REPORT

Environmental Screening of the
Proposed Site Remediation
at the Former FOX-C DEW Line Site
at Ekalugad Fjord, Nunavut

PUBLIC WORKS AND GOVERNMENT
SERVICES CANADA, WESTERN REGION

PROJECT NO. ABC50626

Jacques Whitford

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REPORT TO **Public Works and Government Services Canada, Western Region**

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EXECUTIVE SUMMARY

Public Works and Government Services Canada (PWGSC), on behalf of Indian and Northern Affairs Canada (INAC) is planning to complete the clean up and remediation of the former FOX-C Intermediate DEW Line Site on Baffin Island. Various stages of clean up of the site have been ongoing since 1985. The first phase of PWGSC's clean up and remediation consisted of a detailed site assessment and preliminary consolidation of existing wastes at the site. The second phase involves the remediation of the site. As required under the *Nunavut Land Claim Agreement* (*NLCA*) and the *Canadian Environmental Assessment Act* (*CEAA*), the remediation activities proposed for FOX-C must undergo an environmental screening.

The remediation at FOX-C is scheduled to begin in 2006 with completion in 2007. Mobilization activities will begin in September 2005 with demobilization to follow remediation activities in the winter of 2007. Activities will consist of contaminated soil excavation/remediation, dump area remediation, collection and disposal of hazardous and non-hazardous debris, and demolition and disposal of site facilities.

The remediation activities at FOX-C will interact with the environment through vehicle and machinery emissions, waste disposal, surface disturbance and the provision of employment to local inhabitants. There is also the potential for spills of fuel or hazardous materials. The activities will be carried out following standard good operating practices for northern Canada, with spill prevention practices and contingency plans in place. The objectives of the activities are to clean up and return sites to as close to natural conditions as is possible. Specifically, the remediation will mitigate and/or control the release of contaminants into the environment. The environmental effects of the activities are assessed as being of low magnitude and not significant. The activities will benefit the area through the short-term employment of local individuals and through the clean up of the site.

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1.0 INTRODUCTION

The former FOX-C Intermediate DEW Line Site has been undergoing various stages of clean up since 1985. Indian and Northern Affairs Canada (INAC) has requested Public Works and Government Services Canada (PWGSC) Western Region to complete the remediation of the site over the next several years. In 2004, PWGSC completed a detailed site assessment, preliminary waste consolidation, and general site clean up at the site. This is to be followed by the implementation of a remediation plan. This Environmental Screening assesses the potential impacts of the proposed remediation of the FOX-C DEW Line Site.

2.0 REGULATORY CONTEXT

2.1 Permits, Licences, and Authorizations - Current Regulatory Regime

Development of the Project will involve a number of distinct undertakings and activities, requiring authorizations from a variety of federal, territorial, Inuit, and resource co-management agencies. Table 2-1 provides a preliminary listing of permits, licences, and authorizations that may be required to develop the Project. The specific permits, licences, and authorizations that will be required will depend on the final configuration of the Project and all related activities, and may include others not listed here. Regulatory procedures that must be followed differ for each permitting, licencing, or authorizing agency. The application for a permit, licence, or authorization will usually initiate a review of the Project under one or more environmental assessment processes, unless the proposed activity has been explicitly exempted from assessment.

Within Nunavut, INAC regulates land use on Crown (or federal) lands, whereas Nunavut Tungavik Incorporated (NTI) and the regional Inuit associations regulate subsurface and surface land use on Inuit Owned Lands. The Nunavut Water Board regulates water use in Nunavut. Environmental screening and assessment is the responsibility of the Nunavut Impact Review Board (NIRB). The *Nunavut Land Claim Agreement* (*NLCA*) establishes these new boards and regulatory processes, with the *Nunavut Land Claim Settlement Act* and the *Nunavut Act* being the federal legislation enabling the implementation of the provisions of the *NLCA*. Depending on the activity, environmental screening and assessment may also have to accommodate the requirements of the federal *Canadian Environmental Assessment Act (CEAA)*, in addition to the requirements of NIRB.

Table 2-1: Permits, Licences, and Authorizations That May Be Required			
Activity	**Permit/Approval**	**Legislation**	**Agency**
Remediation			
Route and site clearing, laydown and staging areas, borrow sources	Land Use Permit / Quarry Permit/ Permit to Access Inuit Owned Land	*Nunavut Land Claims Settlement Act Territorial Lands Act and Regulations** *Federal Real Property Act & Regulations*	Nunavut Tungavik Incorporated, Kivalliq Inuit Association, Lands Division INAC
Construction of watercourse crossings affecting fish habitat	Authorization or Letter of Advice for Works or Undertakings Affecting Fish Habitat	*Fisheries Act**	Fisheries and Oceans Canada
Water use and waste water disposal at bridge crossings	Water Licence	*Nunavut Waters Act*	Nunavut Water Board
Transportation, use of heavy equipment	Vehicle Registration or Permit	*Motor Vehicles Act (Nunavut)*	Nunavut Department of Community Government and Transportation
Transportation of dangerous goods	Certificate / Permit	*Transportation of Dangerous Goods Act*	Transport Canada Nunavut Department of Sustainable Development
Sewage disposal, food premises, sanitation at camps	Permit / Criteria	*Public health Act (Nunavut)*	Nunavut Department of Health and Social Services

* Indicates legislation triggering *CEAA*

2.2 Existing Environmental Assessment and Review Process

This section provides a summary of the typical regulatory provisions for environmental assessment pursuant to the *NLCA* and the *CEAA*, as outlined in the agreement, enabling legislation, guidelines, and operational procedures, that may apply to any project within Nunavut.

Article 12 of the *NLCA* establishes processes for the screening and review of project proposals on land and marine areas within the Nunavut Settlement Area (including Inuit Owned Lands, Commissioners lands, and Crown lands) and to the Outer Land Fast Ice Zone. The NIRB was established in 1996, under Article 12.2.1 of the *NLCA*, as an institution of public government with responsibilities for environmental assessment. The NIRB's primary functions are to screen and review the ecosystemic and socio-economic effects of project proposals, and to make recommendations to the federal or territorial Minister(s) responsible for authorizing such projects to proceed. The NIRB also can issue recommendations for monitoring of project effects, but the responsibility for enforcement of such provisions lies with the agency issuing a permit, licence, or authorization. The NIRB's objectives are to protect the ecosystemic integrity of Nunavut, and to protect and promote the existing and future well-being of the residents and communities of Nunavut, and of Canada.

The FOX-C DEW Line Site is on federal lands that are regulated by INAC. As the Responsible Authority, INAC requires that an environmental screening be conducted in accordance with the *CEAA*. Where a proposed project in Nunavut involves a *CEAA* trigger, federal and territorial governments and the NIRB work together to harmonize the environmental screening process. This process is intended to provide information for the federal authorities to support the screening of the project pursuant to the

requirements of *CEAA*. As such, the study has been conducted in a manner that is consistent with the *NLCA* and *CEAA* and the guidance documentation of the NIRB, the Canadian Environmental Assessment Agency and INAC.

The initial step in obtaining approval for a project proposal within the Nunavut Settlement Area is the submission of an application for a permit, licence, lease, or approval to an authorizing agency (*i.e.,* government department, Designated Inuit Organization, regulatory board). It is important to note that more than one authorization may be required for undertakings and activities on land or water.

The authorizing agency is responsible for initial processing of the application. Where regional land use plans are in place, the application is forwarded to the Nunavut Planning Commission (NPC) for review of conformity with the land use plan. Where a project proposal conforms to an approved land use plan, or if a variance has been approved, the NPC forwards the project proposal application to the NIRB for screening. If no approved land use plans exist, project proposal applications are referred directly by the authorizing agency to the NIRB for screening.

The initial steps of the screening involve notification of the proponent and authorizing agencies, establishment of a timeline for a screening determination (where not specified by regulation), and distribution of the project proposal application to appropriate stakeholders. Taking into account all comments received from stakeholders regarding the project proposal, existing scientific information, Inuit traditional knowledge, and the information provided by the proponent, the NIRB then reviews the potential effects of the project and the level of public concern about and/or in support of the project proposal. Once the screening has been completed, the NIRB will produce a Screening Decision Report that documents its determination as to whether the project proposal should be approved without further review, abandoned or modified by the proponent, or subject to review under Part 5 or 6 of the NLCA.

If the NIRB determines that the project proposal should proceed without further review, the NIRB may include in its Screening Decision Report terms and conditions to be attached to the authorizations to be issued. The authorizing agency will include the NIRB terms and conditions in the final authorization. However, where the authorizing agency disagrees with the recommended terms and conditions, the agency must provide the NIRB with a rationale for omissions from the final authorization. Monitoring of adherence to terms and conditions is the responsibility of the authorizing agency. The NIRB will complete its screening and issue its Screening Decision Report to the authorizing agency (or agencies) within applicable legislated timelines to allow the agencies to meet their legislative requirements. However, should an agency have no legislated time limits regarding the issuance of permits, NIRB will provide its Screening Decision Report within “an acceptable time period”.

When the Screening Decision Report indicates that a review is required, the Minister may:

- refer the proposal to the Minister of Environment for review by a federal environmental assessment panel;
- refer the proposal back to the NIRB for a review of ecosystemic and socio-economic impacts; or
- inform the proponent that the proposal should be abandoned or modified and resubmitted to NIRB.

The scope of the project has been determined pursuant to Section 15.1 of *CEAA*. Discussions with PWGSC were undertaken to establish the scope of the project, the scope of the environmental screening and the establishment of Valued Environmental Components (VECs). Factors considered in the environmental screening include those prescribed in Section 16.1 (a) to (e) of *CEAA*, listed below:

(a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
(b) the significance of the effects referred to in paragraph (a);
(c) comments from the public that are received in accordance with this Act and the regulations;
(d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
(e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to project, that the responsible authority or, in the case of a screening, the Minister after consulting with the responsible authority may require to be considered.

Cumulative environmental effects have been considered pursuant to Section 16.1(a) of *CEAA* for likely future projects. No additional factors have been prescribed under Section 16.1(e) by INAC for inclusion in the potential cumulative environmental effects assessment analysis.

The existing conditions of the project area environment, with respect to the identified VECs, are characterized in this report. Potential interactions of specific project activities with the environment are identified and the environmental effects are evaluated in consideration of appropriate mitigation measures.

3.0 ENVIRONMENTAL ASSESSMENT CONTACTS

Responsible Authority Contact: Robert Martin Contaminated Sites, Project Officer Nunavut Regional Office P.O. Box 2200 Iqaluit, NU X0A 0H0 Phone: (867) 979-7931 Fax:(867) 979-7939	***CEAA Contact:*** Brian Torrie Project Assessment Group Canadian Environmental Assessment Agency 160 Elgin Street, 22nd Floor, Ottawa, ON K1A 0H3 Phone: (613) 957-0791
Proponent Contact: Robert Martin Contaminated Sites, Project Officer Nunavut Regional Office P.O. Box 2200 Iqaluit, NU X0A 0H0 Phone: (867) 979-7931 Fax:(867) 979-7939	***Nunavut Impact Review Board:*** Jorgen Komak Environmental Assessment Officer P.O. Box 2379 Cambridge Bay, NU X0B 0C0 Phone: (867) 983-2593 Fax:(867) 983-2594 e-mail: jkomak@nirb.nunavut.ca

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4.0 PROJECT DESCRIPTION

The Department of Indian Affairs and Northern Development (DIAND) wishes to implement a remedial action plan at the abandoned military station, intermediate DEW Line site FOX-C, located at Ekalugad Fjord, Nunavut. Remediation assessment activities at the site were carried out in the summer of 2004 to quantify the volume of contaminated soil and hazardous materials at the site and to conduct a waste audit on all non-hazardous materials. Potential gravel and rock borrow sources and suitable locations for an engineered landfill were also identified.

The former DEW Line site was constructed in 1957 and subsequently closed and abandoned in 1963. The site has not been formally occupied since 1963. Assessments completed in 1985 and 1994 and the detailed site assessment in the summer of 2004 have confirmed the presence of various hazardous materials and contaminated soil.

DIAND has requested PWGSC to assume responsibility for cleaning and remediating the site. PWGSC developed a work plan for a detailed site assessment in 2004 which was carried out to address this responsibility. The results from the detailed site assessment were used to develop a remediation work plan which is proposed to be carried out in 2006 / 2007, with initial site preparation commencing in September 2005.

The full Project consists of two components:

1. a detailed site assessment and preliminary waste consolidation at the FOX-C DEW Line Site (conducted in summer 2004); and
2. the implementation of a remedial action plan for the site (scheduled to commence in 2005).

This environmental screening focuses on the second component, the implementation of a remedial action plan.

4.1 Project Location

The site description and history information is extracted from Reimer et al. (1994) and PWGSC's work plan for FOX-C (UMA Engineering Ltd. 2005).

FOX-C DEW Line Site (Figure 4-1) is located on the east coast of Baffin Island (68° 42'N, 68° 38'W) in Nunavut. The nearest community is Clyde River, 195 km to the north. The beaching area is located on the south shore of Ekalugad Fjord, while the operations station is situated about 1.5 km inland at 770 m asl, overlooking Home Bay. FOX-C is located approximately halfway between two former auxiliary DEW Line stations, Dewar Lakes (FOX-3), 108 km to the west and Cape Hooper (FOX-4), 78 km to the east.

The FOX-C site covers both Federal (Crown) Lands and Inuit Owned (IO) Lands.

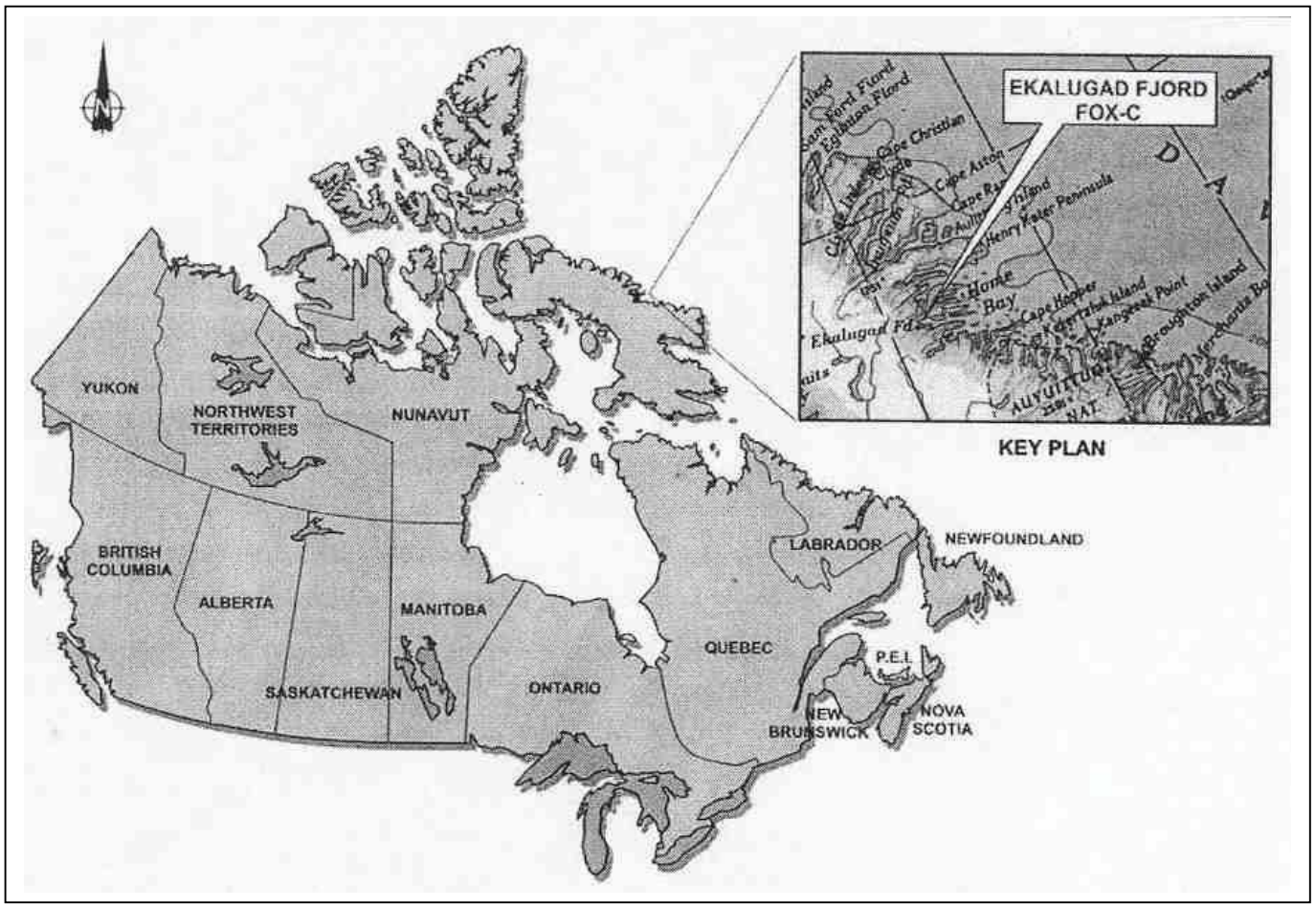

Figure 4-1: FOX-C DEW Line Site Location Map

4.2 History

Ekalugad Fjord was reserved by the Department of National Defence (DND) in 1956 and FOX-C was constructed in 1957 as an intermediate DEW Line site. The station consisted of a five-module building train, a warehouse, a vehicle garage, an Inuit house, three storage sheds, a POL (Petroleum, Oil, Lubricant) drum storage facility and a continuous wave tower. In addition to the main station, a cargo beaching area was constructed as part of the site facilities. A gravel road was built linking the beaching area and the freshwater lake to the upper site. An airstrip was not constructed at this site, due to lack of adequate level terrain, although the freshwater lake served as a location for an ice airstrip during the winter. A helipad was constructed at the upper site, just east of the station buildings.

Details of the facilities and equipment that were used during the operation of this site have been documented by Andzans and Associates (1984) and are similar to those observed at other Intermediate sites. The site was abandoned as part of the DEW Line system in October 1963, and the responsibility for the site was taken over by DIAND.

In 1963, Ekalugad Fjord was reserved for scientific use by government or university groups. Although the site was never used as a research station, a botanical survey was conducted in the area in July 1967.

Environmental assessment of the FOX-C DEW Line site was initiated in 1986 when DND and Environment Canada visited the site to remove contaminants such as PCBs and POLs and identify areas of buried materials that could pose environmental risks in the future. Their findings identified a number of drum caches with many of the drums still containing product. These were left in place. Removal of PCB-containing equipment was conducted and elevated PCB concentrations were noted in soil samples at several areas. Various sampling and clean-up activities have been conducted at the site during the 1990s.

The site was revisited in 1994 by the Environmental Sciences Group of Royal Roads Military College at which time a detailed surface soil sampling program was completed. Their investigations identified soil contamination exceeding Tier I and Tier II DEW Line Clean-up Criteria (DCC) near the module train, garage, warehouse, dumps, crashed aircraft and construction camp. However, these investigations did not include assessment of hydrocarbon contamination that has the potential to be a significant source of contamination at the site. Analysis of paint, barrel contents, and asbestos has also been conducted.

A detailed site assessment and preliminary waste consolidation was conducted in 2004. The detailed site assessment involved:

- assessment of the existing landfills including delineation of landfill boundaries, identification and quantification of hazardous materials in the landfills, and determination of whether the landfill is releasing deleterious substances into the surrounding environment;
- contaminated soil delineation including areal and vertical limits of the contamination on-site;
- hazardous materials inventory including identification and quantification of materials that will require specialized disposal and a sampling of barrels containing liquid;
- assessment of new landfill location and borrow sources including a survey of the site to tie in all site structures, borrow sources, landfill areas and assessed locations;
- site-specific risk assessment to quantify the risk to human and ecological receptors;
- site assessment of the lake to determine if contamination has occurred;
- an evaluation of the condition of the site roads;
- an airstrip evaluation to confirm condition of the airstrip for further activities; and
- a waste consolidation of barrels in non aquatic areas of the site.

Based on the results and reports generated from the assessment activities, a remediation plan was developed.

4.3 Objectives of the Remediation Program

The objectives of the remediation program at FOX-C are to remediate the site to an acceptable level of environmental risk by:

- removing contaminated soils;
- stabilizing existing dumps;
- developing engineered landfill facilities;
- collecting and disposing of surface debris;
- demolishing and removing exiting site facilities; and
- physically restoring the site.

4.4 Existing Infrastructure

UMA Engineering Ltd. (2005) provides several drawings and photographs describing the FOX-C DEW Line site. These are presented in Appendix A of this report. Site infrastructure consists of the following:

- module train;
- warehouse and garage;
- Inuit house (dormitory);
- Petroleum, Oil, Lubricants (POL) pumphouse;
- quonset hut;
- wooden hut in the lake area;
- collapsed communications antenna;
- refuelling pipeline;
- four 75,500-L POL tanks;
- two 22,700-L mobile fuel tanks;
- upper storage shed;
- paint shed;
- lower storage shed;
- one 7,600-L fuel tank;
- four dump sites; and
- a lake airstrip.

The FOX-C site includes upper and lower portions, as shown in Figure 4-2. The Lower Site, which includes beach and lake areas is on IO Lands, as is the lower portion of the access road to the Upper Site. The Upper Site and portions of the access road are located on Crown Lands.

