regional airports, and all three communities have the potential to provide basic support services for the remediation project.

6.4 Aesthetic Values

Natural landscapes are highly valued for their aesthetic value and beauty. However, those landscapes that have undergone human-related disturbances are often much less valued. The natural landscapes at the Site have been disturbed by anthropogenic activities, buildings, road/trails, waste (both hazardous and non-hazardous), debris, and soil contamination. As is, the Site currently possesses low aesthetic value.

7.0 PROJECT-ENVIRONMENT INTERACTIONS

This EA has been prepared in a manner that is consistent with NIRB requirements as outlined in the Article 12 of the NCLA and the *Guide to Filing Project Proposals and the Screening Process* (NIRB 2007).

7.1 Identification of Valued Ecological and Socio-Economic Components

The NIRB (NIRB 2007) defines valued ecosystem components (VECs) as "those aspects of the environment considered to be of vital importance to a particular region or community", including:

- Resources that are either legally, politically, publicly or professionally recognized as important, such as parks, land selections, and historical sites.
- Resources that have ecological importance.
- Resources that have social importance.

Valued Socio-Economic Components (VSECs) are defined by the NIRB (NIRB 2007) as "those aspects of the socio-economic environment considered to be of vital importance to a particular region or community, including components relating to the local economy, health, demographics, traditional way of life, cultural well-being, social life, archaeological resources, existing services and infrastructure, and community and local government organizations."

Potential VECs and VSECs were identified in a three-stage process. Initially, a review of the regulatory responsibilities of applicable Nunavut and other government agencies was completed, including the NIRB. In addition, previous documentation of VECs and VSECs previously identified in the West Kitikmeot and North Baffin Land Use Plans, and outlined in the Nunavut Planning Commission Cumulative Effects Referral Criteria report (Nunami Jacques Whitford Ltd. 2009) also help ascertain components considered important to local stakeholders. Public concerns and general input gathered during the community consultations at Ivujivik, Salluit, and Cape Dorset were also incorporated in this identification process.

Once these VECs and VSECs are identified, they are confirmed during the field work and public consultation process and in discussions with local government. Finally, based on the activities in the RAP, professional judgement of environmental practitioners and remediation specialists identified any potential gaps in the VECs and VSECs previously identified. As a result of this process, a comprehensive list and selection rationale was developed and is outlined below in Table 5.

Table 5: List of VECS and VSECs and Selection Rationale

VEC or VSEC	VEC and VSEC Selection Process			
	Regulatory Requirement	Identified in other Environmental Assessment Reports	Public/Inuit Input	Professional Judgment
Climate and Air Quality	✓	✓		✓
Terrain and Geology		✓		
Soils	✓	✓	✓	✓
Hydrology	✓	✓	✓	✓
Vegetation	✓	✓		✓
Wildlife (Terrestrial Species)	✓	✓	✓	✓
Wildlife (Marine Species)	✓	✓	✓	✓
Fish (Freshwater Species)	✓	✓		✓

Table 5: List of VECS and VSECs and Selection Rationale

VEC or VSEC	VEC and VSEC Selection Process			
	Regulatory Requirement	Identified in other Environmental Assessment Reports	Public/Inuit Input	Professional Judgment
Fish (Marine Species)	✓	✓		✓
Cultural Features and Special Places	✓	✓	✓	✓
Employment	✓	✓	✓	✓
Traditional Land Use (eg. harvesting)	✓	✓	✓	✓
Community Services	✓			✓
Aesthetics	✓	✓		✓

7.2 Identification of Project Impacts and Mitigation

Using the VECs and VSECs as the primary focus for the analysis, the assessment of potential impacts for each environmental component begins with a review of the main project activities that could cause environmental disturbances during the proposed remedial program.

To determine the potential impacts to the various VECs or VSECs, the baseline information along with specific project activities outlined in the RAP were reviewed, and using professional judgement, project activities that would impact and/or interact with a specific VEC or VSEC were identified. As recommended by the NIRB (2010b) in *Screening Part 2 Form Project Specific Information Requirements (PSIR)* this process was completed using a matrix of project activities versus VECs and VSECs. This matrix and the results of the process are included in Table 6.

The evaluation of impacts for each environmental component is addressed in terms of the type or nature of effects that may occur following the application of appropriate environmental management and mitigation measures.

In NIRB (2007b) *Guide 2 Guide to Terminology and Definitions,* significance is defined as "…a consideration of the context of the project and the intensity of adverse effects, by giving particular regard to the following:

- The environmental sensitivity of the geographic area likely to be affected by the project;
- The historical, cultural, and archaeological significance of the geographic area likely to be affected by the project;
- The extent of the effects of the project, including the geographical area that will be affected, the size of the affected human populations, and the size of the affected wildlife populations and related habitat;
- The extent of the effects of the project on other regional human populations and wildlife populations, including the extent of the effects on Inuit harvesting activities;
- The magnitude and complexity of adverse effects;

- The probability of adverse effects occurring;
- The frequency and duration of adverse effects;
- The reversibility or irreversibility of adverse effects; and
- The potential for cumulative adverse effects given past, present, and future relevant events.

Environmental effects are defined as "any positive or negative change in the biophysical and/or socio-economic environment caused by, or directly related to, a former, ongoing or proposed activity" (NIRB 2007b). There are three types of effects:

- Direct effects - refer to changes in the environmental components that result from direct cause-effect consequences of interactions between the project activities and the environment;
- Indirect effects - result from cause-effect consequences of interactions between the environment and direct impacts. For example, the effect of pollution may not only be seen directly in the loss of local vegetation, but indirectly as a degradation of the health, culture, and social structure of the local people;
- Residual Effects – refers to impacts that remain after mitigation has been applied; and
- Cumulative Effects - refers to the accumulation of changes to the environment caused by human activities (e.g. past, existing, and proposed activities, including activities associated with the project under assessment). These changes occur over space and time and can be brought about by environmental effects that are additive or interactive. For example hunting, oil spills, and loss of habitat, commercial fishing pressure on prey species, can affect marine mammals in the Arctic.

Socio-economic effects are defined as "any of a variety of social and economic effects, including impacts upon the local economy, health, demographics, traditional way of life, cultural well-being, social life, archaeological resources, existing services and infrastructure, and local and regional government organizations" (NIRB 2007b).

Once an impact to a particular VEC or VSEC was identified, the impact was rated using the system outlined in Table 7 This rating system has been modified so that the definitions provided by NIRB have been considered and to make it suitable for this project.

Table 7: Impact Rating Criteria

Attribute	Options	Definition
Direction	Positive	Beneficial impact to population or resource
	Neutral	No change to population or resource
	Negative	Adverse impact to population or resource
Scope	Local	Impact restricted to area within 1 km of the Project site
	Regional	Impact extends up to several kilometers from the Project site
	Territorial	Impact extends throughout Nunavut
Duration	Short-Term	Impacts are significant for less than a year before population or resource returns to its previous state; or for a species, less than one generation
	Medium-Term	Impacts are significant for 1 to 10 years; or for a species, for one generation
	Long-Term	Impacts are significant for greater than 10 years; or for a species, significant for more than one generation
Frequency	Once	Occurs only once
	Intermittent	Occurs occasionally at irregular intervals
	Continuous	Occurs on a regular basis and regular intervals
Magnitude	Negligible	No measurable change from background in the population or resource; or in the case of air, soil or water quality, if the parameter remains less than the standard, guideline or objective
	Low	Impact causes <1% change in the population or resource (where possible the population or resource base is defined in quantitative terms)
	Moderate	Impact causes 1 to 10% change in the population or resource
	High	Impact causes >10% in population in resource
Probability	Low	The impact is unlikely to occur
	Moderate	The impact is fairly likely to occur
	High	There is a high probability of the impact occurring
Significance	Insignificant	Minimal or no measurable change from background conditions that may last over a long-term period (less than 10 years or for one generation)
	Significant	Measurable change from background conditions that may last over a long-term period (greater than 10 years or for more than one generation)
	Unknown	Insufficient data available to make a professional judgment, more study required.

Different project activities have similar impacts and impact ratings, and consequently, similar mitigation strategies; therefore, in the following sections, project activities with analogous impacts, impact ratings, and mitigation have been grouped together for each of VECs and VSECs. The following tables provide an assessment of project interactions, potential impacts and ratings, and mitigation strategies. A brief summary for each VEC is also included. A discussion, rather than a table format, is provided for VSECs and project interactions later in the report.

7.3 Project Impacts and Mitigation

7.3.1 Climate and Air Quality Impacts and Mitigation

Project-related impacts and mitigation for climate and air quality is provided in Tables 8a and 8b.

In summary, adverse impacts to climate and air quality are associated with all phases, including mobilization, remediation, and demobilization. As a result of this Project, emissions of greenhouse gases, nitrogen oxides (NO_x), sulphur dioxide (SO_2) particulate matter, and carbon monoxide (CO) due to combustion of fuel and gasoline, as well as the incineration of liquid hazardous waste and burning of non-hazardous wood waste will increase for the duration of the short-term activity. Emissions from construction equipment will be short term and intermittent and will not have a significant residual effect on the climate within the local study area, regionally, or nationally.

Adverse potential impacts to air quality are also associated with all phases, including mobilization, remediation, and demobilization. To complete the proposed remediation, heavy equipment, liquid waste treatment, and incineration equipment will be used and wood waste will be burned. In addition, a bedrock quarry will be developed and material will be crushed to useable sizes for backfill of the excavations. As a result emissions will increase due to combustion of diesel fuel and gasoline, incineration of liquid organic waste and burning of wood waste. Emissions from vehicles and construction equipment however will be short term and intermittent and will not have a significant residual effect on air quality within the local study area, regionally or nationally. Dust generation is expected to also be moderate in magnitude and intermittent in frequency, but insignificant.

A number of measures will be implemented to mitigate the potential adverse effects associated with Project activities. These will include, though not be limited to: dust suppression/control measures, implementation of good practice measures and avoidance of work during extreme wind events. There is potential for emissions of dioxins and furans through the incineration of liquid organic wastes and the inadvertent burning of hazardous wastes, but these will be managed by ensuring proper on-site diversion and segregation of waste, thus only appropriate waste streams are burned and / or incinerated. Additionally, the amount of soil exposed and disturbed will be limited to the areas requiring remediation and the movement of soils will be minimized whenever possible. A Best Management Plan (BMP) for Dust Control will be developed and implemented and will contain these and other measures. Following implementation of mitigation measures, adverse impacts associated with project activities to climate and air quality will be local, short term, and insignificant. No residual effects are anticipated, and are not expected to contribute to any adverse cumulative effects.

7.3.2 Terrain and Geological Impacts and Mitigation

Project-related impacts and mitigation for terrain and geology is provided in Table 9.

In summary, adverse potential impacts to the terrain and geology are primarily associated with the development of the proposed bedrock quarry and crushing operations. Impacts generally include the direct alteration of terrain and the potential for impact of the underlying permafrost. However, with the preparation and adherence to a Quarry Development Plan (and its recommended mitigation specific to the site) following the AANDC Representative assessment of quarry suitability, no significant impacts and

residual effects are expected. Additional negative impacts may occur during the preparation, handling, and transport of Site materials/equipment. Impacts may include rutting and alteration of the permafrost. These impacts can be mitigated and no residual effects are expected.

It is expected that the Project will have long-term beneficial effects at the sites due to the removal or treatment of hazardous waste and treatment of impacted soil as these sources of impact will have been removed. No significant cumulative impacts are expected.

7.3.3 Soil Impacts and Mitigation

Project-related impacts and mitigation for soil is provided in Table 10.

In summary, adverse potential impacts to soils are associated with all phases of the Project, including mobilization, remediation and demobilization, especially in the event of extreme precipitation. Adverse effects may include degradation of soil through compaction and/or admixing of topsoil and subsoil. Potential soil impact can occur from improper storage, transportation, and use of fuel and hazardous waste.

Adverse effects associated with extreme precipitation events include erosion, slumping or sliding of surficial materials (especially if construction of the bedrock quarry in an ice-rich zone). A number of measures will be implemented to mitigate the potential adverse effects associated with project activities. These will include, though not be limited to, locating access routes and storage areas on previously disturbed areas, limiting the area and time that permafrost is exposed, re-contouring and grading to ensure that landforms match pre-disturbance conditions as much as possible. Other measures include avoiding working with equipment during extreme precipitation events, using rubber tracked equipment, and if required separating topsoil and subsoil during construction activities. A soil handling protocol will be developed prior to construction activities, as well as a quarry development plan to minimize erosion during operations and after reclamation.

To mitigate potential soil impacts, fuel and hazardous material will be stored in an easily accessible bermed area, and hazardous waste and fuel storage areas (including drums) will be inspected daily. Fuel and hazardous material containers will be stored in a manner that allows easy removal in case of a leak or spill. A Spill Contingency BMP will be developed and implemented, and along with spill containment equipment, be available to all workers on-site.

Overall, the removal of abandoned site infrastructure and debris, removal or treatment of hazardous and non-hazardous waste, and removal or treatment of impacted soil will be beneficial to soil resources as sources of impact will be removed and soil quality at the Site will improve. Following implementation of mitigation measures, adverse effects associated with project activities to soils will be local, short term, and insignificant. Additionally, these impacts are not expected to contribute to any adverse and cumulative effects.

7.3.4 Hydrology Impacts and Mitigation

Project-related impacts and mitigation for hydrology is provided in Table 11.

In summary, no remedial activities are proposed in freshwater and marine waters, and no in-water infrastructure or works are anticipated for the construction or the barge landing. Adverse potential

impacts to aquatic resources and water quality are possible during all phases of the Project due to potential leaks or spills and sedimentation events (especially during extreme rainfall events). Silt generated by the use and movement of heavy equipment and remediation equipment across the site, the excavation of impacted soil, the construction and operation of the quarry, bedrock crusher, and barge landing, along with fugitive dust emissions may have an effect on surface water quality and could impact local aquatic environments. Surface water impacts could occur from improperly storing and transporting fuel, explosives, and hazardous waste, refuelling equipment, improper incinerating and / or burning of hazardous and non-hazardous waste. In addition, potential impacts to marine water quality from spills and ballast water from shipping operations may occur. To avoid and minimize potential impacts from shipping related operations, personnel will be knowledgeable and responsible for complying with shipping best management practices including all transportation procedures on and off-site such as the Transportation of Dangerous Goods Act, the Canada Shipping Act, and Arctic Waters Pollution Prevention Act and their regulations.