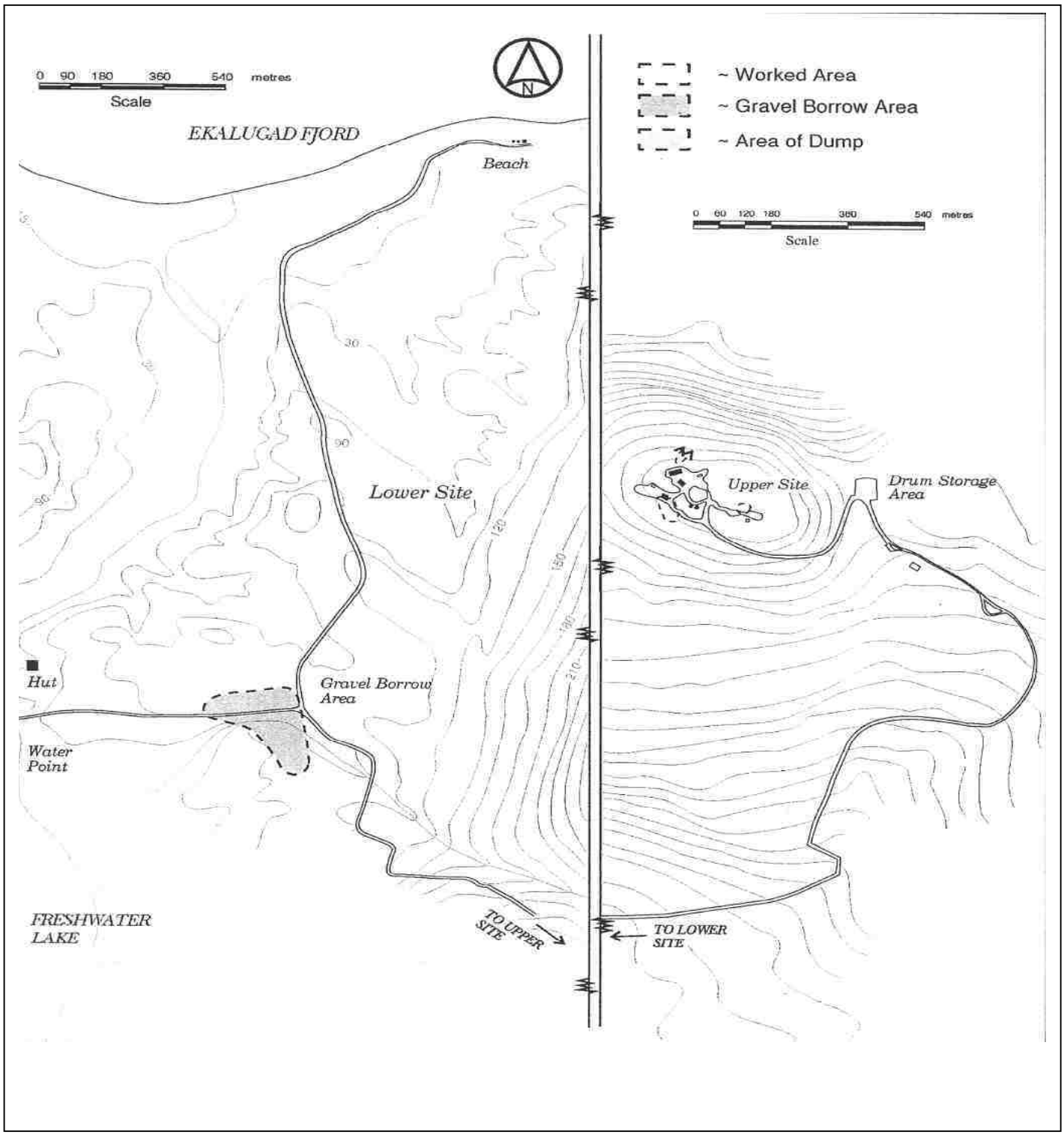

Figure 4-2: General Site Layout – FOX-C DEW Line Site

4.5 Project Activities

The remediation activities at FOX-C are described below. The work plan has been developed by UMA Engineering Ltd. (2005). Their drawings showing the remediation sites described below are presented in Appendix A.

4.5.1 Contaminated Soil Remediation

There is a total of approximately 1455 m^3 of contaminated soils on the FOX-C site.

Table 4-1 details the locations of the soils, their contaminants of concern and the proposed remediation options for each area. In general, Tier I, petroleum hydrocarbons (PHC) and metals-contaminated soils can be covered with fill and regraded. CEPA-contaminated soils must be excavated and disposed of at an off-site approved facility. All soils contaminated with Hydrocarbons F1/F2 from the Beach POL area will be land farmed.

Table 4-1: Contaminated Soils at FOX-C

Location	Contaminant of Concern[1]	Tier II Volume m^3	Notes[1]	Remediation Option[1]
Beach Area – POL Tanks	PHCs (F2)	340	PHC contaminated soils to depth of 1.2 m	• Landfarm • Excavate and dispose off site
Beach Area – Barrel Dump #1	Metals	-	Potentially 340 m^3 of chromium contaminated soils to depth of 0.3 m. Elevated levels may be due to naturally occurring chromium.	• No remediation required relative to Tier II criteria
Beach Area – Dump #2	Metals	-	Potentially 680 m^3 of chromium contaminated soils to depth of 0.3 m. Elevated levels may be due to naturally occurring chromium.	• No remediation required relative to Tier II criteria.
Water Lake Area – Heli-pad Surface Stains (2)	PHCs (F3)	75	PHC contaminated soils to depth of 0.6 m.	• Cover with granular fill • Excavate and dispose as Intermediate Fill in on-site NHW Landfill
Drainage Course Stain	PHCs (F3/F4)	6	18 m^2 area at 0.3 m depth = 6 m^3	• Cover with granular fill • Excavate and dispose as intermediate fill in on site NHW Landfill
Mid-station Area – Existing Pad	PHCs (F3/F4), PAHs	75	Can excavate pad, off pad consists mostly of boulders with little contaminated soil infill.	• Leave existing pad soils in place and build NHW Landfill over. • Excavate and dispose off pad soils as intermediate fill in on-site NHW Landfill.
Mid-Station Area – Barrel Dump #2	PHCs (F3/F4)	50	Covers an area of 1800 m^2, mostly of boulders with little soil contaminated infill material.	• Cover with granular fill

Table 4-1: Contaminated Soils at FOX-C				
Location	**Contaminant of Concern[1]**	**Tier II Volume m^3**	**Notes[1]**	**Remediation Option[1]**
Mid-Station Area – Barrel Dump #6	PHCs (F3/F4)	60	Two areas with an area of 1800 m^2, mostly boulders with little soil contaminated infill.	• Cover with granular fill
Upper Station – Main Dump	Tier I / II? PCBs, PHCs	30	PCB / Hydrocarbon contamination	• Delineate Tier II PCB Soils and provide on site or off site disposal • Excavate and dispose of Tier I soils as intermediate fill in on-site NHW landfill
Upper Station – Main Dump	Tier II Metals	15	Copper, Lead, Zinc and Chromium contamination	• Excavate and dispose as Intermediate fill in on-site NHW Landfill
Upper Station – South of Module Train	Tier I PCBs	7	PCB Contamination	• Excavate and dispose as intermediate fill in on-site NHW Landfill
Upper Station – West of Module Train	PHCs (F2/F3)	14	Hydrocarbon contamination	• Landfarm • Excavate and dispose off-site
Upper Station – Warehouse	PHCs (F2/F3/F4)	15	Warehouse AST contamination	• Landfarm • Excavate and dispose off-site
Upper Station – Gravel pad West of Garage	PHCs (F3)	140	Depth = 0.5 to 0.75 m	• Cover with granular fill
Upper Station – D8 Cat	PHCs (F2/F3)	4	Depth = 0.15 m	• Cover with granular fill
Upper Station – West of Garage Building	Tier I PCBs, Metals	1	PCB Contamination (3.8 ppm) over 5 m^2	• No remediation relative to metals exceeding Tier II criteria • Excavate and dispose Tier I contaminated PCB soils as intermediate fill in on-site NHW Landfill
Upper Station – East of Garage Building	Tier I PCBs PHCs (F3)	15	PCBs at 3.8 ppm PHC contamination over 40 m^2	• Excavate and dispose as intermediate fill in on-site NHW Landfill
Upper Station – Garage Dump	Tier I PCBs, PHCs (F2/F3/F4), Tier II Metals	8 35 330	Metals contamination depth = 0.2 m PCB contamination Hydrocarbon Contamination covers an area of 1100 m^2 with a depth 0.3 m	• Contaminated soils to be dealt with as part of landfill remediation
Upper Station – POL Storage	PHCs (F2/F3)	200	Hydrocarbon contamination covers an area of 650 m^2 with a depth of 0.3 m.	• Landfarm in place
Surface stain – Antenna Base Area	PHCs (F3/F4)	25	Hydrocarbon contamination	• Cover with granular fill • Excavate and dispose as intermediate fill in on-site NHW Landfill

Table 4-1: Contaminated Soils at FOX-C				
Location	**Contaminant of Concern[1]**	**Tier II Volume m^3**	**Notes[1]**	**Remediation Option[1]**
Surface Stains – NW of Module Train	Tier I PCBs, PHCs (F3/F4)	10	PCB / Hydrocarbon contamination	• Excavate and dispose as intermediate fill in on-site NHW Landfill
Total volume of soil requiring remediation		1,455 m^2		

[1]
1) AST = Aboveground Storage Tanks
2) NHW = Non-hazardous Wastes
3) PAHs = Polycyclic Aromatic Hydrocarbons
4) PCBs = Polychlorinated Biphenyls
5) PHCs = Petroleum Hydrocarbons
   F1 = C6 – C10
   F2 = C11 – C16
   F3 = C17 – C34
   F4 = C35 +

4.5.2 Dump Area Remediation

4.5.2.1 Main Dump

The Main Dump is located approximately 20 m northeast of the module train on the north side of the summit on a steep slope with bedrock ridges and small plateaus. The Main Dump contains mainly scattered surface debris, including barrels and miscellaneous wood and metal. It covers an area of approximately 5000 m^2. There is no specific area containing concentrated debris, however the geophysical survey conducted indicates two small barrel cache locations within the dump. The environmental investigation found contaminated soil areas with exceedances of Tier I PCBs. Because the buried debris is located upgradient of the contaminated soil it may be the source for the contamination.

Because the Main Dump is considered a debris area with contaminated soil rather than a landfill, the proposed remediation falls under the general site clean up methodology including removal and disposal of all surface debris and excavation and disposal of Tier I soils in the NHW Landfill. Any soils with PCB levels exceeding Tier II criteria will be shipped off site for disposal. The two areas containing barrels are considered concentrated surface debris areas and the barrels will be collected and disposed of in the NHW Landfill.

4.5.2.2 Garage Dump

The Garage Dump is located on the edge of the summit, just off the station pad to the south and southeast of the garage. The Garage Dump includes scattered surface debris including barrels and miscellaneous wood and metal. The Garage Dump does not have a specific area where there is significant concentrated debris although one small barrel cache was found in the dump area. The geophysical survey identified two small areas with exposed debris including Lobe A with dozer tracks and miscellaneous metal debris and Lobe B which consists of a barrel cache.

The environmental investigation identified soils contaminated with hydrocarbons, Tier I PCBs and Tier I and II metals. There is significant hydrocarbon surface staining within this dump and the source appears to be from the disposal and release of waste oil. Leaking, partially buried 10-gallon barrels were observed on the edge of the station pad near the garage.

The proposed remediation strategy for the Garage Dump is to remove sources of hydrocarbon contamination, collect and dispose of the surface debris and cap the stained area with fill. Local areas with elevated hydrocarbon concentrations, along with the leaking 10-gallon barrels will be removed as hydrocarbon sources. The proposed capping of the landfill will involve extending the Station Pad over the landfill areas to promote sheet drainage. It is estimated that 5000 m^3 of granular fill will be required to cap this stained area.

4.5.2.3 House Dump

The House Dump is located on the east side of the summit near the remnants of the Inuit House. The dump consists of a small pad among the bedrock outcrops with scattered domestic waste, including metal and wood, and a couple of barrels. There is no specific area where there is significant concentrated debris, although the geophysical survey indicated that there is one small area of surface debris comprised of barrels covering an area of approximately 100 m^2. There were no contaminated soils found in the dump area.

This dump is considered a debris area and proposed remediation would fall under the general site clean-up methodology and would include removal and disposal of all surface debris. The barrels will be collected and disposed of in the NHW Landfill.

4.5.2.4 Mid-Station Dump

The Mid-Station area is located approximately 450 m to the east of the Upper Station area within an elevated u-shaped saddle on the north side of the access road. It consists of concentrated debris including barrels, domestic waste and miscellaneous wood and metal. There is no soil cover over the landfill and there is little soil mixed in with the debris. The geophysical survey conducted in this area shows concentrated debris at two discrete locations, including Lobe A which consists of barrel caches on the gravel pad and Lobe B, which is the actual dumpsite. The surface area of the landfill is estimated at 2000 m^2 with an average depth estimated at 1.5 m.

The environmental investigation identified soils contaminated with hydrocarbon and PAHs in the northwest corner of the gravel pad to about 25 m downslope of the pad. There is no reported contamination with PCBs, metals or hydrocarbons.

The gravel pad located at the dump site has been identified as the only potential NHW Landfill site near the Upper Station and is expected to be used because of its closeness to most of the demolition and debris clean up areas. Barrel caches on the pad will be removed to allow for construction of the NHW Landfill and contaminated soils will be excavated and removed from the area downgradient of the pad area.

The dump is situated over a steep slope which will preclude remediation by covering of the landfill because the cover would be subject to settlement depressions and/or slope movement. Plans are for Lobe B of this landfill to be excavated in its entirety and its non-hazardous waste components disposed of in the adjacent NHW Landfill. If hazardous debris or contaminated soils are discovered during remediation these will be containerized and disposed of at an off-site disposal area.

4.5.2.5 Original Dump

The Original Dump is located along the access road, approximately 1 km southeast of the Upper Station area. This area of the site is comprised of rock outcrops, bedrock-derived boulders and some native surficial soils. This dump contains scattered debris including barrels, domestic waste, miscellaneous metal and wood. There is no specific concentration of debris although the geophysical survey did find a small barrel cache covering an area of 100 m^2. There were no contaminated soils identified in this area.

This area is considered a debris area and proposed remediation falls under the general site clean up methodology including removal and disposal of all surface debris. The barrels will be collected and disposed of in the NHW Landfill.

4.5.3 Disposal of Site Debris

In addition to the Main, Garage, House, Mid-Station and Original Dumps, there were numerous other isolated areas of debris. These debris areas have been designated as: Beach Area containing Barrel Dumps 1, 2 and 3, a Vehicle Dump and POL aboveground storage tank (AST) area; River Area located between Water Lake and Beach; Water Lake Area containing Barrel Dump 1, East Side, West Side and Vehicle Dump; Access Road from Dump #7 to Intersection and Mid-Station to Upper Site; Mid-Station Area including the Heli-Pad, Barrel Dump #s 1 through 8, Quonset Building #s 1 through 4; and Upper Station containing Garage exterior, Paint Shed Area, Warehouse Exterior, Module Train Exterior, Main Dump, Quonset Building, Antenna Base Area, Inuit House Area, Fuel Storage Area and Garage Dump.

All of the site debris will be sorted and classified as hazardous or non-hazardous debris. Hazardous materials will be shipped off-site for disposal and non-hazardous material will be placed in the NHW Landfill.

Any material that contains asbestos will be double bagged and disposed of in the NHW Landfill. PCB-painted material will be segregated, containerized and disposed of off-site at a licensed disposal facility.

Where debris that is partially buried is removed, the landscape will be reshaped where necessary and any holes will be backfilled with granular material and graded to match the natural topography.

Table 4-2 summarizes the non-hazardous demolition and debris areas at the FOX-C site and Table 4-3 the hazardous demolition and debris areas. There is approximately 6455 m^3 of non-hazardous debris on the site and 170 m^3 of hazardous debris.

Table 4-2: Summary of Non-hazardous Debris at FOX-C

Debris Area	Approximate Volume (m^3)	Description
Beach Area Barrel Dumps # 1, 2 and 3	155	920 empty barrels, cement powder, heavy equipment, miscellaneous wood and metal
Beach Area Vehicle Dump	71	Three D4 Dozers, D6 Dozer, D2 Dozer, Tracked Bombardier, 3 generators, 35 empty barrels, creosote timber, miscellaneous wood and metal.
Beach Area POL ASTs Area	30	75,000 L tanks (2) and piping, scattered wood debris, rubber hose and fittings, 40 barrels, propane tank
River Area between Water Lake and Beach	467	450 barrels, domestic waste
Water Lake Barrel Dump #1	31	250 empty barrels, scattered wood debris
East Side of Water Lake	82	Cable spools, fire extinguishers, heavy metal, 200 empty barrels, cement powder, heavy equipment, miscellaneous wood and metal
West Side of Water Lake	1	6 Barrels
Water Lake Vehicle Dump	62	Two tracked Bombardiers, two generators, D3 Dozer, cement mixer, steel cable, rubber hose, 70 barrels, cable spool, miscellaneous wood and metal
Access Road from Dump #7 to Water Lake Access Road	63	250 barrels, wooden sleds, dragline bucket, miscellaneous wood and metal
Mid-Station Area – Heli-Pad	56	360 barrels, 4 compressed gas cylinders, scattered wood debris
Mid-Station Area – Mid-Station Dump	3300	
Mid-Station Area – Barrel Dump #'s 1 through 8	810	5170 barrels, various 10 gallon barrels, cable spools, rubber hoses, cable spools, piping, fire extinguishers, dozer tracks, dozer blades, miscellaneous wood and metal
Quonset Building #'s 1, 2, 3 and 4	218	4 wooden Quonset huts, canvas, snow fencing, heaters, shelving, steel cables, fire extinguishers, piping, dozer tracks, dozer blades, steel hoist, rubber tires, aluminum tubing and pipe fittings, cement powder, rubber hoses, heavy equipment, 50 barrels, plywood, miscellaneous wood and metal
Access Road – Mid-Station to Upper Site	33	150 barrels, miscellaneous wood and metal
Upper Station – Garage Exterior	29	D8 Dozer, tracked bombardier, heavy equipment parts, ladder, rubber hose, 10 barrels, miscellaneous wood and metal
Upper Station – Garage Interior	70	Structural Steel, glass wool insulation, metal decking, interior cladding, interior shelving, tracked bombardier, compressed gas cylinders, HVAC system, shelving, generator units, day tanks, asbestos insulation
Upper Station – Paint Shed Area	46	Shed, dozer parts, strapping, pipe fittings, spool, wire, truck, fuel tank, compressed gas cylinders, miscellaneous wood and metal
Upper Station – Warehouse Exterior	25	Hoist, dozer tracks, bombardier tracks, heavy chain, cables, to 1080 L ASTs, 20 barrels, compressed gas cylinders, miscellaneous wood and metal
Upper Station – Warehouse Interior	20	Structural Steel, aluminum cladding, shelving units, domestic waste, glass wool insulation, furniture, beds and desks, asbestos insulation, asbestos floor tile
Upper Station – Module Train Exterior	7	Rubber hose, miscellaneous wood and metal

Table 4-2: Summary of Non-hazardous Debris at FOX-C		
Debris Area	**Approximate Volume (m^3)**	**Description**
Module Train – Interior	185	Glass wool insulation, plywood, wood studs, aluminum cladding, day tanks, wood support structures, glass, HVAC metal, water tanks, generators (2), electrical equipment, cabinets and furniture, compressed gas cylinders (6), asbestos pipe wrap, asbestos insulation, asbestos floor tile
Dump / Outfall Area	18	40 barrels, cable, domestic waste, rubber hose, pipe, miscellaneous wood and metal
Upper Station – Antenna Base Area	400	135 m antenna structure, concrete support blocks, cables, tractor cab, electrical equipment, small antenna, miscellaneous wood and metal
Upper Station – Inuit House Area	75	Cement Mixer, 2 generators, pump, 200 barrels, house remains, stove, miscellaneous wood and metal, creosote timbers
Upper Station – Fuel Storage Area	160	Two 75,000 L POL tanks, piping, metal pumphouse, pump, water tank, 25 barrels, rubber bladder, rubber hose, miscellaneous wood and metal
Garage Dump	10	Canvas, 10 gallon barrels on pallet in fill, steel cable, 40 barrels, miscellaneous wood and metal

Source: UMA Engineering Ltd. (2005)

Table 4-3: Summary of Hazardous Debris at FOX-C		
Debris Area	**Approximate Volume (m^3)**	**Description**
Beach Area – Vehicle Dump	1	Oil, fuel, air filters
Beach Area – POL ASTs Area	1	Propane tank contents
Water Lake Area – East Side	7	Blasting caps, miscellaneous air, oil and fuel filters, painted hut materials
Access Road from Dump #7 to Water Lake Access Road	9	10 partially full barrels, large diameter metal culverts (galvanized steel), blasting caps
Mid-Station Area – Heli-Pad and Mid-Station Dump	6	20 full-to-partially full barrels
Mid-Station Area – Barrel Dump #'s 1 to 8	21	130 full-to-partially full barrels
Mid-Station Area – Quonset Building #'s 1, 2, 3 and 4	3	PCB-Amended paint on plywood, filter canisters; air, oil and fuel filters
Upper Station Area – Garage Exterior	1	4 lead acid batteries
Upper Station Area – Garage Interior	30	PCB-Amended paint on plywood and cladding, generator units fuel / oil, lead acid starter batteries (8), thermometers and gauges
Upper Station Area – Paint Shed Area	11	22 cans of paint, 2 cans of paint thinner, fuel in fuel tanks on skid
Upper Station Area – Warehouse Exterior	1	Fuel in fuel tanks
Upper Station Area – Warehouse Interior	10	PCB-Amended paint on plywood
Upper Station Area – Module Train Interior	60	PCB-Amended paint on plywood, concrete floors and water tanks, lead acid starter batteries (14), thermometers, fuel in day tanks
Upper Station Area – Dump / Outfall Area	3	Air, oil and fuel filters, 2 partially full barrels

Table 4-3: Summary of Hazardous Debris at FOX-C		
Debris Area	**Approximate Volume (m^3)**	**Description**
Upper Station Area – Inuit House Area	1	PCB-Amended paint on plywood
Upper Station Area – Garage Dump	5	200 leaking 10 gallon barrels

Source: UMA Engineering Ltd. (2005)

4.5.3.1 Barrel Disposal Requirements

The contents of the barrels must first be determined before the correct disposal method can be determined. A representative number of barrels containing product will be sampled and analyzed. If a barrel is found to only contain rust and sediment, they will be treated as empty barrels.

Where a barrel contains only water (with less than 2 percent glycols or alcohols) the contents of the barrel will be transferred to an open vessel and organic material will be removed by agitation with a pillow or segment of oil absorbent material. Once the organic content has been removed, the water can then be discarded onto ground a minimum distance of 30 m from natural drainage courses.

Where a barrel is found to contain water and glycols and/or alcohols or organics, and contains less than 2 mg/L PCBs, 100 mg/L chlorine, 2 mg/L cadmium, 10 mg/L chromium, and 100 mg/L lead it may be disposed of by on site incineration. Alternatively, these contents may be disposed of off-site at a licensed facility. The solid residual material resulting from incineration will be tested for leachate extraction and material that is found to be non-leachate toxic will be disposed of as contaminated soil. Material that is found to be leachate toxic will be treated as hazardous waste and disposed of off-site at a licensed disposal facility.

Where a barrel is found to contain greater the 2 mg/L PCBs, 1000 mg/L chlorine, 2 mg/L cadmium, 10 mg/L chromium or 100 mg/L lead it will be disposed of at an off-site licensed facility. Contents may be combined with compatible material for shipping purposes.

Where barrels are buried in the river, they will be collected using precautions to ensure that product is not released into the river and to ensure that disturbance of river sediments is minimized.

Empty barrels will be disposed of in the NHW Landfill after being shredded or crushed and cleaned. Crushing of the barrels will reduce their volume by a minimum of 80 percent.

4.5.3.2 Demolition of Facilities

The demolition, removal and disposal or containerization of all facilities as shown in demolition drawings contained in Appendix A are included as part of the clean up of the FOX-C facility. The demolition of facilities will include the activities described below (UMA 2005).

- All contents of buildings identified for demolition, including storage tanks, will be removed and disposed of. Tanks and pipes containing fuel will be pumped out or drained prior to cleaning and disposal;
- Building facility components coated with PCB-amended paint at PCB concentrations in excess of 50 mg/kg will be removed, segregated, and containerized;
- In accordance with the asbestos abatement program, asbestos will be removed and disposed of using a method that eliminates the risk of exposure to friable asbestos. Proper personal protection equipment (PPE) and specialized equipment will be used when removing asbestos. Asbestos materials will be bagged in polyethylene prior to placement in a NHW Landfill;
- Hazardous demolition waste will be removed and placed in containers in accordance with the Hazardous Waste regulations. Hazardous demolition waste will be segregated and disposed of according to CEPA guidelines;
- Creosote-treated timbers will be removed, wrapped in plastic and disposed of in the NHW Landfill.
- Drainage culverts will be removed and disposed of; and
- Non-hazardous materials require no special treatment and can be crushed and placed in the NHW Landfill.

Demolition debris that is to be disposed of on-site will be cut into shapes and sizes that will minimize void spaces in the NHW Landfill. Most concrete foundations will be left in place and regraded except where they are coated with PCB paints.

Once all site structures are removed, demolition areas will be reshaped or backfilled to a height flush with the remaining foundations.

4.5.4 Removal of Hazardous Material

All material that is determined to be hazardous under the Nunavut territorial or federal legislation will be placed in containers and shipped off-site to a licensed hazardous material disposal facility. Specific materials that are considered hazardous include:

- batteries;
- metal-contaminated organic liquids;
- liquids containing organic compounds with chlorine concentrations greater than 1000 mg/L;
- oil absorbent material containing organic compounds with PCB concentrations greater than 2 mg/kg;
- liquids containing organic compounds other than those described above;
- fuel tank bottom sludges;
- fuels, lubricating oils, alcohols and glycols; and
- liquids and solids containing organic compounds with PCB concentrations greater than 50 mg/kg.

Fuel-tank bottom sludges and fuels, lubricating oils, alcohols and glycols could be incinerated on site. Temporary storage of these materials on site will be in accordance with the Temporary Storage of PCB Waste Regulations under CEPA.

4.5.5 Transportation of Hazardous Materials Off Site

Hazardous materials will be placed in environmentally suitable containers at an approved containment facility developed on-site as per Environment Canada guidelines. The hazardous materials will be removed by sea lift in accordance with the *Transportation of Dangerous Goods Act*.

4.5.6 Construction of New Landfills

Four potential non-hazardous waste debris landfill locations were evaluated by UMA in 2004 based on size of the area available, acceptable soil and foundation conditions, surface runoff through the area, topography, drainage and setback from natural water bodies or watercourses.

The preferred site is located at Mid-Station Area because of its proximity to the Upper Station and Mid-Station Dump Areas where the majority of site demolition and debris are located. In addition, this location is approximately 2 km from a borrow source and has suitable soil and groundwater conditions.

A second NHW Landfill is proposed at the Lake Area for disposal of Lower Site demolition debris and Tier I contaminated soils.

The landfills will be constructed on grade using containment berms around the perimeter of the landfill area. The debris will be placed in 0.5 m-thick lifts with intermediate fill worked into the voids. The maximum debris thickness will not exceed 2 m. Upon completion, the landfill will be capped with a minimum of 1 m of fill that will be compacted to 95 percent of the standard proctor density. The surface will then be graded to a slope of 2 to 4 percent and contoured to blend with the existing topography. Approximately 10,000 m^3 of borrow material will be required for construction of the containment berms and cover of the NHW Landfill.

4.5.7 Grading and Addition of Granular Materials

The areas identified that require grading and possibly addition of fill material include piles of buried or partially buried, non-hazardous debris that will be covered with additional fill material and shaped to blend in with the natural terrain and promote positive drainage.

4.5.8 Land Treatment of Petroleum Hydrocarbons

A landfarm is proposed at the Potential Soil Disposal Facility Location #1 to treat hydrocarbon F1/F2 contaminated soils from the Beach POL area. The activities associated with the landfarm include (UMA 2004):

- surface preparation, such as removal of boulders and placement of granular bedding material, to facilitate treatment options as required;
- construction and maintenance of roadways required to support treatment operations;

- construction of exterior berms and drainage ditches;
- placement of hydrocarbon F1/F2 contaminated soil in the landfarm;
- specific activities for landfarming operations including nutrient application, tilling, and moisture conditioning;
- final grading to promote drainage away from the site and to match the surrounding terrain;
- supply and installation of groundwater monitoring wells around the perimeter of the landfarm; and
- closure and removal of all equipment and materials following confirmation that treatment has remediated the contaminated soil.

Any areas of contaminated soil that exist within 2 m of a watercourse or within 2 m of the high water mark of the intertidal zone will not be excavated.

Granular nutrients will be distributed evenly over the surface of the contaminated soils during landfarm operation at rates that will provide the minimum nitrogen loading. As required, moisture conditioning will be conducted through the application of freshwater spray to maintain optimum water content within the soil.

Once nutrients have been applied, the full thickness of the soil will be tilled every 10 days, with tilling frequency increased during periods of prolonged warm, dry weather to every 5 days. During periods of precipitation, tilling of the soil will be delayed until the soil is damp to a depth of 100 mm.

Water collected in the perimeter collection system will be collected and tested, relative to the wastewater discharge criteria, prior to the end of each operating season. When the water does not meet guidelines it may be treated (using an oil water separator) so that it does meet the criteria or it will be treated as hazardous material and disposed of off-site.

At the end of each treatment season, the landfarm will be closed by:

- conducting confirmation testing of soils to verify the remediation objectives have been met;
- placement and compaction of granular material from the perimeter berms to provide a cover of at least 300 mm over the remediated hydrocarbon contaminated soils (granular fill will be compacted to 95 percent maximum dry density);
- grading the surface of the area, as required, to promote surface water runoff; and
- decommissioning the groundwater monitoring wells, including backfilling with appropriate grout.

4.5.9 Development of Borrow Areas

There is a need for approximately 25,000 m^3 of fill material for site clean-up activities. This fill is required for upgrading the access roads during construction, backfilling of contaminated soil areas and general site grading purposes. Granular fill is also required for development of the NHW Landfill and the Landfarm. Borrow areas are shown in Figures C01 and C02 in Appendix A.

4.5.10 Contractor Support Activities

The following activities will occur on site in support of the remediation work (UMA 2005):

- access roads at the site will be upgraded for equipment transport and movement;
- the existing beach landing area and roads will be used for equipment transport, movement and access to work areas;
- the site will be set-up for camp and equipment storage and demobilized and cleaned up of following project completion;
- sewage from the camp will be handled with, at minimum, primary treatment and discharge to ground surface; and
- domestic waste to be disposed of, as is, or incinerated as specified by the Land Use Permit in the new NHW Landfill.

Labour and equipment requirements are anticipated to include 15 to 25 personnel, 10 pieces of heavy construction equipment and 2 support vehicles. Duration of work is anticipated to be approximately 4 months, not including winter shutdown period, over a period of two years.

4.5.11 Auxiliary Features

4.5.11.1 Access Road Upgrade

The two access roads at the FOX-C site will require repair and upgrading for the remediation activities. The Beach Road extends approximately 2.2 km inland from the ocean. Four road failures were noted during the 2004 field program and culverts will be required at these locations. The local soils at these sites are fine-grained and are therefore, extremely erodible. All of these crossings are over the glacial stream that flows from the Fox Charlie Glacier. Areas of the road adjacent to the glacial stream will require stabilization to enable the passage of heavy equipment.

The Station Road runs approximately 5.9 km to the Upper Station. The two river crossings on the road have undersized culverts that need replacement. In addition, there are five washout areas along the road that have occurred because the route follows the natural path of the glacial stream. These areas will require the installation of new culverts and stream bank stabilization.

4.5.11.2 Work Camp

A work camp will be established at the FOX-C DEW Line Site to carry out the remediation program. The camp will be owned by the primary contractor who will be responsible for:

- food services;
- heating;

- lighting;
- fuel;
- domestic water systems;
- sewage collection, treatment and disposal system;
- waste, refuse and garbage collection and disposal;
- camp fire prevention, alarm and fire fighting system;
- camp safety and security service;
- sleeping and washroom facilities;
- bedding and bedding laundry service;
- janitorial service;
- personnel laundry facilities; and
- snow removal.

The work camp, including its facilities, utilities, services, location and operation will be operated in accordance with applicable Federal, Territorial, and local codes, regulations and requirements governing camps, including environmental regulatory requirements, Land Use Permit and Water Use Licence.

Prior to the installation of camp facilities, all necessary work will be completed to ensure the protection of the environment. Additionally, consideration will be given to possible wildlife encounters when determining the camp layout. Bear and other wildlife safety literature will be considered when selecting the location of the kitchen, food storage, washroom and sleeping facilities. A working wildlife deterrent system will be put in place and there will be a replacement made available within 24 hours, should the primary system fail.

All camp wastes will be disposed of in accordance with the Land Use Permit. Sewage will be disposed of in pits. All sewage pits will be located a minimum of 60 m away from any drainage courses, water bodies and main camp buildings in accordance with the Land Use Permit. All potable water required for the camp, including dish washing and cooking water, will be brought to the site.

A fire extinguisher will be provided for each camp facility. A carbon monoxide detector will be provided for each facility that is equipped with an oil-burning heater. All flammable liquids will be handled and stored according to the current National Fire Code of Canada.

Basic camp rules will be established for the benefit of all occupants. The rules will cover subjects such as property damage, smoking, use of alcoholic beverages, drugs, firearms, security, nuisance, and any other matter related to the management of the camp operation. A copy of the camp rules will be provided to all occupants upon arrival to camp. Camp rules will prohibit the consumption of alcoholic beverages on site.

Following completion of the remediation activities in October 2007, the camp site will be decommissioned and restored. Decommissioning activities will include removal of all camp facilities, burning and/or removal of garbage, removal of equipment and general site clean up. The site will be graded as required to match surrounding terrain and to ensure positive drainage. The site will be secured for human health and safety and environmental security.

4.6 Schedule of Activities

The proposed activities at the FOX-C DEW Line Site for the remediation program are summarized in Table 4-4.

Table 4-4: Task Description and Tentative Schedule – FOX-C DEW Line Site Remediation

Activity	Status	Comment
Mobilisation	**September 2005 – Winter 2006**	
Transport Equipment from Montreal	September 2005	Via barge or sealift
Temporary Storage	September 2005	Temporary storage to be set up until equipment can be moved to DEW Line Site
Mobilisation to DEW Line Site	Winter 2005/2006	
Remediation	**July to October 2006 and 2007**	
Development of borrow sources.	Summer 2006	25,000 m^3 of fill material required for site clean up
Construction of non-hazardous material landfill	Summer 2006	2 locations – one at Mid-Station Area and second at Lake Area
Remediation of Main Dump	Summer 2006 / 2007	Considered to be a surface debris area with minor buried debris and contaminated soils
Remediation of Garage Dump	Summer 2006 / 2007	Extensive hydrocarbon staining at this landfill as a result of waste disposal oil
Remediation of House Dump	Summer 2006 / 2007	Considered to be a surface debris area with minor buried debris and contaminated soils
Remediation of Mid-Station Dump	Summer 2006 / 2007	Granular cover is expected to be unstable in the long term. Landfill footprint covers an area of approximately 20,000 m^2.
Remediation of Original Dump	Summer 2006 / 2007	Considered to be a surface debris area with minor buried debris.
Demolition of Existing Site Infrastructure – Upper Station	Summer 2006 / 2007	Includes module train, warehouse, garage and two 75,000-L POL tanks
Demolition of Existing Site Infrastructure – Beach area	Summer 2006 / 2007	Includes two 75,000-L POL Tanks
Demolition of Existing Site Infrastructure – Hazardous Materials	Summer 2006 / 2007	Include asbestos, paint amended with PCBs and hydrocarbons
Segregation of demolition wastes into hazardous and non-hazardous	Summer 2006 / 2007	As sites are demolished wastes will be separated
Remediation of contaminated soil areas	Summer 2006/2007	Includes Beach, Lake Mid-Station and Upper-Station areas; primary contaminants are PCBs, hydrocarbons and metals
Collection of surface debris	Summer 2006/2007	Includes Beach, Lake, Mid-Station and Upper-Station areas and access roads
Disposal of Barrels	Summer 2006/2007	8380 barrels throughout site
Landfarming of Hydrocarbon contaminated soils	Summer 2006/2007	Includes soils from Upper Site POL Storage Area and Beach POL Storage Area
Physical restoration of disturbed areas	Summer 2006/2007	All disturbed areas restored and reshaped to match existing terrain

Table 4-4: Task Description and Tentative Schedule – FOX-C DEW Line Site Remediation		
Activity	**Status**	**Comment**
Demobilisation	**Winter 2007 / 2008**	
Demobilisation from DEW Line Site	Winter 2007/2008	Via Sealift

4.7 Environmental Management

The Project, the remediation of a former DEW Line Site, is a component of INAC's environmental management of the abandoned sites. Therefore, environmental protection is a prime component of the Project and remediation activities will follow procedures designed to protect the environment. In addition to the remediation activities discussed above, environmental protection is incorporated into the remediation work plan. Table 4-5 summarizes these measures. In addition, an Environmental Protection Plan has been developed for the removal of drums within the watershed and the installation of culverts, and a Contingency Plan has been developed for the remediation program. These are included as Appendix B and Appendix C.

Table 4-5: Environmental Protection Measures Incorporated into the Remediation Work Plan	
Activity	**Environmental Protection Measures**
Work Camp	All camp facilities will be placed within previously disturbed areas of the site.
	Water will be pumped to site via a small horsepower pump and water intake pipe laid overland and equipped with a small mesh screen. Pump will be placed at least 30 m from either water body and a spill kit will be sited near the pump. A suitably sized screen will be placed over the intake end of the pipe.
Fuel Storage and Handling	Diesel will be transported to site in a truck-mounted tank. Fuel will be transferred directly from barrels or the truck to vehicles and equipment using and electric pump. Fuel transfer will be completed at a location at least 100 m from waterbodies. There will be four drum spill kits present at the site – two at the Upper site and two at the Lower site - each capable of absorbing 174 L of liquid hydrocarbons.
	The kits will be located near the fuel cache areas that will house the drummed fuel. Two standard spill packs capable of absorbing 40 L of liquid hydrocarbons will accompany the equipment on site (one at Upper site and one at Lower site).
Sewage Handling	One two cell temporary lagoon will be constructed a minimum of 100 m from the work camp, a minimum of 450 m from any water body, and downwind of the camp.
	There will be no water discharges into waterbodies.
Hazardous Material Handling	Dedicated spill kits will be on-site during the in-stream barrel removal activities.
	Handling, storage and use of flammable liquids will be governed by the current National Fire Code of Canada. Flammable liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres, provided they are stored in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval.
	Upon award of contract, the Contractor will provide types, quantities, and MSDS for all fuel and chemicals on site.

Table 4-5: Environmental Protection Measures Incorporated into the Remediation Work Plan	
Activity	**Environmental Protection Measures**
	Contractor will comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding employee training, use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) as required by WHMIS legislation.
	Hazardous materials will be removed by sea lift in accordance with the *Transportation of Dangerous Goods Act*.
Waste Handling	Non-hazardous, combustible solid waste will be incinerated on-site in an enclosed container. Non-combustible solid waste generated from the camp operations will be stored in a secure waste disposal bin. The contents of the waste disposal bin will be transported and disposed of in the on-site non-hazardous waste landfills on an as required basis.
	Camp greywater will be directed to a discharge pit excavated a minimum 30 m from the camp, any natural drainage course, or waterbody. Upon completion of site activities the pit will be filled in.
	Groundwater monitoring wells will be installed around the perimeter of the landfill to facilitate long-term leachate monitoring. Monitoring will occur at least annually for the first five years and every five years thereafter for a total of 25 years. The monitoring requirements of the landfill will be reassessed at that time.

5.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

5.1 Overview and Approach

The assessment of the potential environmental effects of the site remediation has been carried out using a rigorous methodological framework developed on the basis of current, accepted practice and professional experience of the study team. The potential environmental effects of activities associated with the project on each VEC selected for consideration has been evaluated. Mitigation measures to address and minimize any potential environmental effects are also identified and discussed. The potential environmental effects resulting from malfunctions and accidents associated with the work plan have been evaluated. As well, the cumulative environmental effects of past, present and planned future activities have been assessed.

The assessment of project impacts is determined through the following procedure:

- VEC definition;
- determination of boundaries;
- potential interactions, assessment of impacts and mitigation analysis;
- summary of residual environmental impacts; and
- summary of mitigation and monitoring.

Each of these steps is described in further detail below.

5.2 VEC Definition and Selection

Standard environmental assessment practice encourages scoping to focus assessments on those environmental issues of greatest importance, referred to as Valued Environmental Components or VECs. The identification of key issues through stakeholder consultation, documents review process and site assessment process is critical to ensuring that the assessment focuses on those matters of primary concern to regulatory authorities, stakeholders and the assessor.

VECs are selected as components of the environment that are valued by society, and upon which the environmental assessment is focused. Potential environmental issues of concern that may be associated with the proposed project have been identified through consultation with INAC, the Government of Nunavut, and the professional judgement of the study team.

Based on the existing environmental conditions, the scope of the screening includes environmental effects on physical, biological, social and environmental components of value. The scope excludes the effects of accidental events on worker safety and the effects of burning fossil fuels by machinery used during the site remediation on the atmospheric environment (including greenhouse gas levels and climate change). The scope of the socio-economic assessment is limited to the basic requirements of the *CEAA* Screening process whereby the assessment of socio-economic effects is limited to "*any change that the project may cause in the environment, including any such change on health and socio-economic conditions"*. The VECs identified for the project take in to consideration the nature, and temporal and spatial scope of the project and anticipated potential-environmental interactions. VECs selected and the rationale for their selection is provided in Table 5-1.

Table 5-1: VEC Selection Rational

VEC	Rationale For Selection		
	Public/Stakeholder Concerns	Regulatory Considerations(*)	Professional Judgement
Air Quality	√	√	√
Soil Quality	√	√	√
Water Quality	√	√	√
Terrain		√	√
Terrestrial Animals and Habitat	√	√	√
Aquatic Animals and Habitat	√	√	√
Health and Safety	√	√	√
Archaeological and Heritage Resources	√	√	√
Land Use	√	√	√
Aesthetics	√	√	√
Socio-economic Issues	√	√	√

(*) Includes federal and territorial regulations.

5.3 Identification of Cumulative Environmental Effects

Cumulative effects have been defined as changes to the biophysical, social, cultural or economic environments caused by a project component in combination with any ongoing, past or future activities. Cumulative effects can occur as interactions between project components (either from the same or more than one site) and/or between environmental components. Effects can occur in one of four ways:

- physical or chemical transport mechanisms;
- "nibbling loss" (*i.e.,* gradual disturbance);
- spatial or temporal crowding; and
- growth induction initiated by a project.

5.3.1 Analysis of Cumulative Environmental Effects

Four steps in the analysis of the cumulative environmental effects of this project include scoping, analysis of effects, mitigation measures, and significance.

Scoping: Scoping includes the identification of issues of potential concern, VECs that could be affected and boundary setting. The activities considered include all remediation activities at the FOX-C DEW Line Site. Temporal and spatial boundaries encompass those periods during, and areas within which, the VECs are likely to interact with, or be influenced by project activities. The spatial boundaries include impacts over a larger (regional) area including the crossing of jurisdictional boundaries. As the landfills will remain on site, temporal boundaries extend beyond the time frame required to complete the clean up. Other boundaries to be considered as appropriate include administrative and technical boundaries imposed by factors such as finite resources of data, time, cost, and labour, as well as technical, political, or administrative and jurisdictional considerations.

Analysis of Effects: This section identifies the specific nature and extent of the interactions between the project and the VECs. Where appropriate, the assessment includes a summary of major concerns or hypotheses of relevance regarding the effect of each activity on the VECs being considered. Where existing knowledge or the application of standard mitigation indicates that an interaction is not likely to result in an impact, certain issues may warrant only limited analysis.