A number of environmental protection measures will be incorporated to reduce the likelihood of surface and groundwater impacts such as developing and implementing a Spill Contingency BMP which will include measures such as having containment equipment available, storing fuel and hazardous material and refuelling of equipment at least 100 m from waterbodies, and proper treatment of waste water. In addition, a quarry development plan will be developed and implemented with consideration to minimize footprint (including any access road) and water management, use of blast mats to minimize flying rock hazards, avoid ice-rich permafrost or slopes prone to erosion (wherever possible), progressive remediation during operations, and a reclamation plan.

Erosion and sediment release can occur at any time, but especially at the beginning of construction (therefore sedimentation control barriers should be placed as soon as possible), and during precipitation events or during snowmelt. The highest potential for sedimentation occurs during clearing, grading, and during activities in or near freshwater and marine shoreline. Specific mitigation measures for the protection of water quality from sedimentation will be in the Sedimentation Control BMP and Quarry Development Plan and will include limiting the disturbance of any new areas and placing temporary sedimentation control barriers.

Overall the remediation activities are expected to have positive impact on the hydrology with removal of hazardous and non-hazardous materials, and impacted soil. Following implementation of mitigation measures, adverse effects associated with project activities to the hydrology of the project areas will be local, short-term in duration, and insignificant. These impacts are not expected to contribute to any adverse cumulative effects.

7.3.5 Vegetation Impacts and Mitigation

Project-related impacts and mitigation for vegetation is provided in Table 12.

In summary, adverse potential impacts to vegetation are associated with all phases of the Project. The movement of heavy equipment, transporting equipment, and remediation equipment across the site, upgrading trails, camp construction, bedrock quarry development and operation, construction and operation of the barge landing/staging, removing waste and debris, and recontouring will result in fugitive dust emissions. Dust suppression and control measures will be implemented, thus dust is not expected to

have a significant effect on adjacent vegetation. Remediation will significantly remove the long-term potential for vegetation damage due to removal of impacted soils. Longer term impacts on vegetation are expected from disturbance during infrastructure and debris removal, hazardous and non-hazardous waste removal, storage and transport, upgrading trails, and camp and storage area construction. To minimize the potential for direct loss and / or alteration of vegetation, remediation activities will be limited to the footprint of previously disturbed areas as much as possible. Extreme windy conditions may exacerbate fugitive dust, extreme rainfall may exacerbate erosion and rutting, and accidental hydrocarbon spills have the potential to adversely affect vegetation. In addition, progressive remediation during and after quarry operations will be developed and implemented. With appropriate mitigation, such as proper fuel storage, erosion control, and dust control measures the probability of significant adverse effects is anticipated to be low. Residual effects on vegetation may remain until natural revegetation occurs; however, any residual effects are considered insignificant. These impacts are not expected to contribute to any adverse cumulative effects.

7.3.6 Wildlife Impacts and Mitigation

Project-related impacts and mitigation for terrestrial and marine wildlife is provided in Tables 13a and 13b, respectively.

In summary, adverse potential impacts to terrestrial and marine wildlife are associated with all phases of the Project. Noise related disturbances from the remedial activities; particularly, the bedrock quarry and crushing operations are considered the most disturbing to terrestrial and near-shore marine species. Remedial activities will be conducted outside sensitive polar bear and small mammal denning and nest initiation and egg laying periods. However, these activities will occur primarily during the sensitive rearing/fledging season as well as early fall migration.

No remedial activities are proposed in marine waters, and no in-water infrastructure or works are anticipated for the construction or the barge landing. Barges were previously used to access the site while in operation, and therefore, the current water depth and other site conditions are anticipated to be appropriate for current barge use. Shipping activities principally being conducted throughout the Project are considered the most disturbing to marine wildlife. Shipping activities are to occur during open water season only (mid-July to mid-November), at a time when few sensitive marine species may be occupying the area. The proposed shipping activities do not overlap with sensitive birthing areas or core-use areas for bowhead whale, beluga whale, and narwhal and subsequently these species are considered at low risk of contact with shipping activities. However, shipping activities may coincide with early fall migration of these species. Walrus and ringed and bearded seals may occupy the area around Nottingham Island year round, and may be directly impacted by remedial activities. Barge operations may impact marine wildlife species occurring in the area and their habitat by causing avoidance and disruption of movement patterns and introduction of non-native species from ballast waters. A number of mitigation measures will be implemented to avoid and minimize impacts from barging operations including, managing travel and speeds, minimizing barge and landing craft travel, suspend barging/landing craft operations if marine wildlife in the bay, and strictly following the *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act*.

Adverse effects may include sensory disturbance, disruption of wildlife movement, habitat loss and alteration, direct and indirect wildlife mortality as a result of project activities, and wildlife/human interactions. Noise from equipment, quarry development and crushing operations, barging/landing craft operations, and remediation and human activities will likely result in the temporary avoidance of the area by most wildlife, and may result in changes in local movement patterns of wildlife (both terrestrial and near-shore marine species). The impacts from noise are considered to be of low magnitude based on the few potential species present and small number of individuals. Maintaining equipment in good working condition, turning equipment off when not in use, use of mufflers, reducing barge/landing craft speeds, minimizing blasting and crushing operations and barging/landing craft traffic will reduce the effects of noise on wildlife.

Nest sites, burrows, or dens maybe disturbed during the demolishment of infrastructure and the removal of non-hazardous waste, hazardous waste (including containers) and debris. Infrastructure should be checked for all wildlife species. In the event that remediation activities cannot be completed without disturbing/destroying nests or burrows associated with migratory birds or species of special concern a wildlife officer from the Government of Nunavut should be contacted for additional guidance and/or to obtain a permit authorizing the removal of nests or disruption of habitat once the nest/burrow becomes inactive.

The potential for wildlife and human interactions during the Project is possible, especially at the camp location; however, it is expected that such encounters will be short-term, infrequent, and insignificant. Polar bear, wolverine, foxes, wolves, and ravens may also be attracted to the site. Proper containment and disposal of wastes/garbage, petroleum products, and explosives, prohibiting feeding of wildlife, and training of workers in wildlife interactions and bear safety will reduce the probability of adverse wildlife encounters.

Leaks or spills of stored hazardous waste or fuel are possible and could impact wildlife and wildlife habitat. Similarly, sedimentation in the marine environment from erosion and sediment release along the shorelines may impact wildlife habitat. Previous measures outlined for preventing or dealing with spills, leaks, and erosion control will be implemented. The development and implementation of a Wildlife Management BMP, Spill Contingency Plan, and Sedimentation Control BMP (including minimizing barge/landing craft speeds) will assist in minimizing project impacts on wildlife and wildlife habitat.

Overall, the removal of abandoned site infrastructure and debris and remediation of impacted soils will improve habitat quality and thus, have long-term benefits for wildlife. Following implementation of mitigation measures, adverse effects associated with project activities to wildlife will be local, short-term, and insignificant. These impacts are not expected to contribute to any adverse cumulative effects.

7.3.7 Fish Impacts and Mitigation

Project-related impacts and mitigation for freshwater and marine fish are provided in Tables 14a and 14b, respectively.

In summary, no remedial activities are proposed in or immediately adjacent to freshwater fish habitat. Similarly, no remedial activities are proposed in marine waters, and no in-water infrastructure or works are anticipated for the construction or the barge landing. Barges were previously used to access the site

while in operation, and therefore, the current water depth and other site conditions are anticipated to be appropriate for current barge use. However, adverse potential impacts to freshwater and marine fish habitat are possible during all phases of the Project due to potential spills and sedimentation events (especially during extreme rainfall events and from barging activities) and transporting equipment, personnel, and remedial products. Silt generated by the use and movement of heavy equipment (including barges and landing crafts) and remediation equipment across the site, the excavation of impacted soil, the construction and operation camp and barge landing/staging area, along with fugitive dust emissions may have an effect on freshwater and marine fish habitat. In addition, fish habitat could be impacted from improperly storing and transporting fuel and hazardous waste, refuelling equipment, and improper incinerating and / or burning of hazardous and non-hazardous waste.

A number of environmental protection measures will be incorporated to reduce the likelihood of fish habitat impacts such as developing and implementing a Spill Contingency BMP which will include measures such as having containment equipment available, storing fuel and hazardous material and refuelling of equipment at least 100 m from any waterbodies (except with the barge/landing craft) and proper treatment of waste water. Construction design of the bedrock quarry must ensure that erosion into surrounding freshwater fish habitat will not occur. Erosion and sediment release can occur at any time, but especially at the beginning of construction (therefore sedimentation control barriers should be placed as soon as possible, where required), and during precipitation events. Specific mitigation measures for the protection against sedimentation will be in the Sedimentation Control BMP and will include limiting the disturbance of any new areas and placing temporary sedimentation control barriers.

Barge operations may impact marine fish and fish habitat by causing avoidance and disruption of movement patterns and introduction of non-native species from ballast waters. A number of mitigation measures will be implemented to avoid and minimize impacts from barging operations including, managing travel and speeds, minimizing barge and landing craft travel, and strictly following the *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act*.

Overall the remediation activities are expected to have positive impact on the freshwater fish habitat with removal of hazardous and non-hazardous materials, and impacted soil. Following implementation of mitigation measures, adverse effects associated with project activities to the freshwater fish in the project area will be local, short-term in duration, and insignificant. These impacts are not expected to contribute to any adverse cumulative effects. Similarly, the remediation activities are expected to have short duration negative impact on the marine fish, principally from barging activities and construction and operations along the shoreline. Following implementation of mitigation measures, adverse effects associated with project activities to the marine fish in the project area will be local, short-term in duration, and insignificant. No residual impacts to freshwater and marine fish are anticipated and any potential impacts are not expected to contribute to any adverse cumulative effects.

7.3.8 Cultural Features and Special Places Impacts and Mitigation

Several important biological areas (IBAs) are located 45 km and 65 km to the northwest and south of the Site, respectively. Based on the proposed RAP, all remedial activities will occur well away from these sites, including barging. Impacts to these designated IBAs will be neutral in direction.

During the AIA field investigation, four previously unrecorded archaeological sites were recorded and documented, including is a stone circle feature, a lithic scatter, a small stone square feature, and a possible stone circle (Golder 2012). These four sites were considered in planning the remedial activities and no Project-related infrastructure and activities are proposed at or adjacent to these identified sites. All known archaeological sites are located well away from the nearest remedial activity and/or infrastructure, with exception of the small square stone feature located approximately 200 m east of the Site. Additional archaeological sites are located approximately 250 m across the narrow inlet from the barge landing area (on top of a bedrock outcrop), and at least 2 km northeast of the Site. No RAP-related activities or infrastructure will disturb any known archaeological site.

Current mobilization, remediation, and demobilization activities proposed will be cognisant to avoid any known archaeological site identified in the AIA. To protect the known archaeological sites, locations of the nearest sites to RAP-related activities will be identified and their boundaries, with a buffer, will be visibly marked to ensure they are avoided. Location and boundary markers will be removed once remediation activities are completed. However, to maintain the integrity of the other distal sites, the location of these sites will remain confidential as no Project-related activities will occur in their proximity.

No mitigation is planned for the nine land use sites identified in the AIA that represent recent human use.

7.4 Socio-Economic Impacts and Mitigation

7.4.1 Job Opportunities and Current Employers

The Project will result in positive socio-economic benefits to the communities of Ivujivik (the nearest community), and possibly Salluit. An Aboriginal Opportunities Considerations (AOC) section will be included in the contract for the work. The AOC will guarantee minimum levels of Inuit employment and Inuit sub-contracting. Project procurement proposals will be evaluated based on criteria such as socio-economic benefit, technical content and cost. Individuals and businesses will be able to benefit through employment and procurement opportunities and related economic benefits. Employment opportunities could provide positive economic benefit through skills acquisition and work experience. Some of the possible employment opportunities could include:

- Camp staff;
- Equipment operators;
- Mechanics;
- Surveyors;
- Trades;
- Labourers;
- Wildlife monitors;
- Interpreters;
- Health and safety officer; and

- Sampling scientist.

No negative impacts to job opportunities and current employers are expected, and therefore, no residual impacts are expected.

7.4.2 Traditional Land Use

Subsistence hunting and fishing activities may occur in the region of the Site and at the same time as Project-related activities. All project related activities are expected to occur during the open barging season (mid-July to mid-November) for approximately three years.

A schedule of Project-related activities, once known, will be provided to the appropriate Hunters and Trappers Organizations (HTO). Potential impacts to the traditional land uses in the project area will be short-term in duration and can be mitigated with proper communications. Positive residual impacts are expected with the removal of non-hazardous and hazardous waste and clean-up of impacted soil at the site. This will improve wildlife habitat and aesthetics; therefore, potentially increase traditional land use activities following the remedial activities.

7.4.3 Community Services

It is expected that much of the labour force for this Project would come from Ivujivik, Salluit, and Cape Dorset. This positive impact would be of short duration (approximately 3 years). Specific experience gained during the completion of the work may have a positive residual impact on the communities.

While many of the staff required to complete the remedial activities may be local, some individuals from outside these communities will likely be needed for the duration of the remedial activities. This influx of people is expected to be small and is not expected to impact the communities as most staff will be staying at the camp that will be set up at Site.

7.4.4 Aesthetics

The proposed remedial activities will have a positive impact to the aesthetics of the Site, as buildings will be demolished and all debris will be removed. A short-term negative aesthetic impact will result from the excavation of the impacted soil and demolition of the buildings. Once the remedial activities cease, all Site related products/materials are removed from the site, the excavations backfilled, and the Site recontoured to match existing terrain, the whole aesthetic impact is considered positive. No residual impacts to aesthetic impacts are expected.

8.0 RESIDUAL IMPACTS AND CUMULATIVE EFFECTS

The proposed remediation program at the Site will initially disturb the existing terrain and environmental conditions of the local area. However, given the limited environmental footprint of the Site and the subsequent remedial activities, the overall impact of the proposed remediation project will be positive. In the long term, the remediation project will facilitate the return of soil, water, vegetation, and wildlife habitat to pre-disturbance conditions.

Residual impacts are impacts that remain after mitigation has been applied. The remediation of the Site is not expected to result in any negative residual impacts, and will have an overall positive effect on the environment.

Cumulative effects occur when two or more concurrent project-related activities and residual impacts interact either additively or synergistically to further impair the effect on a VEC or VSEC. The process of determining cumulative effects first requires an understanding the premise that more than one activity, acting on the same resource, has an effect of concern (Nunami Jacques Whitford Limited 2009). In addition, the temporal scale of the cumulative effects assessment includes known activities that have occurred in the past, present, and foreseeable future (ie. projects currently under regulatory review or are proposed for regulatory review).