Mitigation Measures: For each interaction, options available for mitigation are considered in the impact analysis.

Significance: The environmental assessment considers activities associated with project activities that could result in adverse environmental effects in consideration of their likelihood of occurring, and taking into account appropriate mitigation measures. In determining whether there are adverse environmental effects, the following factors are considered:

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;

- loss of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge or presence of persistent and/or toxic chemicals;
- toxicity effects on human health; and
- effects on cultural issues.

5.3.2 Identification of Mitigation Measures, Residual Impacts and Monitoring

Mitigation measures are identified that will result in a reduction or elimination of likely environmental impacts associated with the clean up. Section 6 discusses each VEC, the associated potential adverse environmental effects, the mitigation, and residual environmental effects. Taking into account the mitigation measures, the significance or anticipated residual impacts are identified for all potential impacts. The significance of the residual environmental impacts of project activities on a VEC is evaluated based on review of relevant literature, consultation with experts, and professional judgement.

Monitoring will be required in the future for a number of reasons including compliance, agreement commitments and impact management. This methodology also allows INAC to be able to establish baseline conditions for the project at the time of initiation. The implementation of recommended mitigation and monitoring will allow future activities to be compared to the current conditions identified by this assessment.

6.0 ENVIRONMENTAL ASSESSMENT

This section describes the potential interactions of specific project activities with the existing environmental conditions. Planned appropriate mitigation activities are identified and an assessment of the potential residual environmental effects (after mitigation is applied), including cumulative environmental effects. Potential interactions between the project and the identified VECs are described in the sub-sections below.

6.1 Regional Setting

FOX-C Intermediate DEW Line Site is located on the south shore of Ekalugad Fjord on the east coast of Baffin Island, approximately 1.5 km inland from the coast. The nearest community is Clyde River, which is approximately 195 km to the north of the site. The site is within the Baffin Mountain Ecoregion in the Arctic Cordillera Ecozone, which is characterized by a high arctic ecoclimate, low species diversity and sparse vegetation cover (Ecological Stratification Working Group, 1995).

6.2 Public Consultation

DIAND had carried out an extensive public consultation program with stakeholders to discuss the remediation of the FOX-C site and to solicit input from the public regarding concerns they may have with the program. The concerns raised have been incorporated into the environmental assessment.

A summary of the consultation program is presented below.

May 2004: initial meetings with Hunters & Trappers Organizations, Hamlet Councils, Qikiqtani Inuit Association representatives and the public in Clyde River and Qikiqtarjuaq to briefly introduce the project, especially the planned site investigation.

July 2004: initial meeting with Nunavut Impact Review Board (NIRB) & Nunavut Water Board (NWB) representatives to introduce project and obtain feedback on regulatory approval requirements and submissions.

August 2004: transported Hunters & Trappers and Hamlet representatives from Qikiqtarjuaq to the site during investigation work to illustrate work being carried out and to familiarize them with the site and specific issues.

December 2004: presented the results of site investigation and preliminary remedial design options to regulators.

December 2004: community public consultations in Clyde River & Qikiqtarjuaq; results of the site investigations and preliminary remediation work plans were presented.

December 2004 Qikiqtaaluk Environmental was contracted to review the Site Specific Risk Assessment (SSRA) and to interview Clyde River and Qikiqtarjuaq elders about the project and project area.

February 2005: presented summary results of site investigation and preliminary remediation options to NIRB. NIRB has drafted a “checklist” of submission requirements and provided these to DIAND/PWGSC to be included with the Ekalugad regulatory submission.

February 2005: presented a brief overview of the project to Fisheries and Oceans Canada (FOC) representatives with specific focus on aquatic and marine elements. Based on the discussions, a Barrel Removal & Culvert Installation Protocol has been completed.

March 2005: PWGSC presented the government contracting process to Inuit businesses.

March 2005: met with potential contractor bidders to familiarize them with the remedial project specifics.

DIAND has made a concerted effort to identify and address concerns raised by members of the public and pertinent regulators through a variety of means. The final Remediation Work Plan was modified to incorporate comments and to address community concerns, wherever possible.

A second meeting that focused on similar project-related issues was held with the Nunavut Impact Review Board in February 2005.

While the scope of comments and concerns has covered a wide variety of types, a few issues have consistently been identified as areas of significant concern that require detailed discussions and effective solutions. Table 6-1 identifies some of the major concerns raised by the public and/or regulators throughout the consultation period, as well as DIAND's planned responses to address each of these issues in turn.

Table 6-1: Public Consultation Issues and Responses

Category	Residents' Concerns	DIAND's Response
Health and Safety	Locals ingesting contaminated fish from site waterbodies	Site Investigation work plan was modified to include tissue analysis of fish taken from site waters. It was determined that fish present at the site do not contain contaminants at levels above other fish populations in the eastern arctic.
Environment	The location of site landfills	There was some concern that leachate from site landfills would impact on adjacent water bodies. DIAND demonstrated that the landfills are being sited a considerable distance from water bodies and will be adequately engineered using proven northern technologies.
Waste Management	The potential for wastes remaining at the bottom of the lake	2004 site investigation focused on sampling water and sediments in lake. No contaminants were identified. DIAND does not believe further action is required at this time. See attached letter for further details.
Waste Management	Barrels remaining in the river and glacial stream	All barrels will be removed during the remediation project. To ensure that this is done in a consistent, environmentally responsible manner a site specific Barrel Removal Protocol has been completed and is attached.
Business Opportunities	Jobs for locals	DIAND will implement a contracting process that increases the credibility of the project within the communities.

DIAND also provided funding and invited Qikiqtaaluk Corporation (QC) to comment on the SSRA. QC did a thorough review of the assessment and provided a number of conclusions in the form of a report. DIAND has officially responded to these conclusions in the form of a letter.

Three of the four QC comments focused on the technical protocols used by the risk assessors. It was determined that these were attributable to professional differences in approach and were not weaknesses in the assessor's risk model.

The fourth comment was that DIAND should not be solely relying on the results of the risk assessment to formulate the site clean up criteria. In fact, DIAND will use these site specific risk based criteria only where no suitable criteria is available.

6.3 Air Quality

6.3.1 Existing Environment

The climate on the east coast of Baffin Island is humid and extremely cold and is marked by very short, cold summers. The mean annual temperature is approximately -11.5°C with a summer mean of 1°C and a winter mean of -23°C. The mean annual precipitation ranges from 200 mm to 400 mm (Ecological Stratification Working Group 1995).

6.3.2 Air Quality Impact Assessment

6.3.2.1 Study Area Boundaries

The spatial boundary for the assessment of project effects on air quality is the airshed around Ekalugad Fjord. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the air quality assessment are the lack of site-specific meteorological data and the limited time frame associated with the environmental screening.

6.3.2.2 Identification of Issues, Interactions and Potential Effects

During the remediation activities, there will be moderate emissions of greenhouse gases, nitrogen oxides (NO_x), sulphur dioxide (SO_2) particulate matter (PM) and carbon monoxide (CO) due to combustion of diesel fuel or gasoline in vehicles. There is also the potential for generation of dust during vehicle movement. These emissions will be of short-term duration and will be restricted to the local area around the site. Table 6-2 is an environmental assessment matrix for the Air Quality VEC.

6.3.2.3 Mitigation

Mitigative measures for controlling fugitive dust emissions during the project activities will be detailed in procedures that the contractors will be required to follow (*i.e.,* watering down roads and exposed portions of the project site, covering exposed soil piles). Windblown dust during project activities is expected to be minor.

Table 6-2: Environmental Effects Assessment Matrix: Air Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Site Preparation Activities	Emissions of greenhouse gases, nitrous oxides, sulphur dioxide, particulate matter, and carbon monoxide from vehicles (A).	• None	1	2	2/5	R	1
	Vehicle movement will generate dust (A).	• Dust control measures will be implemented. Water will be used for dust suppression. Exposed soil piles will be covered.	1	2	2/5	R	1
Hazardous Materials Removal	The removal of the contaminated soil from the environment will reduce the risk of effects on air quality (P).	• N/A					

KEY:

Magnitude:

1 = Low: emissions predicted to be within the CCME National Ambient Air Quality Objectives
3 = High: Emissions predicted to exceed the CCME National Ambient Air Quality Objectives

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A =Not Applicable

6.3.2.4 Residual Environmental Effects

Definition of Significance

Significant impacts to the atmospheric environment are defined to occur when ground-level concentrations associated with emissions from activities exceed ambient air quality standards that have been established by the government to protect human health and the environment. In this case, the

National Ambient Air Quality Objectives from the Canadian Council of Ministers of the Environment (CCME 1999) are the standards used.

Residual Environmental Effects Summary

Table 6-3 summarizes the residual environmental effects of the project activities on air quality. The effects of vehicle and equipment emissions during the remediation are not expected to exceed CCME ambient air quality objectives, although no monitoring of emissions has been carried out. Emissions will be short term and intermittent and will not be unlike those from low traffic volumes in a city such as Iqaluit. Dust generation is expected to also be low in volume and infrequent.

Table 6-3: Residual Environmental Effects Summary Matrix: Air Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Site Preparation Activities	NS		
Removal and Transport of Hazardous Material and Fuel	P		

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.3.2.5 Summary of Environmental Effects on Air Quality

Remediation at FOX-C Intermediate DEW Line Site will not have a significant impact on the air quality. The FOX-C Intermediate DEW Line Site remediation will have a positive impact on air quality in terms of removing contaminated soil from the environment, thereby reducing the risk of dust from this soil affecting air quality.

6.4 Soil Quality

6.4.1 Existing Environment

Dominant soils in the FOX-C Intermediate DEW Line Site area are Turbic Cryosols developed on a discontinuous colluvial, alluvial and morainal deposits. Bare bedrock is common (Ecological Stratification Working Group 1995). Soils consist of sand and gravel with small amounts of clay and organic material that are imperfectly drained and lack profile development (Qikiqtaaluk Corporation 2001).

6.4.2 Soil Quality Impact Assessment

6.4.2.1 Study Area Boundaries

The spatial boundary for the assessment of project effects on soil quality is the FOX-C Intermediate DEW Line Site and the extent beyond the site in which soil contaminants may be expected to migrate. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the Project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements.

Technical boundary of the soil quality assessment is the limited time frame associated with the environmental screening.

6.4.2.2 Identification of Issues, Interactions and Potential Effects

The remediation phase of the Project has the potential to interact with soil quality through the exposure of hazardous materials and contaminated soil to leaching during invasive remediation and through accidental events such as spills. The operation of the work camp will include treatment and disposal of waste, and could negatively affect soil quality if not carried out properly. Table 6-4 is an environmental assessment matrix for the Soil Quality VEC.

Table 6-4: Environmental Effects Assessment Matrix: Soil Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean-up Activities	Hazardous materials or contaminated soils may be exposed to leaching during remediation (A).	• Investigators will have reviewed previous site assessments and activities near known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials.	1	2	2/1	R	2

Table 6-4: Environmental Effects Assessment Matrix: Soil Quality							
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
	Accidental spills may result in soil degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	2/1	R	2
	The operation of the construction camp will include treatment and disposal of waste, which could degrade soil quality (A).	• Hazardous materials will not be disposed of in the camp waste system. • All hazardous materials will be removed from the site for disposal. • All sewage will be disposed of in accordance with applicable regulations and guidelines.	1	2	2/1	R	2
Landfill Development/ Landfill Closure	The migration of contaminants from the new landfills has the potential to degrade soil quality if not constructed properly (A).	• New facilities will be sited away from natural drainages. • The Tier II facility will incorporate leachate containment, which includes synthetic liners and freezeback of permafrost. • Existing landfills will be remediated to eliminate the risk of leachate production and migration. • Upon closure, existing landfills will be graded to promote surface runoff.	1	1	5/1	R	2
	The closure of the existing landfill will reduce the risk of impacting soil quality (P).	• N/A					

Table 6-4: Environmental Effects Assessment Matrix: Soil Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Contaminated Soil Disposal/ Hazardous Materials Removal	The removal of the contaminated soil and hazardous materials from contact with the environment will improve soil quality (P).	• N/A					
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil and/or fuels that could degrade soil quality (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1	1	3/1	R	2

KEY:

Magnitude:

1 = Low: Soil chemical composition is not altered to the extent that vegetation currently present is affected.
2 = Moderate: Soil chemical composition is altered such that a moderate percentage of the vegetation is affected.
3 = High: Soil chemical composition is altered such that all vegetation is degraded and/or contaminants leach to groundwater.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A =Not Applicable

6.4.3 Mitigation

During the remediation activities, Project personnel will be apprised of known locations of hazardous waste and disturbance of these sites will be kept to a minimum. Spill prevention and spill contingency plans will be in effect during all activities.

The new landfills will be sited away from natural drainages. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on site, and no hazardous materials or fuel will be stored on the beach area. Contingency plans for spills will be followed, and will be available on site, and all fuel will be handled in accordance with the contingency plan.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.4.3.1 Residual Environmental Effects

Definition of Significance
Significant Impacts are defined as those altering soil such that one or both of the following occurs:

- soil chemical composition is altered such that it will not support vegetation in areas where vegetation previously grew and the extent is greater than 1 km from the facility; and
- soil chemical composition is altered such that it is a threat to groundwater and surface water.

Residual Environmental Effects Summary
Table 6-5 summarises the residual environmental effects of the project activities on soil quality. Activities during the remediation phase are not expected to affect soil quality significantly.

Table 6-5: Residual Environmental Effects Summary Matrix: Soil Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	P		
Landfill Closure	P		
Landfill Development	NS		
Removal and Transport of Hazardous Material and Fuel	NS		

Table 6-5: Residual Environmental Effects Summary Matrix: Soil Quality			
Phase	**Residual Adverse Environmental Effect Rating**	**Likelihood (of significant adverse environmental effects)**	
		Probability of Occurrence	**Scientific Uncertainty**

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.4.3.2 Summary of Environmental Effects on Soil Quality

Activities associated with the remediation at FOX-C Intermediate DEW Line Site are assessed as not having a significant effect on soil quality.

The potential exists for an accidental release of hazardous materials, contaminated soil and/or fuels that could impact soil quality. However, proper handling procedures for hazardous materials will be implemented for their storage and transportation. Also, all workers will be trained to properly handle hazardous materials on site, and no hazardous materials or fuel will be stored on the beach areas. Spill contingency plans will be followed, and will be available on site. All fuel will be handled in accordance with the contingency plan.

The operation of the work camp will include the treatment and disposal of waste, and has the potential to degrade soil quality. However, hazardous materials will not be disposed of in the camp waste system, and the disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.5 Water Quality

6.5.1 Existing Environment

There is an unnamed freshwater lake to the immediate west of the lower site that is approximately 3 km long and 1 km wide. It is fed primarily by meltwater from the Fox Charlie Glacier, snow melt, and a larger lake 2 km to the west. The lake discharges into Ekalugad Fjord through a river approximately 1.5 km long. Previous work at FOX-C used the small freshwater lake as a source of drinking water (Qikiqtaaluk Corporation 2001).

6.5.2 Water Quality Impact Assessment

6.5.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the water quality of the area is the local watershed for the site. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the water quality assessment are the lack of site-specific water quality data and the limited time frame associated with the environmental screening.

6.5.2.2 Identification of Issues, Interactions and Potential Effects

Interactions between the remediation phase and the water quality environment will be similar to those for the soil quality environment, *i.e.,* the potential for leachate from exposed hazardous materials and contaminated soil, and the potential for spills of fuel and hazardous materials to enter waterbodies and affect water quality.

Some fuel drums that have been dispersed throughout the site by wind action are on the flood plain and in the stream connecting the freshwater lake with the ocean. The freshwater lake also includes drums and debris along the beach and embankments. The removal of these drums and debris will require activities within the stream and lake, potentially resulting in water quality degradation.

The movement of heavy equipment to portions of the site for remediation will require crossing of the stream. The construction of access roads across the stream will require the placement of culverts in the stream. The placement of culverts as part of the road upgrading could result in siltation and degradation of water quality.

Table 6-6 is an environmental assessment matrix for the Water Quality VEC.

Table 6-6: Environmental Effects Assessment Matrix: Water Quality								
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic**
General Clean Up Activities	Hazardous materials or contaminated soils may be exposed to leaching during investigations; the leachate may degrade water quality (A).	• Investigators will have reviewed previous site assessments and activities near or in known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials and the potential for leaching.	1	2	2/1	R	1
	Accidental spills may result in water quality degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	2/1	R	1
Landfill Development/Landfill Closure	The migration of contaminants from the new landfills has the potential to degrade water quality if not constructed properly (A).	• New facilities will be sited away from natural drainages. • Existing landfills will be remediated to eliminate the risk of leachate production and migration.	1	1	5/1	R	2

Table 6-6: Environmental Effects Assessment Matrix: Water Quality								
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic**
		• Upon closure, existing landfills will be graded to promote surface runoff.					
	Closure and remediation of landfills and the removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of surface and active layer water (P)	• N/A					
Contractor Support	The operation of the camp will include treatment and disposal of waste, and could degrade water quality (A).	• Hazardous materials will not be disposed of in the camp waste system. • All sewage and graywater will be disposed of in accordance with applicable regulations and guidelines.	1	2	2/1	R	1
Contaminated Soil Disposal / Hazardous Materials Removal	The removal of the contaminated soil and hazardous material from the environment will reduce the risk of contamination of surface and active layer water (P)	• N/A					

Table 6-6: Environmental Effects Assessment Matrix: Water Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil, and./or fuels that could degrade water quality (A).	• Proper Handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on-site • Hazardous materials or fuel will not be stored near water. • Spill contingency plans related to all materials and equipment will be available on-site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	3/1	R	1
Site Grading, Borrow Source Development	The erosion of soil and sedimentation of water bodies during grading and gravel extraction activities has the potential to degrade water quality (A).	• Siltation will be prevented by use of berms and/or silt fences. • Equipment will not be operated within the wetted perimeter. • Disturbed areas adjacent to water will be stabilized, if required.	1	2	3/1	R	1
	Grading and gravel extraction activities will also alter the terrain, and has the potential to disturb drainage (A).	• Grading and gravel extraction activities will be sited away from natural drainages • Upon completion of gravel extraction activities, the areas will be graded to blend with the natural terrain, and where appropriate , to promote surface runoff	1	2	3/1	R	1
	Some improvements to drainage may be expected as a result of properly grading existing disturbed sites (P).	• N/A					

Table 6-6: Environmental Effects Assessment Matrix: Water Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic
Removal of fuel drums within the watershed	Activities within the watershed could result in sedimentation and the release of hazardous materials (A).	• An environmental protection plan for the removal of fuel drums in the watershed has been developed (Appendix B)	1	2	3/2	R	1
Placement of culverts	Soil erosion and resulting sedimentation of the stream may occur during placement. (A)	• An environmental protection plan for the installation of culverts has been developed (Appendix B)	1	2	3/2	R	1

KEY:

Magnitude:

1 = Low: e.g., Minor changes to water quality but not to the extent that aquatic life is affected or water that was previously potable is now non-potable.

2 = Medium: e.g., Moderate changes to water quality, affecting aquatic life at a local level or decreasing the quality of potable water (e.g., odour problem).

3 = High: e.g., Major changes to water quality, affecting aquatic life at a regional level or rendering previously potable water non-potable.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.5.2.3 Mitigation

The new Landfills will be sited away from natural drainages. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff. Material handling and spill contingency plans will be in place and the disposal of camp wastes will meet all regulatory standards.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on site and no hazardous materials or fuel will be stored on the beach area. Contingency plans for spills will be followed, and will be available on site, and all fuel will be handled in accordance with the contingency plan.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines. The freshwater lake adjacent to the lower site will likely be used for drinking water. Camp personnel will be instructed on procedures to meet the applicable water quality guidelines and on withdrawing water so that fish habitat is not adversely affected. Culverts will not be installed in fish bearing waters.

During grading and gravel extraction activities, siltation will be prevented by the use of berms and/or silt fences, and equipment will not be operated within the wetted perimeter. Additionally, disturbed areas adjacent to water will be stabilized if required. Grading and gravel extraction activities will be sited away from natural drainages, and upon completion, the area will be graded to blend with the natural terrain and where appropriate to promote surface runoff.

An environmental protection plan for the removal of fuel drums within the watershed and culvert installation and removal has been developed and will be implemented (Appendix B).

6.5.2.4 Residual Environmental Effects

Definition of Significance

A significant impact to water quality is defined as one of sufficient magnitude so as to alter the quantity or quality of water to a degree that will result in a significant impact on aquatic life as defined in the impact significance definitions for other related VECs.

Residual Environmental Effects Summary

Table 6-7 summarizes the residual environmental effects of the project activities on water quality. Activities during the detailed site assessment and preliminary waste consolidation phase are not expected to affect water quality significantly.

Table 6-7: Residual Environmental Effects Summary Matrix: Water Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Landfill Development	NS		
Landfill Closure	P		
Contaminated Soil Disposal / Removal	P		
Removal and Transport of Hazardous Material, fuel and Contaminated Soil	NS		

Table 6-7: Residual Environmental Effects Summary Matrix: Water Quality			
Phase	**Residual Adverse Environmental Effect Rating**	**Likelihood (of significant adverse environmental effects)**	
		Probability of Occurrence	**Scientific Uncertainty**
Site Grading / Borrow Source Development	NS		
Site Grading	P		
Contractor Support	NS		
Removal of Fuel Drums from the Watershed	NS		
Culvert Installation	NS		

KEY:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.5.2.5 Summary of Environmental Effects on Water Quality

The effects of the FOX-C Intermediate DEW Line Site remediation on water quality are assessed as not significant.

6.6 Terrain

The terrain VEC includes surficial geology, soils and vegetation. The soils component refers to the physical characteristics of the surficial material; soil quality is addressed as a separate VEC in Section 6.3.