Past and present activities known to occur on or near Nottingham Island include the former weather and radio station operation, hunting, fishing, and gathering activities, and summer barge traffic through Hudson Strait. Future projects include the Mary River Iron Mine project barging activities. The Mary River Iron Mine Project proposes a southern shipping route along Hudson Strait, north approximately 40 km from Nottingham Island (and approximately 90 km from the Site) during the open-water season (a similar shipping route is also proposed north of the Mary River mine site through Milne Inlet). Based on the Development Proposal submitted to the Nunavut Impact Review Board, a fleet of ships including those capable of breaking ice will operate year round for approximately 21 years once the mine is operational. During mine construction, shipping activity is proposed through the Milne Inlet, and not through the Hudson Strait. A spill sensitivity assessment was conducted for this future project, and it was determined that shorelines outside 15 km from the proposed shipping lane was unlikely to be contacted during a spill, including Nottingham Island (Harper 2010).

Similarly, sealifts are a vital link for Nunavut and Nunavik communities. Sealifts are the most economical resource to resupply residents with their annual goods and materials, as well as construction material, equipment, vehicles, and non-perishable items.

The few barge trips related to the Project are proposed to travel primarily along the shipping route south of Nottingham Island, and will merge with the Hudson Strait shipping route also used for the community sealifts and the Mary River Iron Mine. These few Project related barge trips will occur during the open water season over two years. With adherence to mitigation and best management practices, these few barge trips are not considered to have any noticeable residual impact, and are not considered to act cumulatively with the existing sealift and Mary River Iron Mine ship traffic.

However, it can be assumed that hunting, fishing, and gathering will continue to take place on Nottingham Island. Given that the Project will generally have an overall positive local affect, with no residual impacts, the remediation of the Site is not considered to act cumulatively with other past, existing, or future land use activities on the island.

9.0 MONITORING PROGRAM

Project monitoring has two objectives:

- Monitor implementation of the Project to confirm compliance with the remediation objectives and accuracy of impact predictions; and
- Monitor the long-term success of the Project; measuring environmental conditions against triggers and thresholds that would initiate adaptive management and contingency plans.

The NIRB (2007b) defines monitoring as the systematic observation or tracking of an activity to determine whether it is proceeding or functioning as expected. Through monitoring, the accuracy of environmental impact predictions is assessed. Two different monitoring activities that will be incorporated into this Project are identified below:

- Effects monitoring is the process of measuring and interpreting changes to environmental and socio-economic parameters to identify relevant project effects, and may involve assessing the accuracy of impact predictions contained in the Project impact statements; and,
- Compliance monitoring is the process of determining whether and to what extent the activity is carried out according to regulatory requirements, including terms and conditions contained in NIRB project certificates.

Based on the NIRB definition and the monitoring objectives, compliance monitoring will be completed for the duration of the remedial activities. This will include such actions as adherence to safety standards, sampling protocols, and reporting schedules. A monitoring plan will be completed prior to the work being conducted that will outline requirements of compliance monitoring based on regulatory and industry standards.

10.0 KNOWLEDGE DEFICIENCIES

Information on the biophysical conditions present at the Site and local area was collected primarily during a one day field study, due to inclement weather conditions restricting site access the additional planned field days. While this information is adequate for the scope of this work, there are some knowledge deficiencies with respect to remediation work in the arctic that are not specific to this project.

The suitability of the existing site conditions for a barge landing and bedrock quarry are currently unknown until the assessment by the selected AANDC Representative. Until this time, no in-water works and infrastructure are anticipated to support barging activities for this Project, and a suitable bedrock quarry is expected within 100 m of the Site. Once following the additional assessment, if in-water works and infrastructure are required this EA will be reissued with the applicable changes.

11.0 PUBLIC INPUT AND CONCERNS

Informal traditional knowledge interviews were conducted as a record of current and historic wildlife occupancy, distribution, and harvesting activities in the local and regional area. Suitable local persons and elders available for the interviews were suggested by the Ivujuvik Town Manager and the bear monitors on site. Information collected from these interviews supplement scientific species accounts and have been discussed throughout this EA.

To collect public input and to receive public concerns regarding the Project, community meetings were held in Cape Dorset, Ivujivik, and Salluit on January 28 and 29, 2012, respectively, to discuss the draft RAP. In total, approximately 50 members of the local communities attended the meetings. The primary concerns of the community members in attendance were the clean-up of the Site, job opportunities, removal of buildings, negative wildlife impacts, and community involvement.

12.0 CONCLUSION

The proposed remedial activities at Site are expected to occur over approximately three summer seasons. At the end of the Project, all Site-related products will be removed and transported off-site. The mitigation strategies outlined for the remediation of the Site are predicted to result in no negative residual impacts of significance, and overall, the remediation of the Site will have a positive effect on the environment by removing impacted soil, non-hazardous debris, and hazardous material from the Site. Cumulative environmental impacts occur when impacts, in particular residual impacts, from two or more concurrent project activities combine either additively or synergistically to further exacerbate the impact on a VEC or VSEC. Given that the project will have a positive impact on the environment and has no significant residual impacts, the remediation of the Site will not add to the cumulative environmental effects of other land use activities in the local area.

13.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Sincerely,
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TABLES

Table 6. Identification of Project Related Impacts on VECs and VSECs

VEC or VSEC	Site Preparation and Camp Operations				Remediation					Closure	
	Mobilization, Transportation of Personnel and Equipment	Trail, Barge Off-Loading Area, and Camp[1] Construction;	Development of Bedrock Quarry and Crushing Operations	Camp Setup and Operation – Waste Treatment Systems and Maintenance	Structure Demolition and Debris Removal	On-Site Burning of Non-Hazardous Wood Waste	On-Site Incineration of Liquid Organic Waste	On-Site Preparation/ Handling of Hazardous and Non-Hazardous Solid Waste	Off-Site Transportation of Remedial Products	Site Recontouring, Backfilling, and Natural Revegetation	Demobilization and Transportation of Personnel, Equipment, and Remedial Products
Climate and Air Quality	√	√	√	√	√	√	√		√	√	√
Terrain and Geology		√	√						√	√	
Soils		√	√	√		√	√		√	√	
Hydrology		√	√			√			√	√	
Vegetation		√	√	√					√	√	√
Wildlife (Terrestrial Species)	√	√	√	√	√	√	√	√	√	√	√
Wildlife (Marine Species)	√	√	√	√					√	√	√
Fish (Freshwater Species)	√	√	√			√	√		√	√	√
Fish (Marine Species)	√	√				√	√		√		√
Cultural Features and Special Places	√								√		√
Employment	√	√	√	√	√	√	√	√	√	√	√
Traditional Land Use	√	√	√	√	√	√	√	√	√		
Community Services		√	√						√		
Aesthetics		√	√	√					√	√	

1. For the purposes of this ESR, a 24-person on-site temporary camp is assessed rather than the option of barge accommodations.

Table 8a: Assessment of Impacts on Climate

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			
Mobilization and transportation of personnel and equipment Trail, barge landing area, and camp construction; Camp equipment setup and operation – waste treatment systems and incineration, and maintenance	Greenhouse gas emissions from equipment operation and camp waste incineration	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Equipment will be regularly maintained. Incinerator designed to meet air quality guidelines. Air quality monitoring during incineration to ensure compliance with applicable air emission standards including the Canada-Wide Standards for Dioxins and Furans. Water and/or approved dust suppressants will be used during backfilling. Greenhouse gas emissions from this project are insignificant so mitigation is not required
Remediation			
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Greenhouse gas emissions from wood waste, from incineration activities, and from equipment operation		
Closure			
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Greenhouse gas and fugitive dust emissions from equipment operation		

Table 8b: Assessment of Impacts on Air Quality

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations		Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Development and implementation of a Dust Control Best Management Practices (BMP), such as using water for controlling dust and limiting remediation activities during high wind periods Exhaust emissions for project are insignificant so mitigation is not required
Trail, barge landing area, and camp construction	Dust from upgrading trails, and camp and barge off-loading area construction Exhaust emissions from equipment operation		
Development of bedrock quarry and crushing operations	Release of fugitive dust from blasting and crushing operations	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Moderate Probability: High Significance: Insignificant	Development and implementation of a Dust Control Best Management Practices (BMP), such as designing the quarry face with consideration of prevailing winds to direct dust away from the Site, use of water and/or approved dust suppressants, use of dust skirts on conveyors, and ceasing operations during strong wind conditions
Remediation		Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: Low (hazardous emissions) High (particulate matter) Significance: Insignificant	Proper segregation of wood from other material so only wood is burned Proper training of burning operators to ensure high temperatures to limit particulate emissions
On-site burning of non-hazardous wood waste	Potentially hazardous air emissions if hazardous material is burned with wood Potentially increased emissions of particulate matter		
On-site incineration of liquid organic waste	Potentially hazardous air emissions from moving and incinerating hazardous material (e.g., dioxins and furans); Potentially increased emissions of particulate matter Exhaust emissions from equipment operation	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: Low Significance: Insignificant	Incineration equipment only operated by trained contractor and equipment is properly maintained to ensure the liquid organic waste is completely incinerated and particulate emissions are controlled Exhaust emissions for project are insignificant so mitigation is not required
Structure demolition and debris removal On-site compaction of hazardous solid waste On-site handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Potential emissions of hazardous waste particles and dust while completing remediation activities Exhaust emissions will result from equipment operation	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: Medium Significance: Insignificant	Development and implementation of a Dust Control BMP, such as using water for controlling dust and limiting remediation activities during high wind periods Careful segregation and transportation of hazardous waste Exhaust emissions for project are insignificant so mitigation is not required
Closure		Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Development and implementation of a Dust Control BMP, such as using water for controlling dust and limiting remediation activities during high wind periods Exhaust emissions for project are insignificant so mitigation is not required
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization of camp and construction equipment Off-site transportation of remedial products	Potential dust emissions while recontouring disturbed areas and backfilling excavations Exhaust emissions from equipment operation		

Table 9: Assessment of Impacts On Terrain And Geology

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			
Trail, barge landing area, and camp construction	Site preparation and construction activities could disturb the terrain and potentially damage permafrost	Direction: Negative Scope: Local Duration: Short-Term Frequency: Once Magnitude: Low Probability: High Significance: Insignificant	Use existing trails and previously disturbed areas to the fullest extent possible Limit creation of new disturbed areas Disturbed areas will be recontoured to match pre-disturbance conditions to the fullest extent possible
Development of bedrock quarry and crushing operations	Bedrock quarry development will alter the existing terrain, and potentially damage permafrost Fugitive dust and rock from operation may damage permafrost	Direction: Negative Scope: Local Duration: Long-Term Frequency: Once Magnitude: Low Probability: High Significance: Insignificant	Develop a Quarry Development Plan with consideration to minimize footprint (including any access road) and water management, use of blast mats to minimize flying rock hazards, avoid ice-rich permafrost or slopes prone to erosion (wherever possible), and progressive remediation during operations
Remediation			
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Remediation activities and handling and transport of materials could disturb the terrain causing rutting and potentially damage permafrost	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Low Probability: Moderate Significance: Insignificant	Minimize disturbance to the terrain Restrict off-road travel Use tracked equipment to minimize rutting Controlled burn in non-permafrost areas and in containers
Closure		Direction: Negative Scope: Local Duration: Short-term Frequency: Once Magnitude: Low Probability: Moderate Significance: Insignificant	Minimize disturbance to the terrain Restrict off-road travel Use tracked equipment to minimize rutting Land surface will be recontoured to match pre-disturbance conditions to the fullest extent possible Develop a Quarry Development Plan with progressive remediation during and after operations Crushed bedrock material used to backfill excavations Surface area and time of permafrost exposure will be minimized
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Activities could disturb the terrain and potentially damage and/or expose permafrost		

Table 10: Assessment of Impacts On Soil

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations		Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available to all workers on-site Fuel will be stored in easily accessible and bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Use proper explosives handling techniques Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)
Mobilization and transportation of personnel and equipment to site Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations Camp equipment setup and operation – waste treatment systems, incineration, and maintenance	Potential impact of soil from spills when refuelling and servicing equipment		
Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations	Degradation (erosion, compaction, admixing) of soil during site preparation activities	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Low Probability: Moderate Significance: Insignificant	A Soil Management BMP will be developed and implemented Develop a Quarry Development Plan with consideration to minimize footprint (including any access road), avoid ice-rich permafrost and slopes prone to erosion (wherever possible), and progressive remediation during operations Use existing roads, pathways and previously disturbed areas to the fullest extent possible Soil will not be disturbed or handled during wet and / or windy conditions Rubber tracked equipment will be used where appropriate
Remediation		Direction: Negative (beneficial once non-hazardous and hazardous materials and impacted soil have been removed from the site) Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available to all workers on-site Fuel and hazardous material will be stored in easily accessible and bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Hazardous waste and fuel storage areas (including drums) will be inspected daily All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soil Hazardous materials and impacted soil will be exposed for as short time as possible
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site preparation/handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Potential impact on soil from spills when refuelling and servicing equipment Potential soil impact while removing, transporting, burning or incinerating remediation materials		
Structure demolition and debris removal Impacted soil removal Off-site transportation of remedial products	Degradation (erosion, compaction, admixing) of soil during remediation activities such as removing waste and impacted soil	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Low Probability: Moderate Significance: Insignificant	A Soil Management BMP will be developed and implemented Use existing roads and previously disturbed areas to the fullest extent possible Topsoil (if present) and subsoil will be handled and stored separately Soil will not be disturbed or handled during wet and / or windy conditions Rubber tracked equipment will be used where appropriate
Closure		Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available to all workers on-site Fuel will be stored in easily accessible and bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Potential impact of soil from spills when refuelling and servicing equipment		

Table 10: Assessment of Impacts On Soil

Project Activity	Potential Impact	Impact Rating	Mitigation
Site recontouring, backfilling, and natural revegetation of disturbances	Degradation of soil (erosion, compaction, admixing) during recontouring	Direction: Negative Scope: Local Duration: Short-term Frequency: Once Magnitude: Low Probability: Moderate Significance: Insignificant	A Soil Management BMP will be developed and implemented Develop a Quarry Development Plan with progressive remediation during and after operations Topsoil (if present) and subsoil will be handled and stored separately Soil will not be disturbed or handled during wet and / or windy conditions Rubber tracked equipment will be used where appropriate