6.6.1 Existing Environment

6.6.1.1 Geology and Soils

Surficial Geology

The geology in the FOX-C DEW Line Site area is comprised largely of high, rugged hills and is characterized by large boulders and slabs of rock. The upper site is situated at the summit and is surrounded by steep outwash valleys to the south and west, a small chain of lakes to the east, and Ekalugad Fjord to the north. The upper site is primarily bedrock (consisting of granite and quartz monzonite) and colluvium, while the lower site is a combination of bedrock, alluvium deposits from the river, till, and coarse beach sediments. The area is well drained and permafrost is widespread and continuous (Qikiqtaaluk Corporation 2001).

Soils

The FOX-C site is located in the Baffin Mountain ecoregion where bare bedrock is common and Turbic Cryosols developed in discontinuous morainal, alluvial, and colluvial deposits are commonly found. Soils at the FOX-C site could be classified as cryosolic and regosolic and consisting of sand and coarse rock with small amounts of organic material and clay in some locations (Qikiqtaaluk Corporation 2001).

6.6.1.2 Vegetation

The high-arctic climate limits the vegetation to herbaceous species only due to extreme cold, high winds and lack of soil cover. Higher elevations are largely devoid of vegetation cover other than lichens and mosses. Lower mountain slopes and coastal margins provide some vegetative cover, which consists of herbaceous tundra communities. Dominant species include sedges and cottongrass (Ecological Stratification Working Group 1995).

The lower site has a higher diversity of vegetation compared to the upper site. Grasses (*Alopecurus* sp.), sedges (*Carex* sp.) and willows (*Salix* sp.) dominate the lower site, particularly the outwash valley, while the upper site is restricted to small, isolated patches of mosses and lichens (Reimer et al. 1994).

There are over 1000 species of vascular plants in Nunavut. Of these only 18 species have been reviewed as to their general status in the territory. To date no rare or endangered vegetation species have been identified (Department of Sustainable Development, 2001). A botanical survey was completed for the site in 1967. Table 6-8 provides a list of species that occur around the site.

Table 6-8: Vegetation species identified at Ekalugad Fjord

Family	Scientific Name	Common Name
Lichens	*Rhizocarpon geographicum* DC.	Map Lichen
	Thamnolia subuliformis	Worm Lichen
	Cladonia rangiferina Web.	Reindeer Lichen
	Umbilicaria sp.	Rock Tripe
	Xanthoria elegans	Jewel Lichen
Mosses	*Rhacomtrium lanuginosum* (Hedw.) Brid.	
	Rhodobryum roseum (Weis) Limpr.	
Equisetaceae (Horsetail Family)	*Equisetum arvense* L.	Common Horsetail
Lycopodiaceae (Club-moss Family)	*Lycopodium selago* L.	Club Moss
Poaceae (Grass Family)	*Alopecurus alpinus* J.E. Smith	Foxttail
	Arctagrostis latifolia (R.Br.) Griseb sp. *latifolia*	Polargrass
	Deschampsia cespitosa (L.) Beauv. spp. *brevifolia* (R.Br.) Tzvelev	
	Festuca ovina L. var. *brachyphylla* Piper	Fescue
	Hierchloe alpina (Sw.) R.&S.	Holygrass
	Phippsia algida (Sol.) R.Br.	
	Poa arctica R.Br. spp. *arctica*	Arctic Bluegrass
	Trisetum spicatum (L.) Richt. *s.lat.*	

Table 6-8: Vegetation species identified at Ekalugad Fjord		
Family	**Scientific Name**	**Common Name**
Cyperaceae (Sedge Family)	*Carex bigelowii* Torr.	
	Carex misandra R.Br.	
	Eriophorum scheuchzeri Hoppe	Cottongrass
	Eriophorum triste (Th.Fr.) Hadac & Love	Cottongrass
Juncaceae (Rush Family)	*Juncus castaneus* Sm.	
	Juncus biglumis L.	
	Luzula confusa Lindebl.	
Salicaceae (Willow Family)	*Salix arctica* Pall. *s.lat.*	Arctic Willow
	Salix herbacea L.	Least Willow
Polygonaceae (Buckwheat Family)	*Oxyria digyna* (L.) Hill	Mountain Sorrel
	Polygonum viviparum L.	Bistort
Caryophyllaceae (Pink Family)	*Cerastium alpinum* L. *s.lat.*	Mouse-ear Chickweed
	Cerastium sp.	
	Silene acaulis L. ssp. *acaulis*	Moss-campion
Ranunculaceae (Crowfoot Family)	*Ranunculus nivalis* L.	
	Ranunculus sabinii R.Br.	Buttercup
Papaveraceae (Poppy Family)	*Papaver radicatum* Rottb.	Arctic Poppy
Brassicaceae (Mustard Family)	*Draba alpina* L.	
	Draba fladnizensis Wulf.	
	Draba nivalis Lilj. var. *elongata* Wats.	
Saxifragaceae (Saxifrage Family)	*Saxifraga cernua* L.	
	Saxifraga nivalis L.	Alpine Saxifrage
	Saxifraga oppositifolia	Purple Saxifrage
Rosaceae (Rose Family)	*Dryas integrifolia* M. Vahl	Mountain Avens
	Potentilla hyparctica Malte var. *hyparctica*	Cinquefoil
	Potentilla pulchella R.Br.	Cinquefoil
	Potentilla vahliana	Cinquefoil
Ericaceae	*Arctostaphylos alpina* (L.*) Spreng.*	Alpine Bear Berry
	Cassiope tetragona (L.) D.Don ssp. *tetragona*	Arctic White Heather
	Vaccinium uliginosum L. spp. *pubescens* (Wormsk.) Young	Blueberry
Scrophulariaceae (Figwort Family)	*Pedicularis hirsuta* L.	Hairy Lousewort

6.6.2 Terrain Impact Assessment

6.6.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the terrain of the area include the area immediately surrounding the FOX-C Intermediate DEW Line Site facilities. The temporal boundary is the remediation field work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the terrain assessment are the lack of site-specific terrain data and the limited time frame associated with the environmental screening.

6.6.2.2 Identification of Issues, Interactions and Potential Effects

An alteration in the ability of the local terrain to support native plants may result from the remediation activities. The majority of the terrain in the immediate vicinity of the site facilities is already heavily disturbed. Efforts have been made to locate borrow sources and new landfills within or close to the footprint of the facility site. Clean up and remediation of the site will allow for revegetation to occur. The dwarf shrub-lichen association would likely recolonize in the area, however given the harsh growing conditions of the area this may not be noticed for a number of years.

Most of the waste appears to have been deposited directly on the ground and only minor quantities have been buried. The excavation required for the development and subsequent closure of the new landfills and the closure of existing landfills has the potential to degrade permafrost. Efforts will be made to minimize re-grading of the site. The removal of site debris has the potential to further disturb the existing terrain. However, terrain and drainage will be improved as a result of grading disturbed areas to blend in to the natural environment.

Local vegetation may be affected by fugitive dust during the clean up and remediation activities. Mitigation measures used to reduce the levels of fugitive dust should reduce impacts to local vegetation.

The extraction of granular material will alter the terrain of borrow areas, and the movement of contractor's equipment and personnel around the site has the potential to disturb the tundra. Additionally, the excavation and removal of contaminated soil has the potential to degrade the permafrost.

Table 6-9 is an environmental assessment matrix for the Terrain VEC.

6.6.2.3 Mitigation

Excavation required for the development and subsequent closure of the new landfills and closure of existing landfills has the potential to degrade permafrost, however, project activities will be conducted to ensure that the time that the permafrost is exposed is minimized. Additionally, the surface area of exposed permafrost or active zone will be minimized.

The removal of site debris has the potential to further disturb the existing terrain however, the disturbed areas will be re-graded and reshaped to match existing terrain and drainage paths. Unless required for drainage purposes (i.e., landfill cap), smoothing and contouring of the surface will be minimized in order to create microsites that will encourage vegetation growth. During the remediation activities, vehicles and workers will use existing tracks for travel, whenever possible. Terrain and drainage will be improved on previously disturbed areas as a result of grading to blend into the natural environment.

The extraction of granular material will alter the terrain of borrow areas, however these will be re-graded and reshaped to match existing terrain and drainage paths. The excavation and removal of contaminated soil has the potential to degrade the permafrost, however project activities will be carried out to ensure that the time the permafrost is exposed is minimized, and to minimize the exposed surface are of permafrost or the active zone.

Mitigation measures to reduce to levels of fugitive dust will also benefit local terrestrial vegetation.

Table 6-9: Environmental Effects Assessment Matrix: Terrain								
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Landfill Development / Closure	Excavation required for the development and subsequent closure of the new landfills and closure of existing landfills has the potential to degrade permafrost (A).	• The duration of permafrost exposure will be minimized. • The surface area of exposed permafrost or active zone will be minimized. • Unless required for drainage purposes, smoothing and contouring of the surface will be minimized in order to create microsites that will encourage vegetation growth.	1	2	3/1	R	2
Site Debris Disposal	The removal of site debris has the potential to further disturb the existing terrain (A).	• Disturbed area will be regraded and reshaped to match existing terrain and drainage paths. • Existing tracks will be used for movement around the site.	1	2	3/1	R	2
Site regrading	Drainage will be improved as a result of grading disturbed areas. Previously disturbed areas will blend into the natural environment (P).	• N/A					
Borrow Source Development	The extraction of granular material will alter the terrain of the borrow area (A).	• Disturbed area will be regraded and reshaped to match existing terrain and drainage paths.	1	2	2/1	R	1
Contaminated Soil Excavation	The excavation and removal of contaminated soil has the potential to degrade permafrost (A).	• The duration of permafrost exposure will be minimized. • The surface area of exposed permafrost of active zone will be minimized.	1	2	3/1	R	2
Contractor Support	The establishment of the work camp may disturb or destroy landforms.	• The camp will be located on previously disturbed land	1	1	3/6	R	2
	Movement of contractor's equipment and personnel around the site has the potential to disturb the tundra (A).	• Existing roads will be used for movement around the site.	1	2	2/1	R	2

Table 6-9: Environmental Effects Assessment Matrix: Terrain								
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context

KEY:

Magnitude:

1 = Low: Erosion, permafrost degradation and destruction of vegetation is minor and limited in extent.

2 = Medium: Erosion, permafrost degradation and destruction of vegetation is more intense and widespread.

3 = High: Extensive erosion, permafrost degradation and destruction of vegetation.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.6.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect on the terrain VEC is one that results in permafrost degradation, surface erosion, sliding or slumping such that a significant effect results upon one of the water quality, biological, heritage resource, or socio-economic VECs or when the population of a vegetation species is sufficiently affected to cause a decline in abundance and/or change in distribution beyond which natural recruitment would not return the population to its former level within several growing seasons.

Residual Environmental Effects Summary

Table 6-10 summarises the residual environmental effects of the project activities on terrain. Activities during the remediation phase are not expected to affect terrain significantly.

Table 6-10: Residual Environmental Effects Summary Matrix: Terrain			
Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Landfill Development / Closure	NS		
Site Debris Disposal	NS		
Site Regrading	P		
Borrow Source Development	NS		

Table 6-10: Residual Environmental Effects Summary Matrix: Terrain			
Phase	**Residual Adverse Environmental Effect Rating**	**Likelihood (of significant adverse environmental effects)**	
		Probability of Occurrence	**Scientific Uncertainty**
Contractor Support	NS		
Contaminated Soil Excavation	NS		

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.6.2.5 Summary of Environmental Effects on Terrain

The removal of site debris has the potential to further disturb the existing terrain. Vehicles and workers will use existing tracks for movement around the site, as much as possible, to minimize disturbance to the tundra. Movement off the existing tracks will be required to access some barrels blown away from the disturbed areas, but this will be minimized.

Remediation activities are assessed as not having significant effects on the terrain of the FOX-C Intermediate DEW Line Site area.

6.7 Terrestrial Animals and Habitat

6.7.1 Existing Environment

Wildlife in the region is dependent on suitable habitat for survival and given the sparse presence of vegetation in the region low densities and diversity of wildlife in the area are expected. There is however several species that may utilize the area for certain life stages such as breeding or migrating. Based on existing information the keystone wildlife species expected in the area are highlighted below. It should be noted that all existing information for the area has been collected after the FOX-C facilities were already in place.

6.7.1.1 Mammals

Large terrestrial mammals include polar bear, arctic wolf and caribou. Smaller resident mammals include arctic hare, arctic fox, ermine, and collared lemmings. Walrus, ringed and bearded seal, narwhal, and bowhead whale typifies the marine environment (Ecological Stratification Working Group 1995).

Polar Bear

The polar bear is considered a sensitive species in Nunavut (Department of Sustainable Development, 2001) and in 2002 it was listed as a species of Special Concern (COSEWIC 2003). Movements of polar bears are normally dictated by sea ice characteristics, climate and the presence of prey species, especially ringed seals (Taylor et al. 2001). In Nunavut, polar bears are common in the coastal areas, especially in the summer. They move inland to find denning sites, where females will spend the winter with their new-born young.

FOX-C Intermediate DEW Line Site is located within the Baffin Bay polar bear population which is estimated to be 2,200 animals. This population is shared with Greenland (IUCN 2004). Within this population, polar bears exhibit site fidelity to these regions because of discontinuities in movement influenced by land-mass and open-water impediments. Most individuals within this population will spend the open water season on Baffin Island (Taylor et al. 2001). While occurrences of polar bears in the FOX-C Intermediate DEW Line Site region are likely to be low, they could be met there occasionally at any time throughout the year.

Caribou

Caribou on Baffin Island are usually seen in smaller groups compared to the migratory barren-ground caribou that winter below the treeline on the mainland. Ekalugad Fjord lies within the range of the Northeast Baffin Caribou Herd. The population of this herd is estimated to be over 10,000 individuals. Caribou adapt their migrations according to snow conditions and forage availability. They can deplete the food supply in an area, and change their migration routes to utilize new browsing areas. They are particularly sensitive to disturbances during calving and post-calving periods. During May, caribou migrate into the fjord valleys where the bulls will remain through the summer. The cows continue across the mountains to give birth at higher elevations. After calving they move to summer feeding areas in valleys. Calving areas on central Baffin Island have been recorded at a barren plateau east of Dewar Lakes (Elliott 1971), which are approximately 125 km west of Ekalugad Fjord.

Caribou are known to utilize the area around Ekalugad Fjord as tracks and droppings have been recorded on previous visits to the site (Reimer et al. 1994). However, little information exists on the distribution and movement of caribou in the vicinity of the site. Given the habitat features of the site, the area is not expected to be suitable for calving or a major migratory route.

Caribou protection measures are likely to be attached to land use permits in the region. These measures will likely be based on proposed measures outlined in the North Baffin Regional Land Use Plan that states, in general, development activities shall be prohibited within all caribou calving areas during calving season or if activities block or cause substantial diversion to caribou migration. At this time there is little information regarding traditional use of the area for hunting although there is evidence of past camps on the lakeshore near the lower site.

Wolves

Little information exists on the status of wolves in Nunavut but they are expected to occur in low densities (COSEWIC 2003). Wolves are considered a sensitive species in Nunavut and are considered rare on Baffin Island (Department of Sustainable Development 2001). They are usually found in association with caribou herds and have been reported in association with caribou around Dewar Lakes (Elliott 1971). One of the biggest threats to the long-term persistence of wolves are humans and their associated activities that cause habitat alteration and exploitation (Cluff et al. 2002).

Wolverines

The wolverine is listed as a species of Special Concern by COSEWIC and is considered sensitive in Nunavut (COSEWIC 2003; Department of Sustainable Development 2001). There are limited data available on the distribution, abundance, and ecology of wolverines in Nunavut (Mulders 2000). Based on reports from Inuit, the wolverine is likely rare on this part of Baffin Island (Mallory et al. 2001) and are expected to be at low densities compared to other regions in Nunavut. Like wolves, they are usually found in association with caribou herds however odours and waste from human developments have acted as an attraction for these animals.

Fox

The Red Fox and the Arctic Fox occur on Baffin Island, both of which are considered secure in Nunavut (Department of Sustainable Development 2001). Red foxes have adapted well to arctic tundra habitats and compete with arctic foxes. In the arctic, foxes primarily prey upon lemmings and nests of waterfowl species. The cyclic nature of lemming populations influences the populations and behaviour of foxes.

Foxes prefer vegetated soft ground for denning so the potential for dens exists in the FOX-C Intermediate DEW Line Site region. Foxes are territorial and rarely den less than a mile apart. If foxes are present in the FOX-C Intermediate DEW Line Site region they would likely have only one or two dens.

The curious nature of foxes often brings them in contact with human developments (Anand-Wheeler 2002). Potential interactions with the Project exist if proper waste and odour management strategies for the facilities are not developed. These strategies must identify and describe details of design features, operational measures, employee/contractor staff awareness and training, for handling of food, food waste and other wastes throughout the site and specifically for the kitchen and personnel quarters.

Arctic Hare

The arctic hare occurs on Baffin Island and is known to inhabit the area around Ekalugad Fjord (Qikiqtaaluk Corporation 2001), however population numbers and density are unknown. They are considered secure in Nunavut (Department of Sustainable Development 2001). They have small home ranges that allow them to build up a series of runways and escape routes from predators (Anand-Wheeler 2002). They are a main prey species for carnivores and are important for maintaining predator-prey relationships in this harsh environment. The presence of arctic hare in a region can act as an indicator to the presence of predator species, such as foxes, in the region.

6.7.1.2 Birds

In the Arctic, the presence of birds is for the most part a seasonal phenomenon. Nunavut contains the northern limits of breeding ranges for numerous species of migratory birds, colonial seabirds, shorebirds and waterfowl. Besides being important for subsistence harvesting, birds are also valuable components of the landscape. There have been no bird surveys conducted at the site, however incidental observations have been documented and are discussed below.

Waterfowl and Seabirds

The east coast of Baffin Island has topography that is steep and rugged that makes suitable nesting colonies for many seabirds. Species include Arctic Terns, Common Eiders, Northern Fulmar, Common Murre, and Black Guillemot. There are two small islands in Home Bay, at the mouth of Ekalugad Fjord, that are the only reported breeding sites for Dovekies in Canada (Alexander et al. 1991), although these islands are several kilometres from the site. Thayer's Gulls have been observed at the site, in addition to Snow Goose droppings (Reimer et al. 1994) suggesting that Ekalugad Fjord may act as a migratory stopover for snow geese migrating to northern Baffin Island.

Raptors

The east coast of Baffin Island offers suitable cliffs for nesting raptors along with seabirds. Seabirds may form an important part of raptors' diet here. The peregrine falcon is classified as "May be at Risk" in Nunavut (Department of Sustainable Development 2001) and is listed as a species of Special Concern by COSEWIC (COSEWIC 2003). The major cause of decline of peregrine falcon populations was the presence of agricultural pesticides in the environment. These compounds cause eggshell thinning, egg breakage, and reduced hatching success, brood-size and breeding success. Current threats include the small population size and the diminishing quality of habitat. Human intrusion and disturbance near nest sites may affect peregrine falcons. The species is protected from hunting in Nunavut, except by native people, who hunt the peregrine only rarely for ceremonial purposes. Nunavut also legally protects the falcon from live possession and trade (Environment Canada 2003). It is likely that peregrine falcons nest sparingly throughout the Baffin Region. However result from previous surveys suggest that peregrine falcon populations on Baffin Island have remained stable or increased over the past century (Mallory et al. 2001).

The gyrfalcon is the largest of all falcons, preying on mammals and birds up to the size of arctic hares and geese. They begin nesting in May and return to the same cliffs for many years, leaving a build-up of white guano that becomes encrusted with orange lichen. Average gyrfalcon densities on southern Baffin Island were one territory per 1,300 km^2 (Bromley and McLean 1986).

Rough-legged Hawks are at the limit of their natural range in south Baffin Island, so large numbers would not be expected near the site (Bromley and McLean 1986).

Other Birds

Other birds that have been recorded in the area include Snow Buntings, Redpolls, and Ptarmigan. These species are likely breeding in the area however exact breeding locations are unknown and may vary annually.

6.7.1.3 Species at Risk

The federal *Species at Risk Act* (*SARA*) was passed by Parliament on December 12, 2002. As of June 5, 2003, most of the Act has come into force. *SARA* applies to all aquatic species and migratory birds wherever they are found and to all species listed as endangered, threatened or extirpated species on federal lands (which includes territorial lands) by COSEWIC. In addition, *SARA* amends the definition of "environmental assessment" in the *Canadian Environmental Assessment Act* to include any change that the project may cause to a listed species, its critical habitat or the residences of individuals of that species. Subsequently, any project requiring an environmental assessment under federal law that is

likely to affect a listed species or its critical habitat needs to identify the adverse effects, and, if the project goes forward, steps must be taken to avoid or lessen those effects and to monitor them.

The polar bear, wolverine and peregrine falcon are three wildlife species that are listed by COSEWIC (2003) as species at risk. The status of these species has been highlighted in the subsections above. Activities at the site are not expected to impact these species at risk or their habitat in any substantial manner.

6.7.2 Terrestrial Animals and Habitat Impact Assessment

6.7.2.1 Study Area Boundaries

Given the wide ranging characteristics of most wildlife species, the spatial boundary for the assessment of the effects of project activities on the terrestrial animals includes the footprint of the FOX-C Intermediate DEW Line Site facilities plus the surrounding area. This boundary may extend to the nearest communities (Clyde River to the north and Qikiqtarjuag to the south) and to the western limits of Baffin Island, depending on the type of wildlife species. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the terrestrial animals and habitat assessment are the limited time frame associated with the environmental screening.

6.7.2.2 Identification of Issues, Interactions and Potential Effects

Most wildlife species are likely to exhibit some degree of sensitivity to human disturbance and from noise associated with heavy equipment and aircraft during the remediation. This sensitivity varies based on aspects of their behaviour, including the degree to which they adapt and habituate to human disturbance. This disturbance could result in temporary displacement of certain species from preferred habitat; abandonment of nests, dens or breeding areas; destruction of nests or eggs; or stress-related reduction in reproductive success.

Potential interactions with wildlife, such as polar bear, wolves, wolverine and foxes, and the Project exist if proper waste and odour management strategies for the facilities are not developed. These strategies must identify and describe details of design features, operational measures, and employee/contractor staff awareness and training for handling of food, food waste and other wastes throughout the clean up site and specifically for the incinerator, landfill site, kitchens, camps and personnel quarters.

Major threats to polar bears are occurring at the global scale. Bio-accumulation of pollutants and climate change are affecting the overall survival of this species. Data suggest that the Baffin Bay population is being over-harvested; however, better data from Greenland is required to verify this assumption (IUCN 2004). Co-management discussions between Greenland and Canada are to continue to ensure this population remains stable. A strategy for dealing with polar bear interactions at the site should be implemented to ensure that no bears are unnecessarily destroyed as a result of the project.

Accidents, malfunctions and unplanned events such as collisions between wildlife and Project-related vehicles or hazardous material spills may interact with wildlife in a manner that results in the alteration of habitat, changes in wildlife movement patterns and/or the loss of individual animals. It should be noted that the removal of hazardous materials and contaminated soil from the environment reduces the risk of exposure to terrestrial animals. Table 6-11 is an environmental assessment matrix for the terrestrial animals VEC.

Table 6-11: Environmental Effects Assessment Matrix: Terrestrial Animals and Habitat

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up Activities	The use of heavy equipment during the clean up has the potential to disturb wildlife (A).	• Known wildlife colonies or bird nesting areas will be avoided, if possible. • Minimum distance/height restrictions for transportation activities will be applied. • An Environmental Protection Plan will be prepared.	1	2	4/1	R	1
Contaminated Soil Disposal / Hazardous Materials Removal	The removal of hazardous materials and contaminated soil from the environment reduces the risk of exposure to terrestrial animals (P).	• N/A					
Landfill Developments	Loss of habitat may occur as a result of the development of the new landfills in previously undisturbed areas (A).	• New landfills will be located within the existing facility footprint or adjacent to it wherever possible. • New landfill areas will be graded and reshaped to match existing terrain to facilitate the recovery of ecosystem components.	1	2	3/1	R	1

Table 6-11: Environmental Effects Assessment Matrix: Terrestrial Animals and Habitat

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Facility Demolition	The existing facilities may be used by wildlife as habitat. The demolition of these facilities has the potential to impact availability of habitat (A).	• Facilities will be inspected for use by wildlife prior to demolition. • Facilities will not be demolished in the immediate vicinity of nests while birds are nesting. • Appropriate wildlife officer will be contacted for additional guidance to ensure disturbance of wildlife is minimized.	1	2	3/1	R	1
Borrow Source Development	The extraction of granular material will require the disturbance of the ground and has the potential to impact terrestrial habitat (A).	• Disturbed areas will be graded and reshaped to match existing terrain to facilitate the recovery of ecosystem components.	1	2	3/1	R	1

KEY:

Magnitude:

1 = Low: *e.g.,* a few individuals. Species and or habitats affected occasionally.

2 = Medium: *e.g.,* a moderate percentage/number of individuals, species and or habitats affected within the LSA for a period of more than one month.

3 = High: *e.g.,* a large percentage/ number of individuals, species and or habitats within LSA affected for a period of more than one month.

4 = Very High *e.g.,* long-term regional effects on wildlife abundance distribution and biodiversity (*e.g.,* impact to an endangered species).

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.7.2.3 Mitigation

Prior to commencement of remediation work, workers will receive wildlife awareness training and will be instructed to avoid wildlife encounters.

The Migratory Birds Regulations, Section 6(a), states that: "*no person shall*
(a) disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird…"

During the remediation activities, efforts will be made to avoid known wildlife colonies and bird nesting areas. Where applicable, minimum distance and height restrictions will be employed for transportation activities. Also, the appropriate wildlife officer will be contacted for guidance to ensure that the disturbance of wildlife is minimized and the *Migratory Birds Regulations* are met.

Caribou protection measures are likely to be attached to land use permits. These measures will likely state that project activities shall be prohibited within all caribou calving areas during calving season or if activities block or cause substantial diversion to caribou migration. Since FOX-C Intermediate DEW Line Site is outside of these areas such measures should not affect the project schedule. Helicopter movement during the Project may disturb caribou present in the area. Helicopter pilots will be instructed to avoid caribou when travelling around the site.

There is the potential for accidental events to adversely affect wildlife and wildlife habitat. To minimize the possibility of an accidental event, including collisions, spills, or fires, an environmental protection plan will be implemented that contains a number of sections that will minimize and mitigate potential effects of such an event on wildlife and wildlife habitat. These include Wildlife Protection Measures and Hazardous Materials and Spill Contingency Procedures.

6.7.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on terrestrial animals occurs when the population of a species is sufficiently affected by the Project to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its former level within several generations.

Residual Environmental Effects Summary

Table 6-12 summarises the residual environmental effects of the project activities on terrestrial animals and habitat. Effects of the Project on terrestrial animals and habitat, for the remediation activities are assessed as not significant. The removal and disposal of hazardous materials will have a positive effect on terrestrial animals.

Table 6-12: Residual Environmental Effects Summary Matrix: Terrestrial Animals and Habitat

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	NS		
Contaminated Soil Disposal / Hazardous Materials Removal	P		
Landfill Development	NS		
Facility Demolition	NS		
Borrow Source Development	NS		

Table 6-12: Residual Environmental Effects Summary Matrix: Terrestrial Animals and Habitat

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty

KEY:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.7.2.5 Summary of Environmental Effects on Terrestrial Animals and Habitat

During project activities, efforts will be made to avoid known wildlife colonies or bird nesting areas. Where applicable, minimum distance and height restrictions will be employed for transportation activities. All disturbed areas will be re-graded and reshaped to match existing terrain to facilitate recovery of ecosystem components. Prior to demolition, facilities will be inspected for use by wildlife (*i.e.,* nests in structures). Should any active nests be discovered, waste consolidation will be postponed until nesting is complete. Also, the appropriate wildlife officer will be contacted for guidance to ensure that the disturbance of wildlife is minimized.

Wildlife protection measures that include provisions to reduce attractants through proper waste disposal, education and awareness of potential wildlife interactions and hazardous materials and spill contingency procedures will be adhered to.

The effects of remediation on the terrestrial animals and habitat are assessed as not significant.

6.8 Aquatic Animals and Habitat

6.8.1 Existing Environment

Little information exists about fish species near the project site. Fish have been observed in the unnamed freshwater lake adjacent the site but have not been identified (Reimer et al. 1994). The previous environmental screening for the site has identified Arctic Char *(Salvelinus alpinus*) as a species known to inhabit the area (Qikiqtaaluk Corporation 2001). Studies by Jacques Whitford (2005a) found Arctic Char are present in the freshwater lake in the lower project area and that the river joining the lake to Ekalugad Fiord. The gravel substrates in the lake provide good spawning habitat for adult Arctic Char. Discussions with several Inuit persons confirmed the presence of Arctic Char in the lake. Arctic Char is the most important fish species to the people of Baffin Island. Char are fished during their spring run out of the rivers and during the fall run back into the rivers. Char are usually caught in estuaries as the fish wait there to acclimatise to a change in water salinity. During winter

months, Inuit are known to come to the lake to ice fish when char are spawning (Jacques Whitford 2005a).

Approximately 30 marine fish species have been reported from Davis Strait and Baffin Bay. Arctic cod are by far the most abundant and ecologically important. It is the major food source for many species of seabirds and marine mammals, especially the narwhal, beluga and harp seal.

Several species of marine mammals are expected to be in Ekalugad Fjord. Species include walrus, harbour seal, ringed seal, harp seal, hooded seal, beluga whale, narwhal, bowhead whale and killer whale. Ekalugad Fjord has not been identified as a critical area for any species of marine mammals.

6.8.2 Aquatic Animals and Habitat Impact Assessment

6.8.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the aquatic animals is the freshwater lake adjacent to the site and the river flowing into Ekalugad Fjord. The fjord itself is also considered within the spatial boundary for this screening. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the aquatic animals and habitat assessment are the lack of site-specific information and limited time frame associated with the environmental screening.

6.8.2.2 Identification of Issues, Interactions and Potential Effects

Water from the freshwater lake drains into Ekalugad Fjord so it will be critical that deleterious substances (pollution and sedimentation) are kept out of the lake. The potential exists for an accidental release of hazardous materials, contaminated soil and/or fuels, which could affect aquatic habitat. The removal of fuel drums in the watershed and the placement of culverts could result in sedimentation and the release of hazardous materials that could destroy aquatic habitat and kill fish. Table 6-13 is an environmental assessment matrix for the aquatic animals and habitat VEC.

Table 6-13: Environmental Effects Assessment Matrix: Aquatic Animals and Habitat							
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Landfill Closure	The proximity of landfills to water bodies has the potential to affect aquatic habitat, thereby affecting aquatic animals through sediment or hazardous materials entering the water (A).	• Mitigative measures such as berms, silt fences and/or silt booms will be implemented to prevent deleterious substances from entering the aquatic environment.	2	2	3/1	R	1
	The remediation of the beach landfills will reduce the potential for impact (P).	• N/A					
Site Regrading. Borrow Source Development	The extraction of granular material and grading adjacent to waterbodies (fresh and marine) has the potential to affect aquatic habitat thereby affecting aquatic animals through sediment entering the water (A).	• Mitigative measures such as berms, silt fences and/or silt booms will be implemented to prevent deleterious substances from entering the aquatic environment.	2	2	3/1	R	1
Contaminated Soil Disposal, Hazardous Materials Removal	The removal of contaminated soil and other hazardous materials from areas close to waterbodies reduces the risk of exposure to aquatic animals (P).	• N/A					
Removal of fuel drums within the watershed	Activities within the watershed could result in sedimentation and the release of hazardous materials, resulting in the destruction of aquatic habitat and fish mortality (A).	• An environmental protection plan for the removal of fuel drums in the watershed has been developed (Appendix B)	1	2	3/2	R	1

Table 6-13: Environmental Effects Assessment Matrix: Aquatic Animals and Habitat							
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**				
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Placement of culverts	Soil erosion and resulting sedimentation of the stream may occur during placement, resulting in the destruction of aquatic habitat and fish mortality (A).	• An environmental protection plan for the installation of culverts has been developed (Appendix B)	1	2	3/2	R	1
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	Accidental releases of hazardous materials, contaminated soil and/or fuels may enter the aquatic environment (A).	• A spill prevention and contingency plan will be in effect during activities. • Mitigative measures such as berms, silt fences and/or silt booms will be implemented to prevent deleterious substances from entering the aquatic environment.	2	2	2/1	R	1

KEY:

Magnitude:

1 = Low: <1% loss of critical fish habitat or <1% change in fish population abundance.

2 = Medium: 1-20% loss of critical fish habitat or 1-20% change in fish population abundance.

3 = High: >20% loss of critical fish habitat or >20% change in fish population abundance.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.8.2.3 Mitigation

The implementation of the environmental protection plan for the removal of fuel drums within the watershed and the installation of culverts (Appendix B) and contingency plans for the clean up of FOX-C (Appendix C) will mitigate effects of the remediation on aquatic animals and habitat.

6.8.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on aquatic animals occurs if a population or portion thereof is affected in such a way as to cause a decline or change in abundance or distribution of the population over one or more generations. Natural recruitment may not re-establish the population to its original level. A significant effect on aquatic habitat may alter the valued habitat, physically, chemically or biologically, in quality or extent, to such a degree that there is a decline in the diversity of the habitat. This effect would be reflected by a decline in abundance and/or change in distribution of the benthic community within the area, beyond which natural recruitment would not return that population to its former level within several generations.

Residual Environmental Effects Summary

Table 6-14 summarizes the residual environmental effects of the project activities on aquatic animals and habitat. The implementation of the mitigative measures proposed to protect the aquatic animals and habitat will result in the residual effects being not significant or, in the case of the removal of existing hazardous materials, positive.

Table 6-14: Residual Environmental Effects Summary Matrix: Aquatic Animals and Habitat

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Landfill Closure	P		
Landfill Development	NS		
Site Re-grading / Borrow Source Development	NS		
Contaminated Soil Disposal / Hazardous Materials Removal	P		
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	NS		
Contractor Support	NS		
Removal of Fuel Drums from the Watershed	NS		
Culvert Installation	NS		

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.8.2.5 Summary of Environmental Effects on Aquatic Animals and Habitat

Effects of the Project on aquatic animals and habitat are associated with the potential deposition of eroded material from borrow excavations and water quality affects from landfill leachates and fuel and chemical spills. The implementation of mitigation measures such as berms, silt fences and/or silt booms will prevent deleterious substances from entering the aquatic environment. Spill prevention and contingency plans will mitigate the effects of accidental spills. The effect of the remediation of FOX-C on aquatic animals and habitat is assessed as not significant or as positive.

6.9 Health and Safety

6.9.1 Existing Environment

SENES Consultants Limited (2003) conducted a human health screening-level risk assessment for the FOX-C site. The assessment, conducted using conservative assumptions that lead to an overestimation of potential exposure, found that although contaminants are present in the soil, none of the contaminants of concern exceed the hazard quotient value (for non-carcinogenic effects) or risk level (for carcinogenic effects) designated for acceptable exposure limits at the site. Physical hazards identified at the site included the presence of asbestos in the piping and tiles of the buildings, the physical topography of the site, scattered debris, and hazards associated with use of the current dumps on site.

Jacques Whitford performed a human health and ecological risk assessment (HHERA) of the FOX-C site in 2004 (Jacques Whitford 2005b). The primary objective of this study was to evaluate whether known concentrations of chemicals in surface soil and water at the site would present a significant risk to human or ecological health based on future use of the property in its current condition and after remediation. The results of the HHERA were:

- Surface soil maximums of the identified chemicals are not anticipated to produce adverse effects in human receptors under the exposure scenarios included in the risk assessment; and
- Surface soil exposure point concentrations (EPCs) of the identified chemicals are not anticipated to produce adverse effects in ecological receptors under the exposure scenarios included in the risk assessment.

The HHERA also concluded that the remediation of the site will result in lower contaminant concentrations.

6.9.2 Health and Safety Impact Assessment

6.9.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on health and safety is the FOX-C Intermediate DEW Line Site vicinity (immediate area) and the living quarters of the workers performing the site investigations and remediation. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA for review by NIRB and other federal departments through the normal CEAA process. Technical boundaries of the health and safety assessment are the lack of site-specific information and limited time frame associated with the environmental screening.

6.9.2.2 Identification of Issues, Interactions and Potential Effects

The exposure of potentially hazardous materials during remediation of the landfills, the collection and disposal of potentially hazardous debris, the removal of hazardous materials from facilities, the general handling of hazardous materials, and travel around the site have the potential to impact health and the safety of workers. However, as concluded in the HHERA, exposure to the existing contaminants is not expected to cause adverse effects in humans. It can be concluded that exposure to contaminants during remediation will not have adverse effects either.

Ultimately, the removal of contaminated soil and other hazardous materials from the environment reduces the risk of exposure to people. Table 6-15 is an environmental assessment matrix for the Health and Safety VEC.

Table 6-15: Environmental Effects Assessment Matrix: Health and Safety								
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
General Clean Up Activities	The excavation of potentially hazardous materials from the landfills, the collection and disposal of potentially hazardous debris, the removal of hazardous materials from facilities and the general handling of hazardous materials has the potential to impact health and the safety of workers (A).	• Transportation of any hazardous materials will be in accordance with Transportation of Dangerous Goods Regulations. • A comprehensive health and safety plan will be developed and implemented. • Workers will be required to wear and use appropriate personal protective equipment. • Workers will be trained in the use of personal protective equipment and proper handling procedures for hazardous materials.	1	N/A	1/1	R	N/A
Contaminated Soil Disposal/Hazardous Materials Removal	The removal of contaminated soil and other hazardous materials from the environment reduces the risk of exposure to people. (P)	• N/A					

KEY:

Magnitude:

1 = Low: No more than a few individuals are affected with minor, short-term health problems.

2 = Medium: A small portion of the local community are affected with minor, short-term health problems.

3 = High: An individual is affected with a chronic health problem or a large portion of the local community is affected with minor, short-term health problems.

Geographic Extent:

N/A

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.9.2.3 Mitigation

The transportation of any hazardous materials will be in accordance with the Transportation of Dangerous Goods Regulations. A comprehensive health and safety plan will be developed and

implemented with requirements for workers to wear and use appropriate personal protective equipment. Workers will also be trained in the use of personal protective equipment and proper handling procedures for hazardous materials.

6.9.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on health and safety occurs if an individual is injured on site and requires medical evacuation, or is killed, or develops a chronic health problem as a result of working on the Project.

Residual Environmental Effects Summary

Table 6-16 summarizes the residual environmental effects of the project activities on health and safety.

Table 6-16: Residual Environmental Effects Summary Matrix: Health and Safety

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	NS		
Contaminated Soil Disposal/Hazardous Materials Removal	P		

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.9.2.5 Summary of Environmental Effects on Health and Safety

The collection and disposal of potentially hazardous debris, the removal of hazardous materials from facilities and the general handling of hazardous materials has the potential to affect the health and the safety of workers. To help mitigate this risk, the transportation of any hazardous materials will be in accordance with Transportation of Dangerous Goods Regulations. Additionally, a comprehensive health and safety plant will be developed and implemented, which will require workers to wear and use appropriate personal protective equipment. Workers will also be trained in the use of personal protective equipment and proper handling procedures for hazardous materials. The effects of the remediation activities on health and safety are assessed as not significant. Ultimately, the removal of contaminated soil and other hazardous materials from the site reduces the risk of exposure to humans.

6.10 Archaeological and Heritage Resources

6.10.1 Existing Environment

The Department of Culture, Language, Elders and Youth of the Government of Nunavut was contacted for information on the archaeological and heritage resources of the FOX-C DEW Line site. They responded that there are no recorded archaeological sites within a 15-km radius of the site (J. Ross pers. comm. 2005). The recent history of the site is as a DEW Line facility.

6.10.2 Archaeological and Heritage Resources Impact Assessment

6.10.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on archaeology and heritage resources is the facility and access route footprint. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA for review by NIRB and other federal departments through the normal CEAA process. Technical boundaries of archaeological and heritage resources assessment are the lack of site-specific information and limited time frame associated with the environmental screening.

6.10.2.2 Identification of Issues, Interactions and Potential Effects

The presence and movement of people around the site has the potential to disturb unrecorded archaeological resources that may be present. Remediation activities also have the potential to expose new sites. Table 6-17 is an environmental assessment matrix for the archaeology and heritage resources VEC.

Table 6-17: Environmental Effects Assessment Matrix: Archaeology and Heritage Resources

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up Activities	Excavation activities at the site have the potential to unearth new artefacts (P).	• N/A					
	The presence and movement of people around the site has the potential to disturb previously unrecorded archaeological and heritage resources (A).	• The Nunavut Department of Culture, Language, Elders and Youth will be contacted if new artefacts or a site are discovered and work will be stopped until the site can be assessed and permission to proceed is obtained from the Department.	1	2	1/1	I	N/A

KEY:

Magnitude:

1 = Low: *e.g.,* loss of a minor proportion of data at site, local or regional level; after low impact, interpretative capacity of the remains is virtually intact, limited only by loss of minor items and/or features.

2 = Medium: *e.g.,* a proportion of the data at the site, local or regional level is lost but a significant proportion remains unimpaired; after medium impact, the interpretative capacity of the remains is hindered by loss of basic data about cultural descriptions and lifestyles.

3 = High: *e.g.,* a significant proportion of data at the site, local or regional level is lost; interpretative capacity of the remains following impact is minimal.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.10.2.3 Mitigation

No archaeological sites have been identified in the study area. If, during the course of the remediation program, archaeological resources are discovered, the Nunavut Department of Culture, Language, Elders and Youth will be contacted and work will be stopped at that location until an assessment of the find is made and permission to proceed is obtained from the Department.

6.10.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on archaeology and heritage resources would involve the destruction or disturbance of all or part of an archaeological, historic or palaeontological site considered to be of local, regional territorial, national, or international value. This effect, if not controlled through mitigative investigation and documentation would result in the permanent loss of part of the non-renewable heritage resource base.

Residual Environmental Effects Summary

Table 6-18 summarizes the residual environmental effects of the project activities on archaeology and heritage resources. Residual effects are assessed as not significant or as positive for the remediation activities.

Table 6-18: Residual Environmental Effects Summary Matrix: Archaeology and Heritage Resources

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	NS/P		

KEY:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.10.2.5 Summary of Environmental Effects on Archaeology and Heritage Resources

The presence and movement of people around the site has the potential to disturb the archaeological and heritage resources that may be present. In the event that a new resource is discovered, the Nunavut Department of Culture, Language, Elders and Youth will be contacted. The effects of the Project on archaeology and heritage resources are assessed as not significant or as positive.

6.11 Land Use

6.11.1 Existing Environment

The FOX-C Intermediate DEW Line Site facilities have been in place since 1957. The site was used as an intermediate DEW line site until 1963. Assessments were completed for the site in 1985 and 1994. A hunting and fishing camp was located at the mouth of the river that leads from the freshwater lake. All that remains of the camp is wood and metal debris. It is unknown when the camp was occupied and

for how long it was used. Residents of Clyde River indicated in a community meeting held for the purposes of announcing this Project in May 2004 that the site is part of a traditional hunting area.

6.11.2 Land Use Impact Assessment

6.11.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on land use is the Ekalugad Fjord and adjacent land areas. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA for review by NIRB and other federal departments through the normal CEAA process. No technical boundaries have been recognized for the assessment of the project on land use.

6.11.2.2 Identification of Issues, Interactions and Potential Effects

Remediation activities have the potential to disturb traditional land use such as hunting and fishing activities that potentially occur during the summer months. Table 6-19 is an environmental assessment matrix for the land use VEC.