Table 11: Assessment of Impacts on Hydrology

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Develop a Quarry Development Plan with consideration to minimize footprint (including any access road) and water management, use of blast mats to minimize flying rock hazards, avoid ice-rich permafrost or slopes prone to erosion (wherever possible), and progressive remediation during operations Proper containment and removal of fuels away from any waterbodies Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from waterbodies Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992) Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Mobilization and transportation of personnel and equipment to site Trail, barge landing area, and camp construction Camp equipment setup and operation – waste treatment and incineration systems and maintenance Development of bedrock quarry and crushing operations	Potential impact of surface water and groundwater from spills when refuelling and servicing equipment Potential impact to marine water from spills and ballast water when refuelling and barging material/equipment to and from Site	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	
Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations	Sedimentation or damage to riparian and shoreline areas can occur during site preparation activities and quarry/crushing operations	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Moderate Significance: Insignificant	Development and implementation of a Sediment Control and Water BMP Design the quarry with adequate sloping to avoid ponded water in permafrost areas Development and implementation of a Dust Control Best Management Practices (BMP), such as designing the quarry face with consideration of prevailing winds to direct dust away from the Site, use of water and/or approved dust suppressants, use of dust skirts on conveyors, and ceasing operations during strong wind conditions Placement of temporary and permanent erosion control measures (i.e., berms, silt fences) surrounding the remediation areas, quarry, and trails, where necessary Limit disturbance of any new areas Monitoring during the development of the barge landing/staging area Avoid in-water activities during development of the barge landing/staging area Disturbed areas adjacent to water bodies will be stabilized Environmental monitoring will occur during construction activities to ensure erosion control measures are implemented and adequate
Camp equipment setup and operation – waste treatment systems and maintenance	The operation of the work camp will include disposal of camp sewage, grey water, garbage and other non-hazardous wastes which could impact water quality	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Camp grey water will be diverted to a sump located a minimum of 31 m from a watercourse or a waterbody Sumps will be closed off at the end of remediation activities Sewage treatment and non-hazardous camp waste will be incinerated, and the subsequent ash/compost will be removed off-site All other camp waste will be disposed of off-site on completion of the remediation activities

Table 11: Assessment of Impacts on Hydrology

Project Activity	Potential Impact	Impact Rating	Mitigation
Remediation			
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Potential impact of surface water and groundwater from spills when refuelling and servicing equipment Potential surface water and groundwater impact while removing, transporting, burning or incinerating waste materials	Direction: Negative (beneficial once non-hazardous and hazardous materials and impacted soil have been treated or removed from site) Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels away from any waterbodies Fuel and hazardous material will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel caches, hazardous material storage, and refueling of equipment will occur at least 100 m from waterbodies Hazardous waste and fuel storage areas (including drums) will be inspected daily Hazardous materials and impacted soil will be exposed for as short time as possible All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soil Environmental monitoring will occur during remediation activities to ensure erosion control measures are implemented and adequate
Structure demolition and debris removal Removal of impacted soil	Sedimentation or damage to shoreline areas can occur during remediation activities that disturb the land surface through erosion and sedimentation	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Moderate Significance: Insignificant	Development and implementation of a Sediment Control BMP. Placement of temporary erosion control measures (i.e., berms, silt fences) Limit disturbance of any new areas Disturbed areas adjacent to water bodies will be stabilized Remedial excavations will provide for proper drainage and soil stability Environmental monitoring will occur during remediation activities to ensure erosion control measures are implemented and adequate
Closure			
Demobilization and transportation of personnel, equipment, and remedial products off-site Site recontouring, backfilling, and natural revegetation of disturbances	Potential impact of surface water and groundwater from spills when refuelling and servicing equipment Potential impact to marine water from spills and ballast water when refuelling and barging material/equipment to and from Site	Direction: Negative (beneficial once non-hazardous and hazardous materials and impacted soil have been treated or removed from the sites) Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels away from any waterbodies Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from any waterbody Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992) Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters

Table 11: Assessment of Impacts on Hydrology

Project Activity	Potential Impact	Impact Rating	Mitigation
Site recontouring, backfilling, and natural revegetation of disturbances	Sedimentation or damage to shoreline areas can occur during site recontouring through erosion and sedimentation	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Moderate Significance: Insignificant	Development and implementation of a Sediment Control BMP. Disturbed areas near adjacent to water bodies will be stabilized Recontouring site to match natural terrain after infrastructure, hazardous and non-hazardous waste, and impacted soil removal Develop a Quarry Development Plan with progressive remediation during and after operations

Table 12: Assessment of Impacts on Vegetation

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations		Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Development and implementation of a Dust Control Best Management Practices (BMP), such as designing the quarry face with consideration of prevailing winds to direct dust away from the Site, use of water and/or approved dust suppressants, use of dust skirts on conveyors, and ceasing operations during strong wind conditions
Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations	Dust from development and operation of quarry and crushing, upgrading trails, and camp construction could impact vegetation		
Mobilization and transportation of personnel and equipment to site Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations Camp equipment setup and operation – waste treatment systems and maintenance	Potential impact to vegetation from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Medium-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)
Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations	Loss or alteration of vegetation cover can occur when completing site preparation and camp and quarry construction	Direction: Negative Scope: Local Duration: Long-Term Frequency: Intermittent Magnitude: Low Probability: High Significance: Insignificant	Develop a Quarry Development Plan with consideration to minimize footprint (including any access road) and water management, use of blast mats to minimize flying rock hazards, avoid ice-rich permafrost or slopes prone to erosion (wherever possible), and progressive remediation during operations Use existing roads, pathways, and previously disturbed areas to the fullest extent possible Ensure natural drainages are recreated to limit water ponding and foster revegetation Use rubber tracked equipment and/or those with low pressure tires Storage of non-impacted surface soil for use in revegetation
Remediation		Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Development and implementation of a Dust Control BMP, such as using water for controlling dust and limiting remediation activities during high wind periods
Structure demolition and debris removal Removal of impacted soil	Dust from remediation activities could impact vegetation		
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site handling of hazardous and non-hazardous solid waste Removal of impacted soil Off-site transportation of remedial products	Potential impact to vegetation from spills when refuelling and servicing equipment Potential vegetation impact from wastes while moving, transporting, burning or incinerating waste materials	Direction: Negative (beneficial once non-hazardous, but especially hazardous materials and impacted soil have been treated or removed from the sites) Scope: Local Duration: Medium-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Fuel and hazardous material will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Hazardous waste and fuel storage areas (including drums) will be inspected daily All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soil Hazardous materials and impacted soil will be exposed for as short time as possible

Table 12: Assessment of Impacts on Vegetation

Project Activity	Potential Impact	Impact Rating	Mitigation
Structure demolition and debris removal Removal of impacted soil Off-site transportation of remedial products	Physical disturbance, loss or alteration of vegetative cover can occur when completing remedial activities	Direction: Negative Scope: Local Duration: Long-Term Frequency: Intermittent Magnitude: Low Probability: High Significance: Insignificant	Use existing roads, pathways, and previously disturbed areas to the fullest extent possible Ensure natural drainages are recreated to limit water ponding and foster revegetation Limit creation of new disturbed areas while completing remediation Use rubber tracked equipment and/or those with low pressure tires
Closure		Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	Development and implementation of a Dust Control BMP, such as using water for controlling dust, backfilling excavations, and limiting remediation activities during high wind periods
Site recontouring, backfilling, and natural revegetation of disturbances	Dust from recontouring and backfilling could impact vegetation		
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Potential impact to vegetation from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Medium-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)
Site recontouring, backfilling, and natural revegetation of disturbances	Loss or alteration of vegetative cover can occur when completing recontouring activities	Direction: Negative Scope: Local Duration: Long-term Frequency: Intermittent Magnitude: Low Probability: High Significance: Insignificant	Develop a Quarry Development Plan with progressive remediation during and after operations Use existing roads, pathways, and previously disturbed areas to the fullest extent possible Ensure natural drainages are recreated to limit water ponding and foster revegetation Land surface will be recontoured in to match pre-disturbance conditions to the fullest extent possible but with the minimal equipment use to foster natural revegetation Utilize stockpiled surface soil for revegetation Use rubber tracked equipment and/or those with low pressure tires

Table 13a: Assessment of Impacts on Terrestrial Wildlife

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			Implement Wildlife BMP that includes noise abatement measures Develop a Quarry Development Plan with consideration to minimize footprint (including any access road) and water management, use of blast mats to minimize flying rock hazards, avoid ice-rich permafrost or slopes prone to erosion (wherever possible), and progressive remediation during operations Use existing roads, pathways, and previously disturbed areas to the fullest extent possible Conduct pre-disturbance nest surveys; avoid active nests when present Inspect all structures and debris for wildlife use prior to remediation Containers for domestic waste, petroleum products, and explosives will be located in enclosed bear-proof structures Garbage will be removed or incinerated from site daily Bear safety awareness training will be provided as well as information on other wildlife encounters All personnel will be familiar with current 'Safety in Bear/Polar Bear Country' literature produced by Nunavut Department of Environment Bear deterrents will be kept at all sites Feeding of wildlife will be prohibited The use of electric fencing will be considered for the camp
Mobilization and transportation of personnel and equipment to sites Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations Camp equipment setup and operation – waste treatment and incineration systems and maintenance	Direct mortality, disruption of movement patterns, habitat loss/alteration, and indirect mortality produced by wildlife/human interactions potentially caused during transportation of materials and site preparation, such as upgrading trails, construction, camp operations, and quarry development and operations	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: High Significance: Insignificant	
Mobilization and transportation of personnel and equipment to sites Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations Camp equipment setup and operation – waste treatment and incineration systems and maintenance	Potential impact to wildlife habitat from fugitive dust during remedial activities and from spills when refuelling and servicing camp, construction, and transportation equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available to all workers on-site Development and implementation of a Dust Control Best Management Practices (BMP) Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)
Remediation			Implement Wildlife BMP that includes noise abatement measures Use existing roads, pathways, and previously disturbed areas to the fullest extent possible Conduct pre-disturbance nest surveys; avoid active nests when present Inspect all structures and debris for wildlife use prior to remediation Restrict wildlife access to disturbed areas Containers for domestic waste, petroleum products, and explosives will be located in enclosed bear-proof structures Bear safety awareness training will be provided as well as information on other wildlife encounters All personnel will be familiar with current 'Safety in Bear/Polar Bear Country' literature produced by Nunavut Department of Environment Bear deterrents will be kept at all sites
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site compaction and handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Direct mortality, disruption of movement patterns, habitat loss/alteration, and indirect mortality produced by wildlife/human interactions potentially caused by remediation activities like removing debris and demolishing infrastructure using heavy equipment	Direction: Negative (beneficial once non-hazardous and hazardous materials and impacted soil have been treated or removed) Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: High Significance: Insignificant	

Table 13a: Assessment of Impacts on Terrestrial Wildlife

Project Activity	Potential Impact	Impact Rating	Mitigation
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site compaction and handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Potential impact to wildlife and habitat from spills when refuelling and servicing remediation equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available to all workers on-site Fuel and hazardous material will be stored in and easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Hazardous waste and fuel storage areas (including drums) will be inspected daily All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soil Hazardous materials and impacted soil will be exposed for as short time as possible
Closure			
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Direct mortality, disruption of movement patterns, habitat loss/alteration, and indirect mortality produced by wildlife/human interactions potentially caused during transportation of materials by construction equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: High Significance: Insignificant	Implement Wildlife BMP that includes noise abatement measures Bear safety awareness training will be provided as will information on other wildlife encounters All personnel will be familiar with current ‘Safety in Bear/Polar Bear Country’ literature produced by Nunavut Department of Environment Containers for domestic waste, petroleum products, and explosives will be located in enclosed bear-proof structures Bear deterrents will be kept at all sites
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Potential impact of wildlife habitat from spills when refuelling and servicing construction and transportation equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available to all workers on-site Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)

Table 13b: Assessment of Impacts on Marine Wildlife

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuel spills, if occurs Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Fuel required for camp operation will be stored in berms Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992) Employ experienced barging operators that are responsible for and comply with best practices *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Mobilization and transportation of personnel and equipment to site Trail, barge landing area, and camp construction Camp equipment setup and operation – waste treatment and incineration systems and maintenance	Potential impact to marine wildlife habitat from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	
Mobilization and transportation of personnel and equipment to site	Direct mortality, avoidance and disruption of movement patterns, alteration of marine wildlife habitat from introduction of non-native species (flora and fauna) from ballast water	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: High Probability: Moderate Significance: Insignificant	Implement Wildlife BMP that includes noise abatement measures Barge and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers Wildlife will be given the right-of-way Suspend barging/landing craft activities when marine wildlife present in the bay Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Trail, camp, and barge landing area construction (no in-water works and infrastructure anticipated for the barge landing area) Development of bedrock quarry and crushing operations	Sedimentation and shoreline erosion can occur during camp and barge landing area construction, and fugitive dust from quarry and crushing operations	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment and Dust Control BMPs. Barge landing area will be designed to avoid in-water works and infrastructure Placement of temporary erosion control measures (i.e., berms, silt fences) Limit disturbance of any new areas Disturbed areas along the shoreline will be restricted to above the high-tide water mark Environmental monitoring will occur during construction activities to ensure erosion control measures are implemented and adequate
Camp equipment setup and operation – waste treatment and incineration systems and maintenance	The operation of the work camp will include disposal of camp sewage, grey water, garbage and other non-hazardous wastes which could impact marine wildlife habitat	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: Moderate Significance: Insignificant	Camp grey water will be diverted to a sump located a minimum of 31 m from the high-tide mark Sumps will be closed off at the end of remediation activities Sewage treatment and non-hazardous camp waste will be incinerated, and the subsequent ash/compost will be removed off-site All other camp waste will be disposed of off-site on completion of the remediation activities

Table 13b: Assessment of Impacts on Marine Wildlife

Project Activity	Potential Impact	Impact Rating	Mitigation
Remediation			
Debris removal along the marine shoreline On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste Off-site transportation of remedial products	Potential impact of marine wildlife habitat from spills when refuelling and servicing equipment Potential marine wildlife habitat impact while removing, transporting, burning or incinerating waste materials	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuel spills, if occurs Fuel and hazardous material will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Hazardous waste and fuel storage areas (including drums) will be inspected daily Hazardous materials and impacted soil will be exposed for as short time as possible All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soils Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Debris removal along the marine shoreline Off-site transportation of remedial products	Sedimentation and erosion can alter marine wildlife habitat during remediation activities that disturb the shoreline and barging activities	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment Control BMP. Placement of temporary erosion control measures (i.e., berms, silt fences) Limit disturbance to any new areas Environmental monitoring will occur during remediation activities to ensure erosion control measures are implemented and adequate Barges and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers
Off-site transportation of remedial products Debris removal along the marine shoreline	Avoidance and disruption of movement patterns, alteration of marine wildlife habitat from introduction of non-native species (flora and fauna) from ballast water	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: High Probability: Moderate Significance: Insignificant	Implement Wildlife BMP that includes noise abatement measures Suspend barging/landing craft activities and debris removal along the shoreline when marine wildlife present in the bay Barges and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers Ballast water will be discharged only at approved ballast water exchange locations All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters

Table 13b: Assessment of Impacts on Marine Wildlife

Project Activity	Potential Impact	Impact Rating	Mitigation
Closure			
Site recontouring, backfilling, and natural revegetation of disturbances Demobilization and transportation of personnel, equipment, and remedial products off-site	Potential impact of marine wildlife habitat from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels spills, if occurs Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992) Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Demobilization and transportation of personnel, equipment, and remedial products off-site	Avoidance and disruption of movement patterns, alteration of marine wildlife habitat from introduction of non-native species (flora and fauna) from ballast water	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: High Probability: Moderate Significance: Insignificant	Barges and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers Ballast water will be discharged only at approved ballast water exchange locations All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported Employ experienced barging operators that are responsible for and comply with best practices *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters

Table 14a: Assessment of Impacts on Freshwater Fish

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			
Mobilization and transportation of personnel and equipment to site Trail, barge landing area, and camp construction Camp equipment setup and operation – waste treatment and incineration systems and maintenance	Potential impact to fish habitat from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels from waterbodies, if occurs Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Fuel required for camp operation will be stored in berms Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)
Trail, barge landing area, and camp construction Development of bedrock quarry and crushing operations	Sedimentation or damage to freshwater fish habitat can occur during trail upgrading, and from fugitive dust from quarry and crushing operations	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment and Dust Control BMPs, such as use of water and/or approved dust suppressants, use of dust skirts on conveyors, and ceasing operations during strong wind conditions Develop a Quarry Development Plan with consideration for water management, use of blast mats to minimize flying rock hazards, avoid ice-rich permafrost or slopes prone to erosion (wherever possible), and progressive remediation during operations Placement of temporary (during remediation) erosion control measures (i.e., berms, silt fences), where required Limit disturbance of any new areas Disturbed areas adjacent to seasonal pools of water that drain into freshwater fish habitat will be stabilized Environmental monitoring will occur during construction activities to ensure erosion control measures are implemented and adequate
Camp equipment setup and operation – waste treatment and incineration systems and maintenance	The operation of the work camp will include disposal of camp sewage, grey water, garbage and other non-hazardous wastes which could impact freshwater fish habitat	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: Low Significance: Insignificant	Camp grey water will be diverted to a sump located a minimum of 31 m from waterbodies and watercourses Sumps will be closed off at the end of remediation activities Sewage treatment and non-hazardous camp waste will be incinerated, and the subsequent ash/compost will be removed off-site All other camp waste will be disposed of off-site on completion of the remediation activities
Remediation			
Structure demolition and debris removal On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste On-site handling of hazardous and non-hazardous solid waste Off-site transportation of remedial products	Potential impact of freshwater fish habitat from spills when refuelling and servicing equipment Potential freshwater fish habitat alteration or loss while removing, transporting, and burning or incinerating waste materials	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels from any waterbodies, if occurs Fuel and hazardous material will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel caches and refueling of equipment will occur at least 100 m from waterbodies Hazardous waste and fuel storage areas (including drums) will be inspected daily Hazardous materials and impacted soil will be exposed for as short time as possible All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soil

Table 14a: Assessment of Impacts on Freshwater Fish

Project Activity	Potential Impact	Impact Rating	Mitigation
Structure demolition and debris removal Removal of impacted soil Off-site transportation of remedial products	Sedimentation or damage to freshwater fish habitat can occur during remediation activities that disturb the land surface through erosion and sedimentation	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment Control BMP. Placement of temporary erosion control measures (i.e., berms, silt fences) Limit disturbance of any new areas Disturbed areas adjacent to seasonal pools of water that drain into freshwater fish habitat will be stabilized Environmental monitoring will occur during remediation activities to ensure erosion control measures are implemented and adequate
Closure			
Demobilization and transportation of personnel, equipment, and remedial products off-site Site recontouring, backfilling, and natural revegetation of disturbances	Potential impact of freshwater fish habitat from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels from any waterbodies, if occurs Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel cache and refueling of equipment will occur at least 100 m from waterbodies Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)
Site recontouring, backfilling, and natural revegetation of disturbances	Sedimentation or damage to freshwater fish habitat can occur during site recontouring through erosion and sedimentation	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment Control BMP. Disturbed areas adjacent to seasonal pools of water that drain into freshwater fish habitat will be stabilized Recontouring site to match natural terrain after infrastructure, hazardous and non-hazardous waste, and impacted soil removal Excavations will be backfilled with crushed bedrock to minimize erosion

Table 14b: Assessment of Impacts on Marine Fish

Project Activity	Potential Impact	Impact Rating	Mitigation
Site Preparation and Camp Operations			A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuel spills, if occurs Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Fuel required for camp operation will be stored in berms Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992) Employ experienced barging operators that are responsible for and comply with best practices *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Mobilization and transportation of personnel and equipment to site Trail, barge landing area, and camp construction Camp equipment setup and operation – waste treatment and incineration systems and maintenance	Potential impact to marine fish habitat from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	
Mobilization and transportation of personnel and equipment to site	Avoidance and disruption of movement patterns, alteration of marine fish habitat from introduction of non-native species (flora and fauna) from ballast water Sedimentation and shoreline erosion can occur during barging activities (wave action)	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: High Probability: Low Significance: Insignificant	Barge and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers Ballast water will be discharged only at approved ballast water exchange locations Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Trail, barge landing area, and camp construction (no in-water works and infrastructure anticipated for the barge landing area) Development of bedrock quarry and crushing operations	Sedimentation and shoreline erosion can occur during camp and barge landing area construction, and fugitive dust from quarry and crushing operations	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment and Dust Control BMPs. Barge landing area will be designed to avoid in-water works and infrastructure Placement of temporary erosion control measures (i.e., berms, silt fences) Limit disturbance of any new areas Disturbed areas along the shoreline will be restricted to above the high-tide water mark Environmental monitoring will occur during construction activities to ensure erosion control measures are implemented and adequate
Camp equipment setup and operation – waste treatment and incineration systems and maintenance	The operation of the work camp will include disposal of camp sewage, grey water, garbage and other non-hazardous wastes which could impact marine fish habitat	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: Low Significance: Insignificant	Camp grey water will be diverted to a sump located a minimum of 31 m from the high-tide mark Sumps will be closed off at the end of remediation activities Sewage treatment and non-hazardous camp waste will be incinerated, and the subsequent ash/compost will be removed off-site All other camp waste will be disposed of off-site on completion of the remediation activities

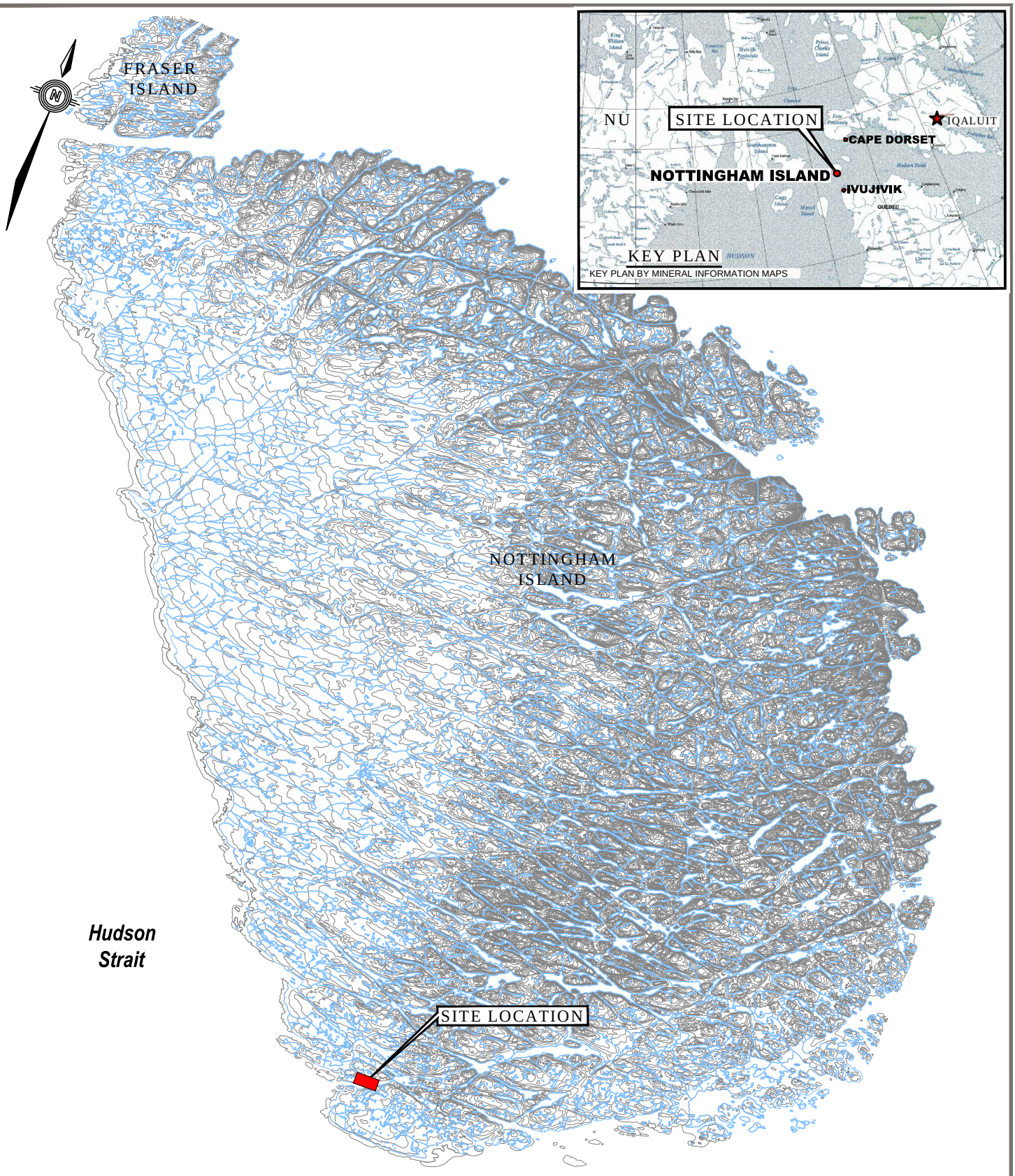
Table 14b: Assessment of Impacts on Marine Fish

Project Activity	Potential Impact	Impact Rating	Mitigation
Remediation			
Debris removal along the marine shoreline On-site burning of non-hazardous wood waste On-site incineration of liquid organic waste Off-site transportation of remedial products	Potential impact of marine fish habitat from spills when refuelling and servicing equipment Potential marine fish habitat alteration while removing, transporting, and burning or incinerating waste materials	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented, and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuel spills, if occurs Fuel and hazardous material will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Hazardous waste and fuel storage areas (including drums) will be inspected daily Hazardous materials and impacted soil will be exposed for as short time as possible All workers will be trained in proper handling of non-hazardous and hazardous materials and impacted soils Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Debris removal along the marine shoreline Off-site transportation of remedial products	Sedimentation and erosion can alter marine fish habitat during remediation activities that disturb the shoreline and barging activities	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	Development and implementation of a Sediment Control BMP. Placement of temporary erosion control measures (i.e., berms, silt fences) Limit disturbance to any new areas Environmental monitoring will occur during remediation activities to ensure erosion control measures are implemented and adequate Barges and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers
Off-site transportation of remedial products	Avoidance and disruption of movement patterns, alteration of marine fish habitat from introduction of non-native species (flora and fauna) from ballast water	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Moderate Probability: Low Significance: Insignificant	Barges and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers Ballast water will be discharged only at approved ballast water exchange locations All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters
Closure			
Demobilization and transportation of personnel, equipment, and remedial products off-site Site recontouring, backfilling, and natural revegetation of disturbances	Potential impact of marine fish habitat from spills when refuelling and servicing equipment	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Low Probability: Low Significance: Insignificant	A Spill Contingency BMP will be developed and implemented and be available on-site for all workers Contain spill as close to release point as possible Proper containment and removal of fuels spills, if occurs Fuel will be stored in an easily accessible bermed area, which will act as a spill barrier and allow for easy removal in case of a leak or spill Fuel storage areas (including drums) will be inspected daily Fuel caches and refueling of equipment will occur at least 100 m from waterbodies, except for barges Transportation procedures on-site and off-site will be in accordance with the *Transportation of Dangerous Goods Act* and *Regulations* (Government of Canada 1992)

Table 14b: Assessment of Impacts on Marine Fish

Project Activity	Potential Impact	Impact Rating	Mitigation
Demobilization and transportation of personnel, equipment, and remedial products off-site	Avoidance and disruption of movement patterns, alteration of marine fish habitat from introduction of non-native species (flora and fauna) from ballast water	Direction: Negative Scope: Local Duration: Short-Term Frequency: Intermittent Magnitude: Moderate Probability: Low Significance: Insignificant	Barges and landing craft operations will be managed to control their wake, and will maintain straight courses and travel at low speeds Barge and landing craft travel to and from the site will be restricted in numbers Ballast water will be discharged only at approved ballast water exchange locations Employ experienced barging operators that are responsible for and comply with best practices All Transport Canada regulations regarding ballast discharge and exchange will be implemented and reported *Canada Shipping Act* and *Arctic Waters Pollution Prevention Act* and their regulations will be followed to prevent pollution in marine waters

FIGURES



ISSUED FOR USE

0 10 km

Scale: 1: 250 000

CLIENT

Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada

A TETRA TECH COMPANY

ENVIRONMENTAL ASSESSMENT FORMER WEATHER STATION NOTTINGHAM ISLAND, NU

SITE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
Y22101291	MM	KL	0

OFFICE	DATE
EDM	April 2013

Figure 1

Q:\Edmonton\Drafting\PROJECTS\Y221\Y22101291 Nottingham\report components\acad\Environment Assessment\Y22101291_EA_Figure 1.dwg [FIGURE 1] April 09, 2013 - 1:50:32 pm (BY: MARSH, MAUREEN)

OLD KITCHEN
OLD RADIO BUILDING
STORAGE SHED 02
STORAGE BUILDING
DEBRIS AREA
TRAIL
DEBRIS AREA 3
FOOD CACHE STORAGE
OUT HOUSE
HELIPAD AND TANKS
NEW RADIO BUILDING
STORAGE SHED 01
CHICKEN COOP
BUNKHOUSE
DEBRIS AREA
GENERATOR BUILDING
PIPELINE
HOUSE AND GARAGE
SHED
DEBRIS AREA
HOUSE
DEBRIS AREA
HUDSON STRAIT

LEGEND

- BUILDINGS
- WET LAND
- ROCK OUTCROP
- WATER
- APEC - AREA OF POTENTIAL ENVIRONMENTAL CONCERN
- APPROXIMATE LOCATION OF FORMER FUEL DISTRIBUTION LINE

NOTES
UTM with NAD83 datum, Zone 18, Meter; Central Meridian 75d W

ISSUED FOR USE

0 100 m
Approximate Scale

CLIENT
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

A TETRA TECH COMPANY

ENVIRONMENTAL ASSESSMENT FORMER WEATHER STATION NOTTINGHAM ISLAND, NU

SITE PLAN SHOWING AREAS OF ENVIRONMENTAL INTEREST AT PROJECT LOCATION

PROJECT NO.	DWN	CKD	REV
Y22101291	MM	KL	0

OFFICE	DATE
EDM	April 2013

Figure 2

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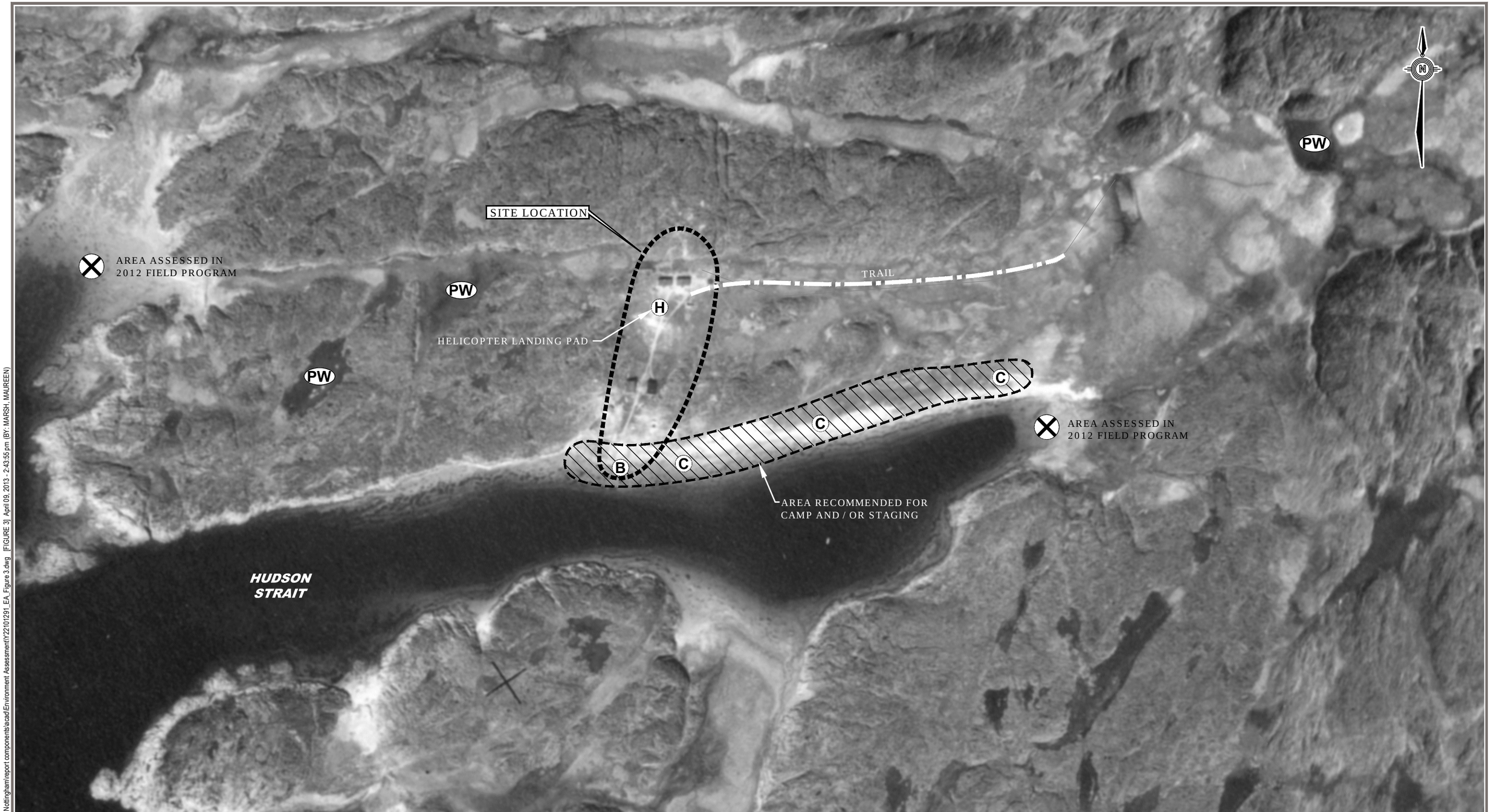

LEGEND

- ⊗ - LOCATION NOT RECOMMENDED FOR CAMP / STAGING / LANDING
- (B) - POTENTIAL BEACH LANDING AREA
- (C) - POTENTIAL CAMP STAGING AREA
- (PW) - POTENTIAL POTABLE WATER SOURCE AREA

NOTES
UTM with NAD83 datum, Zone 18, Meter; Central Meridian 75d W

ISSUED FOR USE

0 250 m

Scale: 1: 5 000

CLIENT

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

eba
A TETRA TECH COMPANY

ENVIRONMENTAL ASSESSMENT
FORMER WEATHER STATION
NOTTINGHAM ISLAND, NU

SITE PLAN SHOWING
RECOMMENDED LOCATION FOR CAMP
AND / OR STAGING AREAS

PROJECT NO.	DWN	CKD	REV
Y22101291	MM	KL	0

OFFICE: EDM
DATE: April 2013

Figure 3

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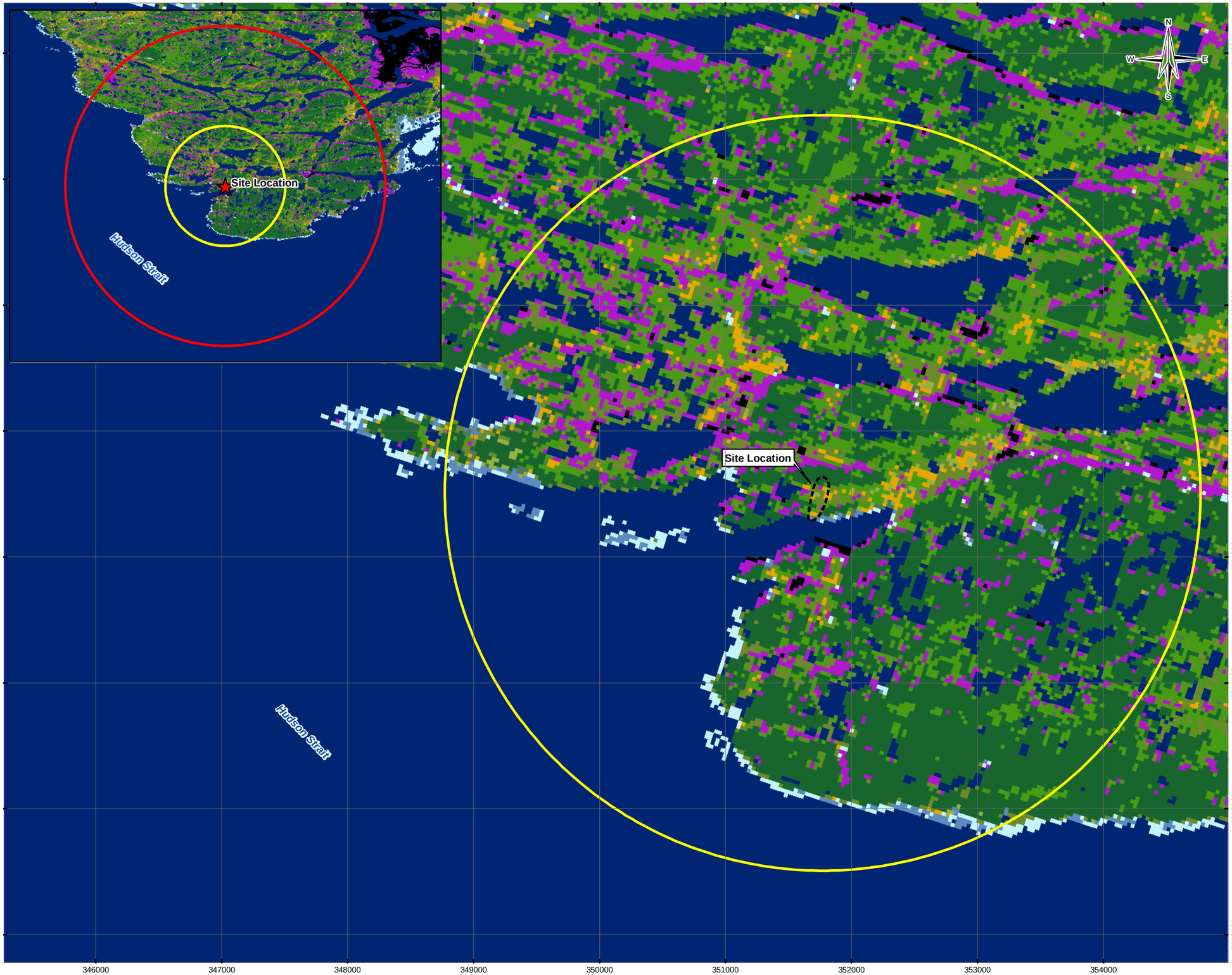

LEGEND

- Site Location
- 3 km Radius of Site
- 8 km Radius of Site

Land Cover Classification

- No Data
- Tussock graminoid tundra
- Wet sedge
- Moist to dry non-tussock graminoid/dwarf shrub tundra
- Low shrub
- Tall shrub
- Prostrate dwarf shrub
- Sparsely vegetated bedrock
- Sparsely vegetated till-colluvium
- Bare soil with cryptogam crust - frost boils
- Wetlands
- Barren
- Water

NOTES
Base data source:
Olthof, I., Latifovic, R. and Pouliot, D., 2008. Circa-2000 Northern Land Cover of Canada. Earth Sciences Sector, Canada Centre for Remote Sensing, Natural Resources Canada.

STATUS
ISSUED FOR REVIEW

ENVIRONMENTAL ASSESSMENT, PROPOSED REMEDIATION OF THE NOTTINGHAM ISLAND WEATHER AND RADIO STATIONS, NUNAVUT

Landcover Classification

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	

Scale: 1:30,000
500 250 0 500
Metres

FILE NO. Y22101291_Figure04.mxd

PROJECT NO.	DWN	CKD	APVD	REV
Y22101291	MEZ	SL	KL	0

OFFICE EBA-VANC
DATE April 9, 2013

A TETRA TECH COMPANY

Figure 4

Q:\Vancouver\GIS\ENVIRONMENTAL\Y221\Y22101291_NottinghamMaps\Y22101291_Figure04.mxd modified 4/9/2013 by morgan.zondervan

PHOTOGRAPHS

Photo 1	Looking south across the former Nottingham Island weather and radio station site to the Hudson Strait.
Photo 2	The proposed barge landing area directly south of the Site.
Photo 3	The Site and the proposed shoreline locations, far side of shoreline, selected for the proposed temporary on-site camp.
Photo 4	Barren land cover unit exists at the intertidal zone south of Site.
Photo 5	This Moist to Dry Non-Tussock Graminoid/Dwarf Shrub land cover unit is common across the Site.
Photo 6	Narrow bands of Prostrate Dwarf Shrub land cover units exist in dry upland areas including the northern edge of the Site, as seen here.
Photo 7	As seen in the foreground, plant cover is restricted primarily between rock crevices in the Sparsely Vegetated Bedrock land cover unit.
Photo 8	Sparsely Vegetated Till-Colluvium Bare Soil land cover units, as seen here, are most dominant along the marine shoreline in the proposed camp locations.
Photo 9	Wet Sedge land cover units, as seen here, are most common across the central and southern portions of the Site.

Photo 1: Looking south across the former Nottingham Island weather and radio station site to the Hudson Strait.

Photo 2: The proposed barge landing area is located directly south of the Site.

Photo 3: The Site and the proposed shoreline locations, far side of shoreline, selected for the proposed temporary on-site camp.

Photo 4: Barren land cover unit exists at the intertidal zone south of Site.

Photo 5: This Moist to Dry Non-Tussock Graminoid/Dwarf Shrub land cover unit is common across the Site.

Photo 6: Narrow bands of Prostrate Dwarf Shrub land cover units exist in dry upland areas including the northern edge of the Site, as seen here.

Photo 7: As seen in the foreground, plant cover is restricted primarily between rock crevices in the Sparsely Vegetated Bedrock land cover unit.

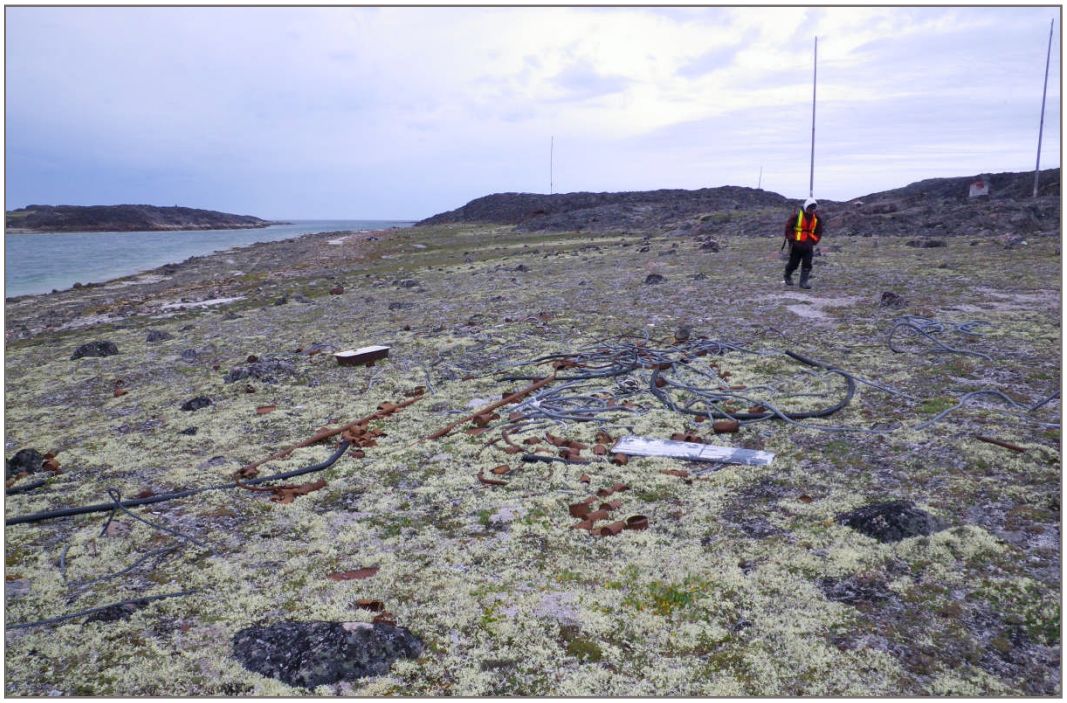

Photo 8: Sparsely Vegetated Till-Colluvium Bare Soil land cover units, as seen here, are most dominant along the marine shoreline in the proposed camp locations.

Photo 9: Wet Sedge land cover units, as seen here, are most common across the central and southern portions of the Site.

APPENDIX A
EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEO-ENVIRONMENTAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA’s client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA’s Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA’s instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

CCME NATIONAL CLASSIFICATION SYSTEM FOR CONTAMINATED SITES, NOTTINGHAM ISLAND RANKING SUMMARY

CCME National Classification System (2008, 2010 v 1.2)
Score Summary

Scores from individual worksheets are tallied in this worksheet.
Refer to this sheet after filling out the revised NCS completely.

I. Contaminant Characteristics	Known	Potential
1. Residency Media	4	---
2. Chemical Hazard	8	---
3. Contaminant Exceedance Factor	6	---
4. Contaminant Quantity	6	---
5. Modifying Factors	5	---
Raw Total Score	29	0
Raw Total Score (Known + Potential)	29	
Adjusted Total Score (Raw Total / 40 *33)	**23.9**	(max 33)

II. Migration Potential	Known	Potential
1. Groundwater Movement	---	5
2. Surface Water Movement	12	---
3. Soil	12	---
4. Vapour	---	12
5. Sediment Movement	0	---
6. Modifying Factors	0	0
Raw Total Score	24	17
Raw Total Score (Known + Potential)	41	
Adjusted Total Score (Raw Total / 64 * 33)	**21.1**	(max 33)

III. Exposure	Known	Potential
1. Human Receptors		
A. Known Impact	---	
B Potential		
a. Land Use		3
b. Accessibility		1
c. Exposure Route		
i. Direct Contact		3
ii. Inhalation		4
iii. Ingestion		6.5
2. Human Receptors Modifying Factors	6	---
Raw Total Human Score	6	17.5
Raw Total Human Score (Known + Potential)	23.5	
Adjusted Total Human Score	22.0	(maximum 22)
3. Ecological Receptors		
A. Known Impact	---	
B. Potential		
a. Terrestrial		10
b. Aquatic		7
4. Ecological Receptors Modifying Factors	2	1
Raw Total Ecological Score	2	18
Raw Total Ecological Score (Known + Potential)	20	
Adjusted Total Ecological Score	18.0	(maximum 18)
5. Other Receptors	0	0
Total Other Receptors Score (Known + Potential)	0	
Total Exposure Score (Human + Ecological + Other)	**40.0**	
Adjusted Total Exposure Score (Total Exposure / 46 * 34)	**29.6**	(max 34)

Site Score

Nottingham Island-Former Deparment of Transport Weather Station

Site Letter Grade	**C**
Certainty Percentage	**75%**
% Responses that are "Do Not Know"	**2%**
Total NCSCS Score for site	**74.6**
Site Classification Category	**1**

Site Classification Categories*:

Class 1 - High Priority for Action (Total NCS Score >70)
Class 2 - Medium Priority for Action (Total NCS Score 50 - 69.9)
Class 3 - Low Priority for Action (Total NCS Score 37 - 49.9)
Class N - Not a Priority for Action (Total NCS Score <37)
Class INS - Insufficient Information (>15% of responses are "Do Not Know")

* NOTE: The term "action" in the above categories does not necessarily refer to remediation, but could also include risk assessment, risk management or further site characterization and data collection.

APPENDIX C

NOTTINGHAM ISLAND INVENTORY OF MATERIAL AND UNCRUSHED/CRUSHED METAL VOLUME TABLES

Appendix C. Nottingham Island Inventory Table

APEC #	WESA Feature Designation	Material Type	Material Description	Volume (m^3), except drums and liquid	Material Items	Condition
1	Storage Shed 01 (18.5 x 9 x 2.4m)	Non-Hazardous	Unpainted wood	101	Building, external step, debris around building	Good, unpainted
			Metal	6	Cans, oil fired warm air furnace, ducting, electrical lines, external fence cover	Rusted, blue paint not lead containing lead
			Black felt	2	Black felt under exterior panels	Intact
			Glass windows	0.5	8 windows, no caulking	Some broken
			Flooring	3	Beige linoleum with textile backing	Good
			Drums (205L)	1 drum	Empty, rusted	Intact
			Asphalt shingles	3	Red/white shingles on roof	Good, some missing
			AST (900L)	0.5	Metal, no paint, no contents, no sludge	Rusted, intact
		Hazardous	Asbestos Insulation	50	Insulation in attic, some may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Friable, spread on floor of building
			Asbestos Panels	11	Interior wall and ceiling panels	Good, intact
			Asbestos Siding	5	Exterior white siding	Good, intact
			Fibre glass insulation (Asbestos contaminated)	33	Contaminated with the asbestos insulation, which may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Good, some on floor
			Total and leachable lead paint on wood	10	Window sills, exterior step, bottom exterior	Poor, peeling
2	Old Kitchen (8.7 x 17.8 x 3.4 m)	Non-Hazardous	Unpainted wood	41	Building interior, and adjacent wood pole, paint worn off	Weathered
			Metal	10	Electrical lines, metal sheeting	Pieces
			Black felt	2	On interior walls	Good, some ripped pieces
			Porcelain	0.5	One sink	Intact
			Asphalt shingles	3	Green and red shingles, adjacent and inside building	Poor, in pieces
			Flooring	3	Linoleum with textile backing	Poor, scattered on floor
			Brick and brick mortar	6	Two chimneys	Good, not asbestos containing
			Concrete	1	Two concrete cubes	Intact
		Hazardous	Total and leachable lead paint on wood	45	Various colors on exterior and interior walls and floor	Poor, peeling
3	New Radio Building (2.5 x 15.2 m) and Small Shed (3.4 x 2.5 x 2.1 m)	Non-Hazardous	Unpainted wood	101	Building, external step, debris around building	Good, unpainted
			Metal	9	Cans, oil fired warm air furnace, ducting, electrical lines, external fence cover, cables, electrical boxes	Rusted
			Concrete	2	Metal pole support, 4 cubes	Intact
			Asphalt shingles	2	Red/white shingles on roof	Good, some missing
			AST (900L)	0.5	Metal, no paint, no contents, no sludge	Rusted, intact
			Glass windows	0.5	9 windows	Most broken, shattered
		Hazardous	Asbestos floor tiles	0.5	Vinyl floor tiles (9x9')	Some broken
			Asbestos Insulation	50	Insulation in attic, some may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Friable
			Asbestos, total lead and leachable lead containing on panels	11	Painted interior wall and ceiling panels	Intact
			Asbestos Siding	3	Exterior white siding	Intact
			Asbestos Light Backings	0.01	Four double layer light fixture backings	Friable, in pieces
			Fibre glass insulation (Asbestos contaminated)	10	Contaminated with the asbestos insulation, which may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Good, some on floor
			Total and leachable lead paint on metal	6	On ducting and electrical equipment in small shed, adjacent fallen metal pole	Poor, peeling
			Total and leachable lead paint on wood	5	Various colors on exterior and interior walls and floor and small shed	Poor, peeling
			Mercury, PCBs and lead solder in electrical components	2	In capacitors and electrical boxes in the New Radio Building and small shed	Rusted
4	Old Radio Building (2.5 x 2.1 x 4.0 m)	Non-Hazardous	Unpainted wood	5	Building frame, interior walls and shelves	Moderate, visible mould and fire damage
			Metal	1	Electrical lines, debris	Intact
			Brick and brick mortar	1	One chimney	Moderate, some chipping
			Asphalt shingles	0.5	On roof, red	Peeling
			Concrete	1.5	Adjacent to the building	Intact
			Black felt	0.2	Around exterior of building	Peeling
			Batteries	0.08	Four batteries	Poor, crystallized
		Hazardous	Total lead paint on particulate board	4	On walls and ceiling, two layers	Poor, some burnt, in pieces
			Total lead and leachable lead on metal	1	Electrical box	Poor, peeling
			Mercury, PCBs and lead solder in electrical components	0.5	In capacitors and electrical boxes in the building	Rusted
			Total and leachable lead paint on wood	4	Exterior wood boards, window sills some interior wood	Poor, peeling
5	Outhouse (1.3 x 1.8 x 2.7 m)	Non-Hazardous	Unpainted wood	1	Building frame, toilet	Moderate, weathered and intact
			Concrete	1	Two cubes	Intact, partially buried
			Black felt	0.1	Under exterior wood boards	Moderate, some ripped off
		Hazardous	Asbestos Asphalt shingles	0.2	Green, on roof	Poor, peeling
			Total and leachable lead paint on wood	2	Various colors on exterior and interior wood boards	Moderate, weathered some boards on ground
6	Storage Shed 02 (2.8 x 2.2 x 2.6 m)	Non-Hazardous	Unpainted wood	4	Building frame, cable spools	Weathered, intact
			Metal	2	Wiring, parts, tools, in building and adjacent	Intact
			Cables	2	Rubber covering, some metal interior	Intact
		Hazardous	Asbestos asphalt shingles	0.5	Green, on roof and walls	Some blown off
7	Storage Building (4.9 x 6.4 x 3.0 m) 4.5 m is peak height and Small Shed (1.6 x 1.6 x 2.2 m)	Non-Hazardous	Unpainted wood	31	Building frame	
			Metal	1	Cans, some ducting electrical lines and non-hazardous electrical parts	Rusted, blue paint not lead containing lead
			Black felt	0.5	Under exterior white siding	Good, some ripped pieces
			Glass windows	0.1	3 windows	Some broken
			Asphalt shingles	1	Red/white shingles on roof	Good, some missing
			Flooring	1	Linoleum with textile backing	Good
			Drum (205L)	1 drum	Empty, unpainted, staining and odor on linoleum under drum	Rusted, intact
		Hazardous	Asbestos Insulation	9	Insulation in attic, some may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Friable, spread on floor of building
			Asbestos panels	3	Interior wall and ceiling panels	Good, intact
			Fibre glass insulation (Asbestos contaminated)	14	Pink, assumed to be in walls, similar to other buildings	Good, some on floor
			Asbestos Siding	2	Exterior white siding	Intact
			Total and leachable lead paint on wood	1	Window sills, exterior step, bottom exterior	Poor, peeling
			AST (900L)	0.5	Metal, some paint, some contents, some sludge	Rusted, intact
			Organic content in AST (900L)	675 L	3/4 full of heating oil	Rusted, intact
			Mercury, PCBs and lead solder in electrical components	1	Electrical boxes in building and adjacent small shed, some are transformers that contain PCBs and lead and mercury solder	Rusted, intact
8	Chicken Coop (10 x 3.8 x 3.2 m) Caged Area (3.7 x 3.8 x 2.1 m)	Non-Hazardous	Unpainted wood	20	Building and cage frame, interior plywood , unpainted	Poor, moss and mould growing on floor
			Metal	1	Wiring on caged area, stool, electrical wiring	Good, intact
			Black felt	0.5	Black, exterior	Poor, most is blown off
			Drum (205L)	1 drum	Rusted, empty	Rusted, holes
		Hazardous	Asbestos Insulation	6.5	Wall and ceiling insulation, fibreglass insulation is asbestos impacted	Poor, friable, spread out
			Fire Extinguisher	0.1	Red and partially full	Good, intact
			AST (900L)	0.5	Metal, some paint, some contents, some sludge	Rusted, intact
			Organic content in AST (900L)	675 L	3/4 full of heating oil	Rusted, intact
			Total and leachable lead paint on wood	0.2	Some red paint on exterior window sills, door frames and roof edges, some green paint on floors	Poor, peeling
			Total lead paint on particulate board	3	White paint on walls and ceiling particulate board	Poor, peeling
			Asbestos asphalt shingles	0.2	In pieces, on roof, black, assumed to be asbestos containing	Poor, most is blown off

Appendix C. Nottingham Island Inventory Table

APEC #	WESA Feature Designation	Material Type	Material Description	Volume (m^3), except drums and liquid	Material Items	Condition
9	Bunkhouse (31 x 9.2 x3.2 m)	Non-Hazardous	Unpainted wood	300	Building frame, adjacent wood walkway	Good, intact
			Metal	12	Cans, two oil fired warm air furnaces, ducting, electrical lines, water lines, external fence cover, cables, electrical boxes, flooring in furnace room, metal sheeting, exterior metal pole and vents	Good, rusted
			Glass windows	0.3	20 windows	Some broken
			Fibre glass insulation	137	Pink, assumed to be in walls and ceiling, similar to generator building	Good, some on floor
			Flooring	6	Linoleum with textile backing	Good, some mould
			Rubber	0.5	Piping running under building to exterior	Good, intact
			Porcelain	2	Four sinks, one bath tub	Good, intact
			AST (900L)	1	Two, peeling paint, sludge and fuel in both	Moderate, bear scratches, holes
			Asphalt shingles	6	Red/white shingles on roof	Good, some missing
			Exterior siding	15	White metal panels with fibrous insulation interior and black felt	Good, intact
		Hazardous	Asbestos furnace gasket	0.1	Grey gaskets on furnace, falling off	Poor, friable
			Total and leachable lead paint on asbestos panels	25	All walls and ceilings	Moderate, some holes
			Total and leachable lead paint on wood	7	Some red and white paint on exterior window sills, door frames, roof edges, vents and steps, shelves	Poor, peeling
			Total and leachable lead interior painted metal	18	Two water holding tanks in bathroom, silver and orange, white toilet and shower, painted ducting	Good, intact
			Organic contents in AST (900L)	50L	Partially full of heating oil and some sludge	N/A
			Mercury in fluorescent lights	0.3	Mercury vapor in bulbs	Moderate, one broken
			PCBs in light ballasts	1	Fluorescent light ballasts	Poor, some leaking
			Mercury, PCBs and lead solder in electrical components	0.5	Electrical boxes and panels	Open, rusted
10	Generator Building (14 x 6.8 x 3.2 m)	Non-Hazardous	Unpainted wood	60	Building frame (walls, attic is painted)	Good, intact
			Metal	24	Exterior metal sheeting, oil fired warm air furnace, ducting, electrical lines, water lines, cables, electrical boxes, exterior sheeting and vents, flooring	Good, rusted
			Glass windows	0.1	8 windows	Some broken
			Fibre glass insulation	30	Pink, assumed to be in walls and ceiling	Good, some on floor
			Cables	5	Rubber exterior, in attic	Good, intact
			Drum (205L)	3 drums	One 1/2 full, two partially full	Moderate rusted
			Concrete	4	Pad holding generators	Good, intact
			Asphalt shingles	2	Red/white shingles on roof	Good, some missing
			Exterior siding	4	White metal panels with fibrous insulation interior and black felt	Good, intact
		Hazardous	Asbestos panels	1	Exterior bottom panels and interior painted ceiling and wall panels	Moderate, some holes
			Aqueous content in drum (205L)	200L	Weathered, watery content, hydrocarbon odor	N/A
			Total lead painted generators	3	Total lead paint, Not leachable paint on three generators	Poor, peeling
			Total and leachable lead paint on wood	40	Various colors of paint on shelves and attic on exterior window sills, door frames, roof edges, vents and steps	Poor, peeling
			Total and leachable lead paint on asbestos panels	12.5	All walls and ceilings are painted surfaces	Good, intact
			Total and leachable lead interior paint on metal	10	On electrical boxes, metal shelves, debirs	Good, intact
			Equipment contents	500 L	Anti-freeze, oil and fuel in generators and open drum	Weathered liquids
			Mercury in fluorescent lights	0.2	Mercury vapor in bulbs	Moderate, one broken
			PCBs in light ballasts	1	Fluorescent light ballasts	Poor, some leaking
			Batteries	0.06	Two intact in building, one broken apart adjacent to the building	Poor
			Mercury, PCBs and lead solder in electrical components	1	Electrical boxes and panels, some could contain PCBs and lead and mercury solder	Open, rusted
	Debris Adjacent to the Generator Building	Non-hazardous	Unpainted wood	6	Wooden supports for the power line	Intact
			Metal	3	Pipes	Rusted
11	House and Garage (15 x 8 x 2.4 m)	Non-hazardous	Unpainted wood	115	Building frame, external step, debris around building	Good, unpainted
			Metal	2	Cans, toilet, oil fired furnace, ducting, electrical lines, external fence cover, stove	Rusted, blue paint not lead containing lead
			Black felt	3.5	Black felt under exterior panels	Good, intact
			Glass windows	N/A	All broken	All broken
			Flooring	3	Linoleum with textile backing	Good
			Asphalt shingles	2.5	Red/white shingles on roof	Good, some missing
			Drums (205L)	3	Empty, rusted	Good, rusted
		Hazardous	Asbestos Insulation	36	Insulation in attic, some may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Friable, spread on floor of building
			Fibre glass insulation (Asbestos contaminated)	15	Contaminated with the asbestos insulation, which may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations	Good, some on floor
			Asbestos panels	7	Interior wall and ceiling panels	Good, intact
			Asbestos siding	4	Exterior white siding	Good, intact
			Asbestos light backings	0.01	Two double layer light fixture backings	Good, intact
			Total and leachable lead paint on wood	10	Interior and exterior wood	Poor, peeling
			PCBs in light ballasts	0.6	Fluorescent light ballasts	Poor, some leaking
			AST (900L)	0.5	Metal, some paint, no contents, some sludge	Rusted, intact
	Building Foundation (Adjacent to the House and Garage)	Non-hazardous	Unpainted wood	4	Wood frame of previous building, wood spools	Weathered, partially buried
			Metal	0.5	Debris	Rusted
			Concrete	6	Foundation	Intact
		Hazardous	Creosote soaked wood	0.5	One wood beam	Weathered
12	Shed (6.5 x 6.5 x 2.9 m)	Non-hazardous	Unpainted wood	10	Building frame	Roof caved, weathered
			Metal	5	Debris, venting	Scattered
			Brick and brick mortar	6	Two chimneys	Good, not asbestos containing
			Asphalt shingles	1	Red shingles from roof, inside building and adjacent	Good, some missing
		Hazardous	Total and leachable lead paint on equipment	8	Orange tracked vehicles and trailer	Poor, paint peeling
			Equipment contents	1 L	Possible fuel, oil and vehicles fluids left	N/A
			Asbestos panels	2	Panels inside building	Poor, broken
13	House (9.6 x 8.8 x 2.9 m)	Non-hazardous	Unpainted wood	46	Attic and interior of walls, ceiling and floor	Intact
			Metal	5	Cans, metal sheeting in attic, electrical lines, stove, adjacent pulley and wire	Intact
			Black felt	2	Black felt on exterior	Good, intact
			Flooring	2	Linoleum with textile backing	Good
			Drums (205L)	3	Empty, rusted	Good, rusted
			Brick and brick mortar	3	One chimney	Good, not asbestos containing
			Asphalt shingles	0.5	Red shingles from roof, inside building and adjacent	Good, some missing
		Hazardous	Fibreglass insulation (contaminated with asbestos)	9	Contaminated with the asbestos insulation, which may have fallen into walls, if so, abate fibre glass insulation following asbestos regulations in back, newer part of house	Intact
			Asbestos insulation	7	Insulation in the back, newer part of the house attic	Friable, spread on floor of building
			Asbestos panels	4	Most interior wall and ceiling panels	Good, intact
			Total and leachable lead paint on wood	14	Various colors of paint: Exterior the roof of the older, front roof and interior cabinets, window frames	Poor, peeling
			Total and leachable paint on particulate board	3	On some interior walls and ceiling	
			Total and leachable lead paint on metal	3	Exterior metal entry way and some interior	Poor, peeling
			AST (900L)	0.5	Metal, some paint, no contents, some sludge	Rusted, intact
			Total and leachable lead paint on equipment	16	Orange steel mine cart	Poor, paint peeling
			Battery	0.02	Lead and acid car battery	Poor, broken
14	AST Farm	Non-hazardous	Metal	20	Pipeline from ASTs to the end 173 m length	Peeling paint
			Drum (205L)	1 drum	1 rusted drum	Intact
		Hazardous	Aqueous content in drum (205L)	20L	Weathered, watery content, hydrocarbon odor	N/A
			Total lead paint on ASTs (73000L each)	146	Two, with peeling paint, minor stain and rust on the bottom	Intact, rusted
15	Food Cache Storage	Non-hazardous	Unpainted wood	5	Partially buried, posts	Weathered
		Hazardous	Battery	0.02	Lead and acid car battery	Intact

Appendix C. Nottingham Island Inventory Table

APEC #	WESA Feature Designation	Material Type	Material Description	Volume (m^3), except drums and liquid	Material Items	Condition
16	Debris Area 01 Located within 10m north of Hudson Strait, appears	Non-hazardous	Unpainted wood	5	Partially burned building	Weathered, burned
			Metal	2	Debris, stoves	Scattered
17	Debris Area 02 Located south of the AST tank farm and West of the Generator building and Bunkhouse	None (inventory listed in other rows)	None (inventory listed in other rows)	None (inventory listed in other rows)	None (inventory listed in other rows)	None (inventory listed in other rows)
18	Debris Area 03 Located Northeast of the AST next to the Food Cache(west) To the Southeast Storage Shed 01, and to the Northeast-Old Kitchen	Non-hazardous	Unpainted wood	5	Wood staircase up the side of the outcrop	Weathered, unstable
			Metal	1	Pole and wires, debris	Intact, rusted
			Concrete	1	Supports, cubes	Some crumbling
		Hazardous	Battery	0.02	One lead and acid car battery	Broken apart
19	Debris Area 04 Located to the Southeast of site next to Hudson Strait appears to be the main dumping area	Non-hazardous	Unpainted wood	1	Partially buried debris	
			Metal	2	Debris, venting, partially buried	Scattered
			Brick and brick mortar	2	In pieces, partially buried	Good, not asbestos containing
		Hazardous	Battery	0.06	Three lead and acid car batteries	Broken apart
20	Debris Area 05 Surrounding Features: Located to the East of the main site removed from area	Non-hazardous	Unpainted wood	16.5	Debris, top of two upright and two laying wood poles	Weathered
			Metal	1.5	Debris, cables	Rusted
		Hazardous	Total and leachable paint on wood	4	Exterior of building	Rusted
			Creosote soaked wood	2	Bottom of four upright poles	Rusted
21	Debris Area 06	Non-hazardous	Unpainted wood	1	Debris	Weathered
			Metal	0.5	Debris	Rusted
22	Road to East of Site	None	None	None	None	None
23	Offsite Communication Tower	N/A	Tower	N/A	New beacon tower, not to be decommissioned	N/A
24	Lake 01	N/A	N/A	N/A	N/A	N/A
25	Lake 02	N/A	N/A	N/A	N/A	N/A
26	Hudson Strait (Materials are located on the shoreline)	Non-hazardous	Unpainted wood	2	A ramp to the strait, parts of a dock	
			Metal	1	Debris, track, stove	Rusted
			Drums (205L)	20 drums	Rusted, partially buried, some in pieces	Rusted
		Hazardous	Compressed gas cylinder	50L	Partially full, unknown contents	Intact, rusted
			Total and leachable lead painted equipment	4	Yellow and green painted machine	Peeling paint, rusted
			Battery	0.02	Lead and acid car battery	Broken apart
N/A	Drums from the ASTs (73000 L) to the Hudson Strait	Non-hazardous	Drums (205L)	44 drums	Approximately nine drums with content, as indicated below, mostly rusted	Good, rusted
		Hazardous	Aqueous content in drum (205L)	400 L	Weathered, watery content, partially organic	N/A
			Compressed gas cylinder	50L	Partially full, some water in it	Intact, rusted
N/A	Various Debris (Throughout and adjacent to the Site)	Non-hazardous	Unpainted wood	17.5	Poles (West and south of site, upright and laying)	Weathered
			Metal	2	Poles and supporting wires	Intact
			Cables	10	Power cables running throughout the site, mostly underground, with a rubber exterior and metal interior	Intact, rusted
			Concrete	5	Cubes	Intact
		Hazardous	Creosote soaked wood	2.5	Bottom of poles	Rusted
Totals: (Uncrushed / m^3)	Non-Hazardous	Unpainted wood	898	Notes: 1. All volumes: uncrushed 2. Volumes of total and leachable amended paint includes the painted substrate 3. Drums volumes are numbers of drums, not m3 4. Liquid volmes are in litres, not m3.		
		Metal	111.5			
		Black felt	10.8			
		Brick and brick mortar	18			
		Cables	17			
		Concrete	21.5			
		Drum (205L)	77 drums			
		Exterior siding	19			
		Fibre glass insulation	176			
		Flooring	18			
		Glass windows	1.5			
		Porcelain	2.5			
		Rubber	0.5			
		ASTs (900L)	4			
		Asphalt shingles	17.7			
	Hazardous	Aqueous content in drum (205L)	620 L			
		Organic contents in ASTs (900L)	1400 L			
		Asbestos asphalt shingles	0.9			
		Asbestos floor tiles	0.5			
		Asbestos furnace gasket	0.1			
		Asbestos Insulation	158.5			
		Asbestos Light Backings	0.02			
		Fibre glass insulation (Asbestos contaminated)	162			
		Asbestos panels	28			
		Asbestos siding	14			
		Asbestos, total lead and leachable lead containing on panels	48.5			
		Batteries	0.28			
		Compressed gas cylinder	100L			
		Creosote soaked wood	5			
		Equipment contents	501 L			
		Fire Extinguisher	0.1			
		Mercury in fluorescent lights	0.5			
		Mercury, PCBs and lead solder in electrical components	5			
		PCBs in light ballasts	2.6			
		Total lead paint on particulate board	7			
		Total and leachable lead paint on particulate board	3			
		Total and leachable lead paint on equipment	28			
		Total and leachable lead paint on metal	38			
		Total and leachable lead paint on wood	128.2			
		Total lead paint on ASTs (73000L each)	146			
		Total lead painted generators	3			

Appendix C. Nottingham Island Uncrushed and Crushed Material Volumes Tables

		Material Description	Volume Uncrushed (m^3), except drums and liquid	Crush Ratio	Volume Crushed (m^3), except liquid
Totals	Non-Hazardous	Unpainted wood	898	1:1	898
		Metal	111.5	4:1	27.875
		Black felt	10.8	1:1	10.8
		Brick and brick mortar	18	1:1	18
		Cables	17	1:1	17
		Concrete	21.5	1:1	21.5
		Drum (205L)	77 drums	4.4:1	4.35
		Exterior siding	19	1:1	19
		Fibre glass insulation	176	5:1	35
		Flooring	18	1:1	18
		Glass windows	1.5	1:1	1.5
		Porcelain	2.5	1:1	2.5
		Rubber	0.5	1:1	0.5
		ASTs (900L)	4	4:1	1
		Asphalt shingles	17.7	1:1	17.7
	Hazardous	Aqueous content in drum (205L)	620 L	1:1	620 L
		Organic contents in ASTs (900L)	1400 L	1:1	1400 L
		Asbestos asphalt shingles	0.9	1:1	0.9
		Asbestos floor tiles	0.5	1:1	0.5
		Asbestos furnace gasket	0.1	1:1	0.1
		Asbestos Insulation	158.5	1:1	158.5
		Asbestos Light Backings	0.02	1:1	0.02
		Asbestos siding	14		
		Fibre glass insulation (Asbestos contaminated)	162	5:1	32.4
		Asbestos panels	28	1:1	28
		Asbestos, total lead and leachable lead containing on panels	48.5	1:1	48.5
		Batteries	0.28	1:1	0.28
		Compressed gas cylinder	100L	1:1	100L
		Creosote soaked wood	5	1:1	5
		Equipment contents	501 L	1:1	501 L
		Fire Extinguisher	0.1	1:1	0.1
		Mercury in fluorescent lights	0.5	1:1	0.5
		Mercury, PCBs and lead solder in electrical components	5	1:1	5
		PCBs in light ballasts	2.6	1:1	2.6
		Total lead paint on particulate board	7	1:1	7
		Total and leachable lead paint on particulate board	3	1:1	3
		Total and leachable lead paint on equipment	28	1:1	28
		Total and leachable lead paint on metal	38	4:1	9.5
		Total and leachable lead paint on wood	128.2	1:1	128.2
		Total lead paint on ASTs (73000L each)	146	4:1	36.5
		Total lead painted generators	3	1:1	3

Uncrushed Notes:
1. All volumes: uncrushed.
2. Volumes of total and leachable amended paint includes the painted substrate.
3. Drum volumes are numbers of drums, not m^3.
4. Liquid volmes are in litres, not m^3.

Crushed Notes:
1. Non-hazardous wood is to be burned and landfilled on-site if ash does not contain leachable metals.
2. Volumes of total and leachable amended paint includes the painted substrate.
3. Drums volumes are in m^3 not number of drums, assuming 1 crushed drum is 0.0565m^3.
4. Liquid volmes are in litres, not m^3.