Table 6-19: Environmental Effects Assessment Matrix: Land Use

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up Activities	Clean up activities may disturb traditional land use such as hunting and fishing activities that occur during the summer months (A).	• The local hunter and trapper organization will be notified of the scheduling of clean-up activities.	1	2	3/1	R	N/A

Table 6-19: Environmental Effects Assessment Matrix: Land Use								
Project Activity	**Potential Positive (P) or Adverse (A) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**	
	Clean up of the site will improve wildlife habitat and provide easier access for hunters and trappers (P).	• NA						

KEY:

Magnitude:

1 = Low: *e.g.,* a few land or water use activities precluded.

2 = Medium: *e.g.,* a moderate number of land or water uses precluded.

3 = High: *e.g.,* a large number of land or water uses precluded.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.11.2.3 Mitigation

In order to minimize impacts to traditional land use such as hunting and trapping activities, local hunter and trapper organizations will be identified and notified of the scheduling of remediation activities.

6.11.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on land use occurs if traditional land use activities are not permitted to occur.

Residual Environmental Effects Summary

Table 6-20 summarizes the residual environmental effects of the project activities on land use. The effect of remediation activities are assessed as being not significant or as being positive.

Table 6-20: Residual Environmental Effects Summary Matrix: Land Use			
Phase	**Residual Adverse Environmental Effect Rating**	**Likelihood (of significant adverse environmental effects)**	
		Probability of Occurrence	**Scientific Uncertainty**
General Clean Up Activities	NS/P		

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.11.2.5 Summary of Environmental Effects on Land Use

Clean up activities may disturb traditional land use such as hunting and fishing activities that occur during the summer months. In order to minimize these effects, local hunter and trapper organizations will be notified of the scheduling of remediation activities. The effects of the Project on land use are assessed as not significant or as positive.

6.12 Aesthetics

6.12.1 Existing Environment

The FOX-C Intermediate DEW Line site is located on arctic tundra. The facilities interrupt a natural arctic landscape view with one of a former military operation.

6.12.2 Aesthetic Impact Assessment

6.12.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on aesthetics is the FOX-C Intermediate DEW Line Site facility. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA for review by NIRB and other federal departments through the normal CEAA process. No technical boundaries have been recognized for the assessment of the project on aesthetics.

6.12.2.2 Identification of Issues, Interactions and Potential Effects

Ultimately, the clean up activities will improve the aesthetics of the site by removing unsightly debris and restoring the site to a more natural state. However, remediation activities themselves are not expected to have any interaction with the aesthetics of the area. Table 6-21 is an environmental assessment matrix for the aesthetics VEC.

Table 6-21: Environmental Effects Assessment Matrix: Aesthetics

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up Activities	The clean up will improve the aesthetics of the site by removing unsightly debris and restoring the site to a more natural state (P).	N/A					

KEY:

Magnitude:

1 = Low: Little change to the visual landscape.

2 = Medium: Some viewscapes are partially obscured or degraded.

3 = High: Most viewscapes are obscured or degraded.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.12.2.3 Mitigation

No mitigation is required since there are no project-aesthetic interactions identified.

6.12.2.4 Residual Environmental Effects

Definition of Significance
A definition of significance for residual effects on aesthetics is not required since no interactions have been identified.

Residual Environmental Effects Summary
Table 6-22 summarizes the residual environmental effects of the project activities on aesthetics.

Table 6-22: Residual Environmental Effects Summary Matrix: Aesthetics

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	P		

KEY:

Residual Environmental Effects Rating:	Probability of Occurrence: based on professional judgement:	Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:
S =N/A	1 = Low	1 = low level of confidence
NS =N/A	2 = Medium	2 = medium level of confidence
P =Positive Environmental Effect	3 = High	3 = high level of confidence
	n/a = effect not predicted to be significant	n/a = effect not predicted to be significant

6.12.2.5 Summary of Environmental Effects on Land Use

The remediation activities are not expected to interact with the aesthetic environment.

6.13 Socio-Economics

6.13.1 Existing Environment

FOX-C, located on the central Baffin Island, is in the Qikiqtaaluk region of Nunavut. The closest communities include Clyde River (195 km north) and Qikiqtarjuaq (235 km southeast). Population of the communities, according to the 2001 census was 785 in Clyde River and 519 in Qikiqtarjuaq. The economy of the region is based on hunting and fishing and on the tourist industry.

6.13.2 Socio-Economic Impact Assessment

6.13.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on socio-economics is Nunavut, as labour and equipment may be required from Iqaluit, Clyde River and/or Qikiqtarjuaq. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA for review by NIRB and other federal departments through the normal CEAA process. No technical boundaries have been recognized for the assessment of the project on socio-economics.

6.13.2.2 Identification of Issues, Interactions and Potential Effects

The Department of National Defence (DND) and Nunavut Tunngavik Incorporated (NTI) have signed a *DND/NTI Agreement for the Clean Up and Restoration of the DEW Line Sites within the Nunavut Settlement Area* outlining the economic provisions. The agreement includes a Minimum Inuit Content (MIC) for the clean up contract and requirements for training, specifically related to the clean up activities. Generally, the contracts for the clean up of DEW Line sites include clauses requiring the contractor to maximize Inuit Involvement. Inuit involvement in the remediation activities will include both employment and business (contracting) opportunities, and local purchases.

Table 6-23 is an environmental assessment matrix for the socio-economic VEC.

Table 6-23: Environmental Effects Assessment Matrix: Socio-Economics

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up activities	Nunavut residents will have employment opportunities during the remediation work (P).	N/A					

Table 6-23: Environmental Effects Assessment Matrix: Socio-Economics								
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context	

KEY:

Magnitude:

1 = Low: *e.g.,* Few individuals affected.

2 = Medium: *e.g.,* A moderate number of individuals affected.

3 = High: *e.g.,* A large number of individuals affected.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.13.2.3 Mitigation

During any remediation project, whenever possible, DIAND strives to support and enhance the development of healthy, sustainable communities by leveraging local skills and knowledge into their approach to addressing environmental issues associated with contaminated sites. By these means core competencies are maximized and deployed. Whenever possible, the project will also adopt solutions tailored to the northern environment and its inhabitants. This includes leveraging local knowledge and the incorporation of provisions accounting for the unique needs of northerners and the needs of the environment in which they live into the development and implementation of policies and procedures.

6.13.2.4 Residual Environmental Effects

Definition of Significance

A definition of significance for residual effects on socio-economics is not required since effects are positive.

Residual Environmental Effects Summary

Table 6-24 summarizes the residual environmental effects of the project activities on socio-economics.

Table 6-24: Residual Environmental Effects Summary Matrix: Socio-Economics			
Phase	**Residual Adverse Environmental Effect Rating**	**Likelihood (of significant adverse environmental effects)**	
		Probability of Occurrence	**Scientific Uncertainty**
Contractor Support	P		

KEY:

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.13.2.5 Summary of Environmental Effects on Socio-Economics

The contractor will be required to have a minimum Inuit content in the workforce for the remediation work. This will provide employment benefits, training and related economic benefits. The effects of the remediation of FOX-C on the socio-economics VEC are assessed as positive.

6.14 Summary of Environmental Effects

Table 6-25 is an interaction matrix between the Project and several environmental parameters, showing the effects of the Project on the environment. The parameters listed are those required by the NIRB and those that were not identified as specific VECs in the preceding sections, were included as part of the VECs discussed.

TABLE 6-25:

NUNAVUT IMPACT REVIEW BOARD
ENVIRONMENTAL INTERACTION MATRIX
FOX-C (EKALUGAD FJORD) REMEDIATION

INTERACTION MATRIX		ENVIRONMENTAL COMPONENTS	PHYSICAL	climate/ weather	ground stability	noise	sediment quality	soil quality	air quality	water quality	hydrology/ limnology	permafrost	eskers and other unique landscapes	BIOLOGICAL	vegetation	wildlife including habitat	birds including habitat	freshwater Biota and Habitat	marine Biota and Habitat	protected areas	land use	archaeology & heritage resources	aesthetics	socio-economics
PROJECT ACTIVITIES																								
SITE PREPARATION	Mobilization to the site				M				M	M														P
	Camp construction				M							M			M	M	M				M			P
	Development of borrow sources						M	M	M	M		M			M	M	M				M	M		
	Construction of landfill				M		M	M	M	M		M			M	M	M							P
	Access road upgrades				M		M	M	M	M	M							M						P
REMEDIATION	Remediation of dumps						M	M	M	M					P	P					P		P	P
	Demolition of infrastructure																						P	P
	Segregation of demolition wastes							M		M					M									P
	Remediation of contaminated soil							P		P						P	P	P						P
	Collection of debris																							P
	Disposal of barrels																							P
	Landfarming of hydrocarbon-contaminated soils							P								P	P	P						P
	Physical restoration of disturbed areas														P	P	P				P		P	P
CLOSURE	Site closure and demobilization				M																		P	P

Notes: Please indicate in the matrix cells whether the interaction causes an impact and whether the impact is:

P *Postitive*
N *Negative and non-mitigatable*
M *Negative and mitigatable*
U *Unknown*
If no impact is expected then please leave the cell blank

6.15 Cumulative Effects

The effects of the remediation of the former FOX-C DEW Line site will be cumulative with the effects of other activities in the area. The purpose of the remediation program is to repair the environmental effects of the DEW Line site. The only other activities identified at the site are traditional land use activities. The remediation program will interact with traditional land use during the time on-site activities are occurring but this period is of short duration (September 2005, Winter 2005/2006, and July-October 2006 and 2007) and traditional land users (hunters and trappers) will be notified of the periods when the remediation crews will be on site. The remediation of the site will have a positive effect on the environment through the removal of hazardous materials and the restoration of the habitat to one that is similar to what was present before site construction. There is a potential negative cumulative effect of the remediation on the socio-economic VEC. Ongoing remediation of other DEW Line sites in the region (e.g., Cape Hooper and Cape Dyer) will put pressure on the available labour pool and may make it difficult for contractors to meet their minimum Inuit labour content for their work. Overall, however, the contribution of the effects of the remediation to the cumulative effects of the area are assessed as being positive or not significant.

6.16 Impact of the Environment on the Project

The implementation of a clean up project in an Arctic environment has unique logistical issues. Equipment and personnel must either be flown in or shipped in during the ice-free season. The potential exists for delays in the clean up associated with bad weather. These delays may include work stoppage on-site or delays in the transportation to and from the site of personnel and supplies. Conditions related to the Arctic climate, such as ice and frozen ground may also delay clean up activities. Ice may delay marine transport to and from the site. Clean up activities which are best completed at maximum thaw may be delayed depending on seasonal climate changes.

7.0 CONCLUSIONS

The remediation of the former FOX-C DEW Line site at Ekalugad Fjord involves the removal of hazardous waste, the burial of non-hazardous waste, and the removal of facilities. The remediation activities are part of DIAND's environmental management of the North. Remediation will be carried out following procedures that will protect the environment. For the more sensitive activities of removing fuel drums within the watershed and culvert installation, an environmental protection plan has been developed. Contingency plans have also been developed for the remediation activities. The effects of the remediation on the environment have been examined and assessed, as required under the *Canadian Environmental Assessment Act*. The effects of the project on the environment have been assessed as not significant or as positive.

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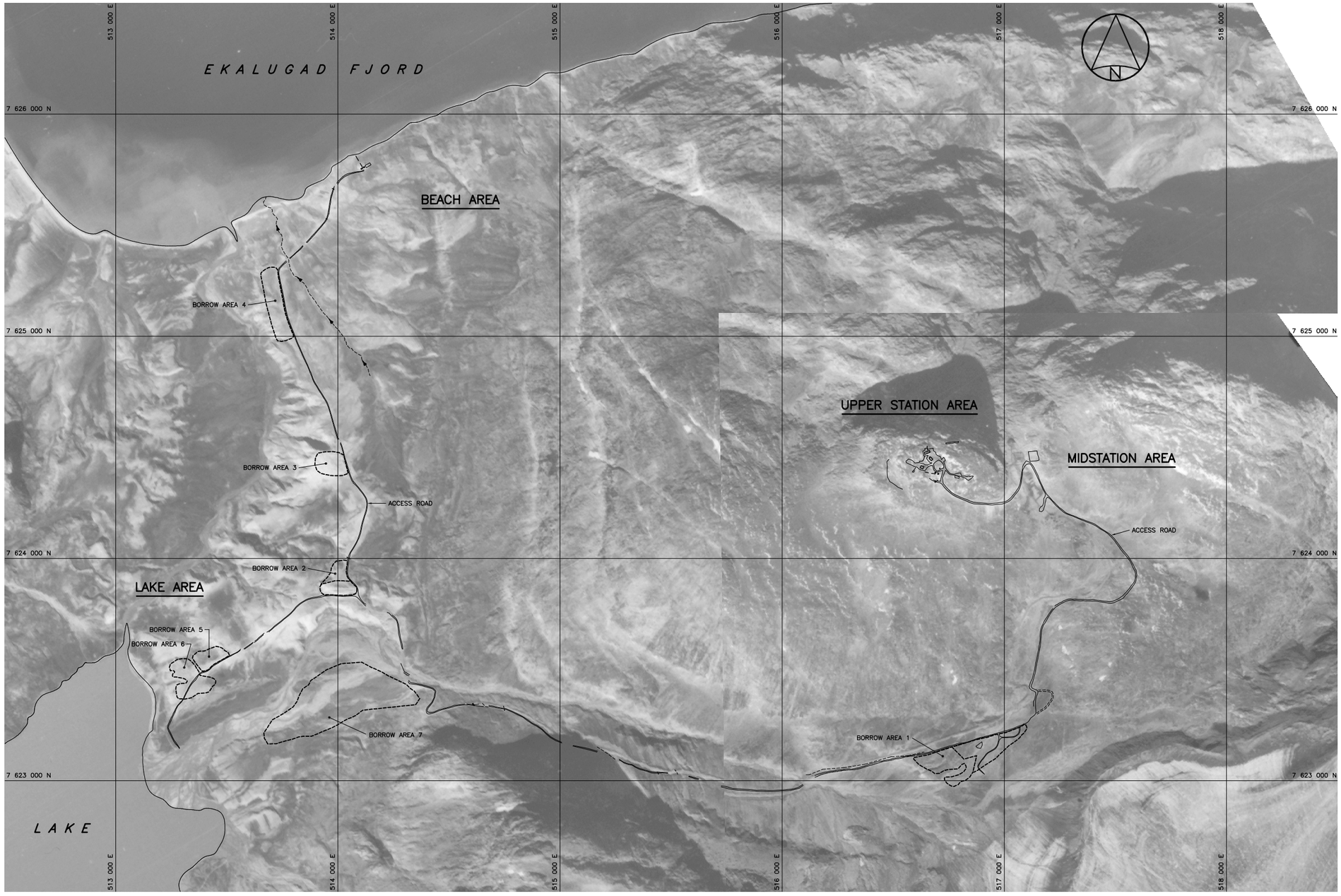
APPENDIX A

Drawings and Photographs from the Remediation Work Plan Fox-C Ekalugad Fiord Intermediate Dew Line Site

Appendix I -
Drawings



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

REAL PROPERTY SERVICES
Western Region

Client: UMA Engineering Ltd.

PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:

- APPROXIMATE EXTENT OF BORROW AREAS
- BODY OF WATER

REVISIONS	DESCRIPTION	DATE

A detail number / numéro du détail
B source drawing no. / de dessin no.
C detail on drawing no. / détail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
OVERALL SITE PLAN

designed by / conçu par	B. FEDORAK
drawn by / dessiné par	C. EROS
approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / échelle	1:7500
project no. / projet no.	413759
date	NOVEMBER 2004
sheet / feuille	C01 OF XX

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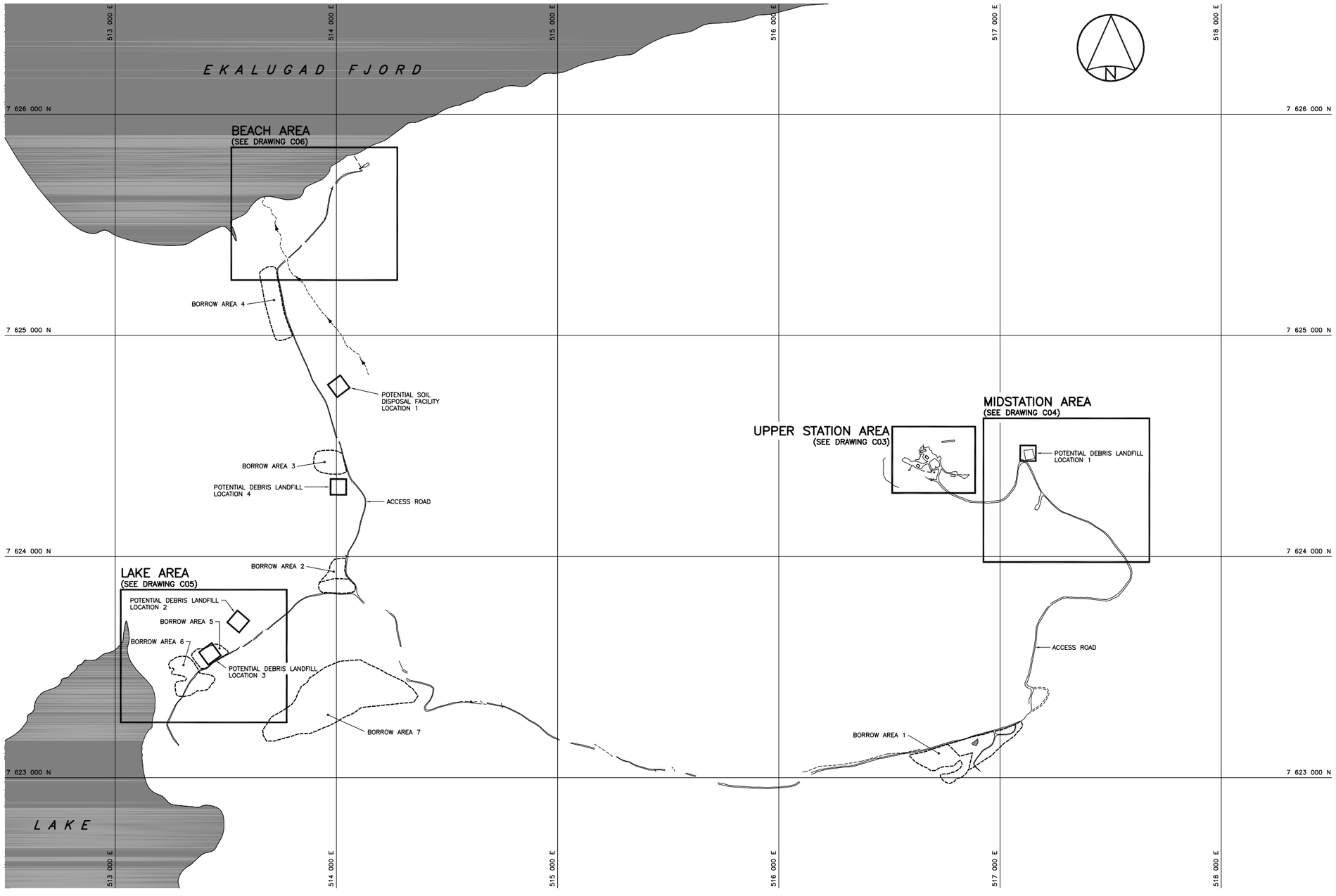

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Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

Client: UMA Engineering Ltd.

PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:

- APPROXIMATE EXTENT OF BORROW AREAS
- BODY OF WATER

REVISIONS	DESCRIPTION	DATE

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
PROJECT LAYOUT

designed by / conçu par	B. FEDORAK
drawn by / dessiné par	C. EROS
approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / echelle	1:7500
project no. / projet no.	413759
date	NOVEMBER 2004
sheet / feuille	C02
	OF XX

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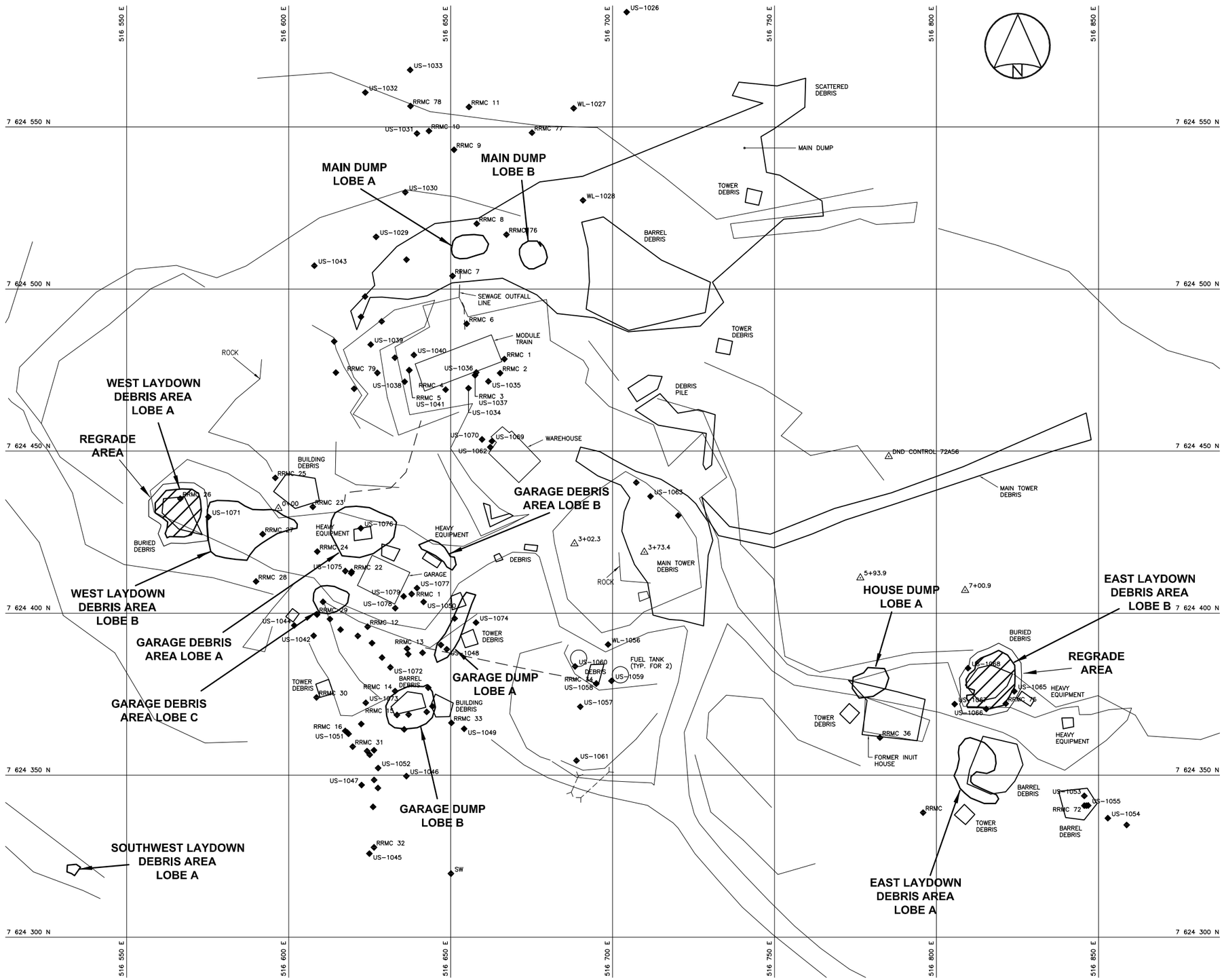

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PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:

- SURVEY CONTROL MONUMENT
- TEMPORARY BENCHMARK
- TEST PIT LOCATION
- SAMPLE LOCATION
- BODY OF WATER

REVISIONS	DESCRIPTION	DATE

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
UPPER STATION AREA
SITE PLAN

designed by / conçu par	B. FEDORAK
drawn by / dessiné par	C. EROS
approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / échelle	1:500
project no. / projet no.	413759
date	NOVEMBER 2004
sheet / feuille	C03 OF XX

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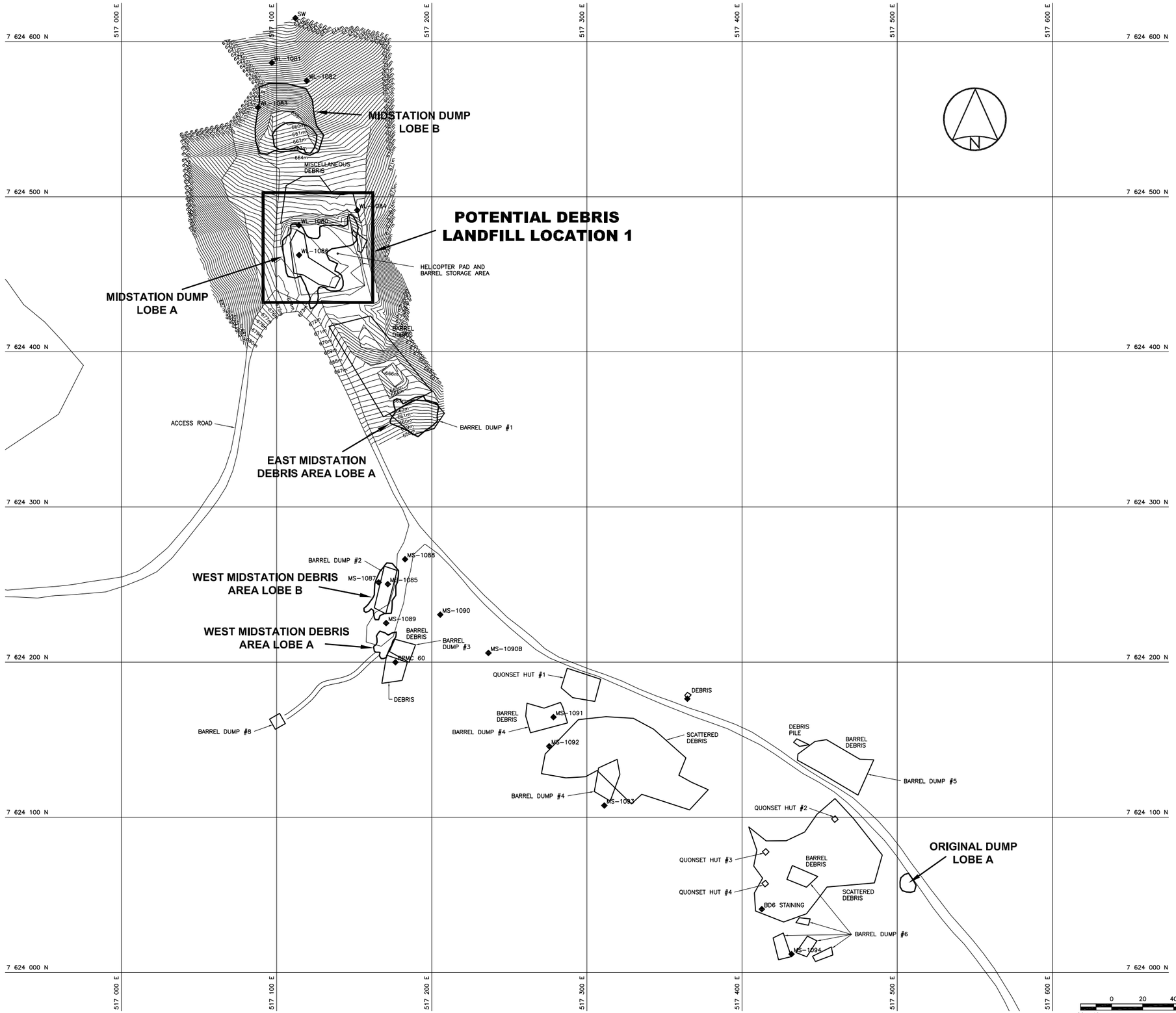

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Western Region

Client: **UMA Engineering Ltd.**

PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:
- TEMPORARY BENCHMARK
- TEST PIT LOCATION
- SAMPLE LOCATION
- BODY OF WATER

REVISIONS	DESCRIPTION	DATE

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
MIDSTATION AREA SITE PLAN

designed by / conçu par	B. FEDORAK
drawn by / dessiné par	C. EROS
approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / échelle	1:1000
project no. / projet no.	413759
date	NOVEMBER 2004
sheet / feuille	C04 OF XX

413759-C04.DWG

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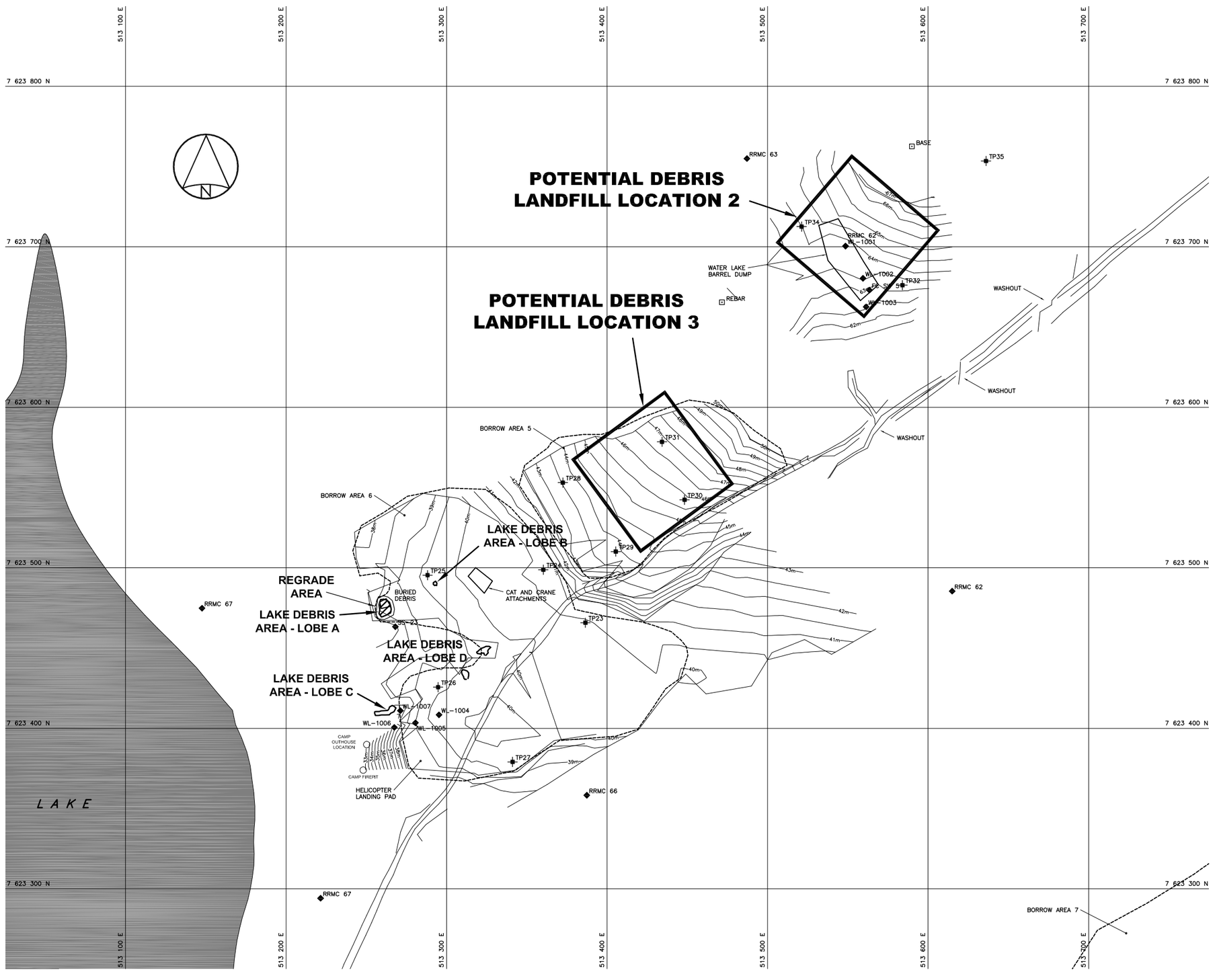

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REAL PROPERTY SERVICES
Western Region

Client: **UMA Engineering Ltd.**

PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:
- TEMPORARY BENCHMARK
- TEST PIT LOCATION
- SAMPLE LOCATION
- BODY OF WATER

REVISIONS	DESCRIPTION	DATE

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
LAKE AREA
SITE PLAN

designed by / conçu par	B. FEDORAK
drawn by / dessiné par	C. EROS
approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / échelle	1:1000
project no. / projet no.	413759
date	NOVEMBER 2004
sheet / feuille	C05 OF XX

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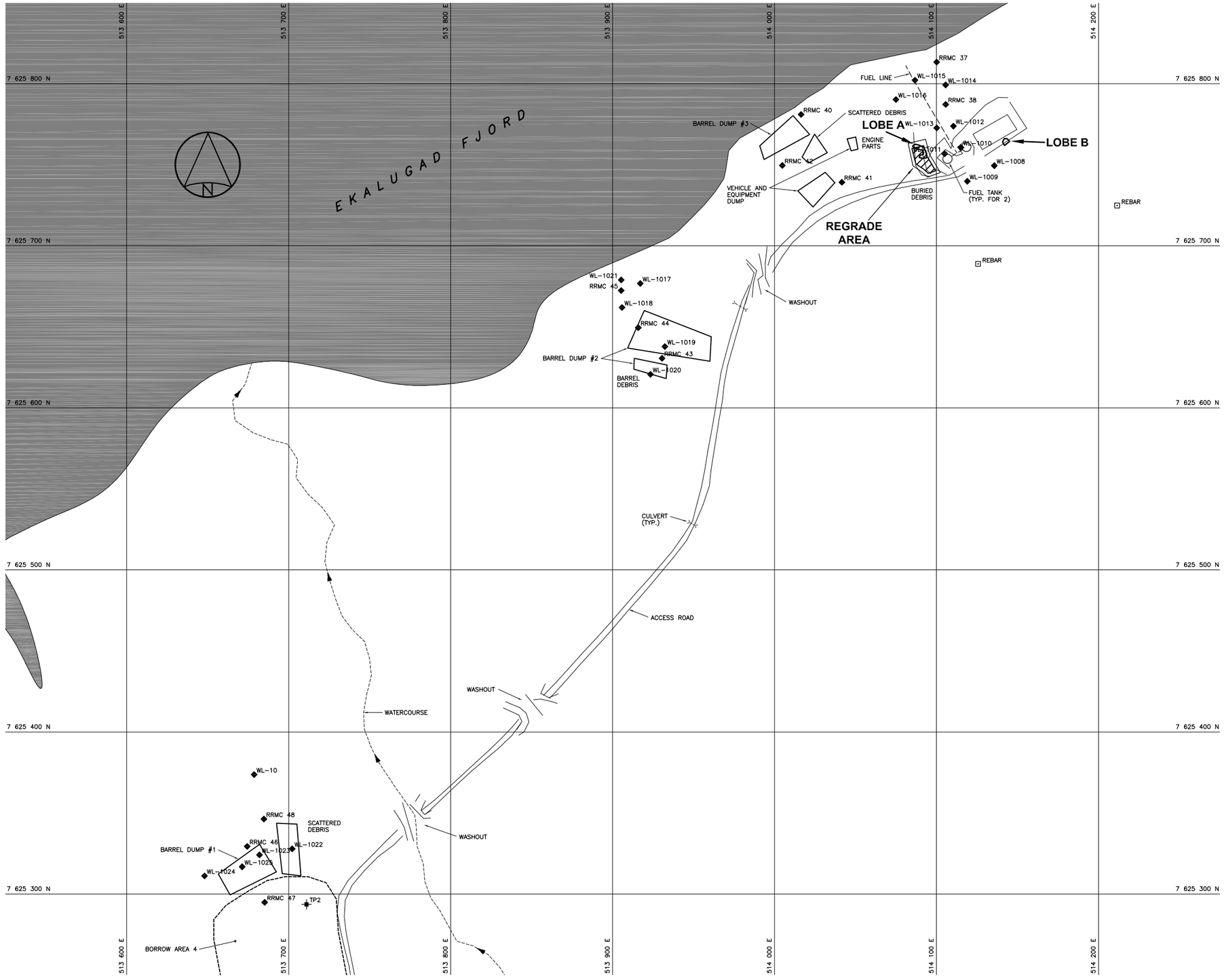

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REAL PROPERTY SERVICES
Western Region

Client: **UMA Engineering Ltd.**

PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:
- TEMPORARY BENCHMARK
- TEST PIT LOCATION
- SAMPLE LOCATION
- BODY OF WATER

REVISIONS	DESCRIPTION	DATE

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
BEACH AREA
SITE PLAN

designed by / conçu par	B. FEDORAK
drawn by / dessiné par	C. EROS
approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / échelle	1:1000
project no. / projet no.	413759
date	NOVEMBER 2004
sheet / feuille	C06 OF XX

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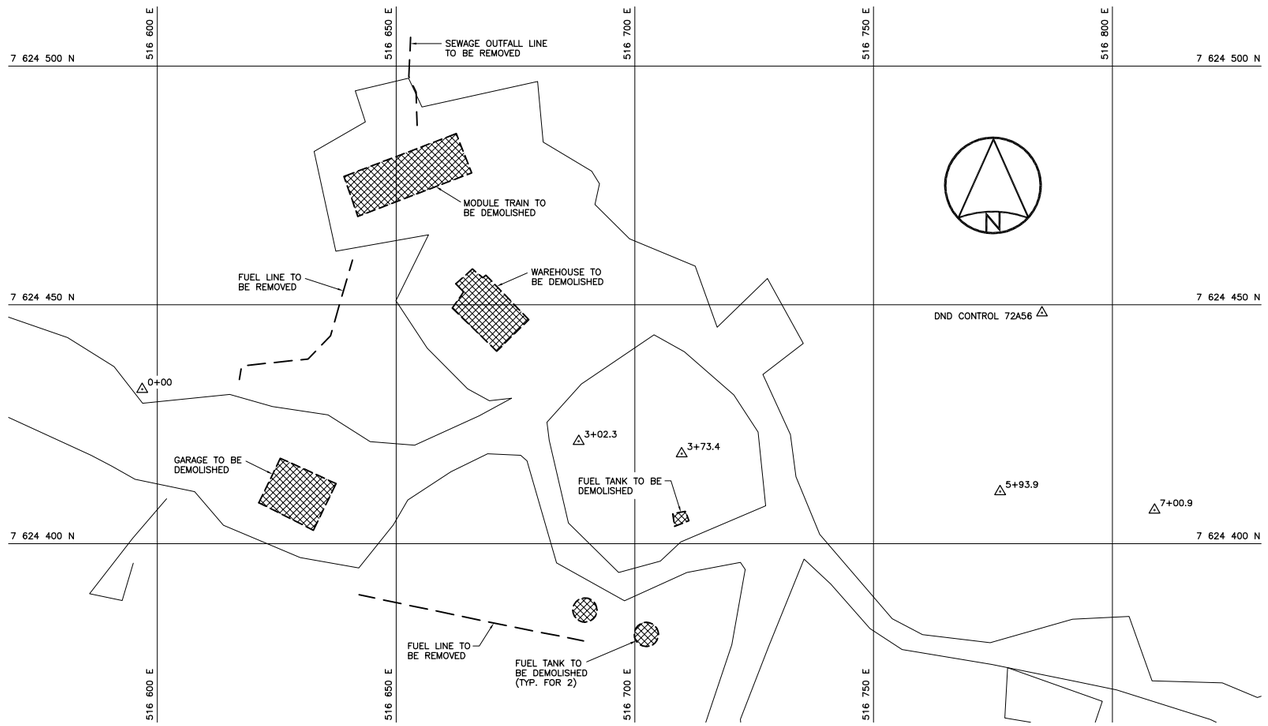
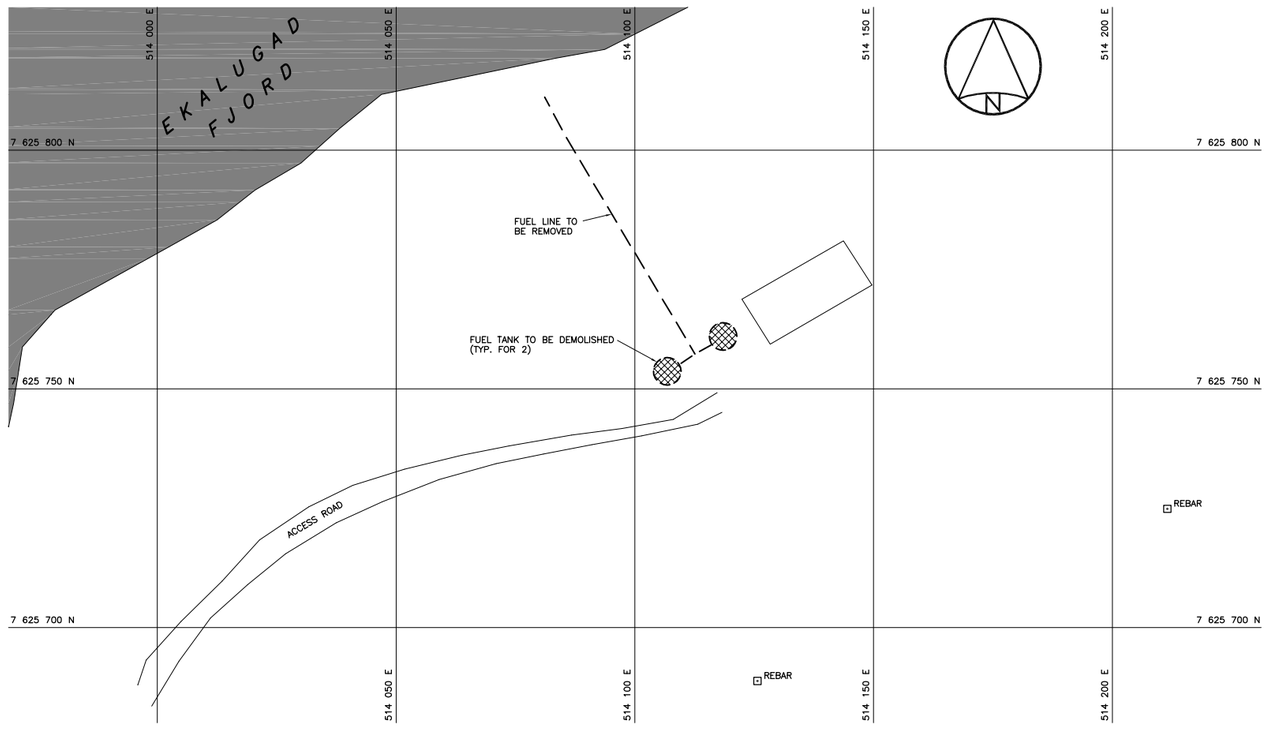


UPPER STATION AREA



BEACH AREA

0 10 20 30m
10 5 1:500

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

REAL PROPERTY SERVICES
Western Region

Client / Client
UMA Engineering Ltd.
Client / Client

PRELIMINARY
NOT FOR CONSTRUCTION

General Notes:

Legend:
- SURVEY CONTROL MONUMENT
- TEMPORARY BENCHMARK
- BODY OF WATER
- TO BE DEMOLISHED
- PIPELINE TO BE REMOVED

REVISIONS	DESCRIPTION	DATE

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet
FOX-C
EKALUGAD FJORD

drawing title / titre du dessin
UPPER STATION AREA AND BEACH AREA DEMOLITION SITE PLANS

designed by / conçu par	B. FEDORAK
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approved by / approuvé par	R. SCHMIDTKE
PWGSC Project Manager / Administrateur de Projets TPSGC	J. BUCHKO
scale / échelle	1:500
project no. / projet no.	413759
date / date	NOVEMBER 2004
sheet / feuille	S01 OF XX

81 1000 x 707

413759-S01.DWG

Appendix II -
Photographs

Photo 1 - Beach Area and Access Road

Photo 2 - Beach Area and POL Storage Tanks

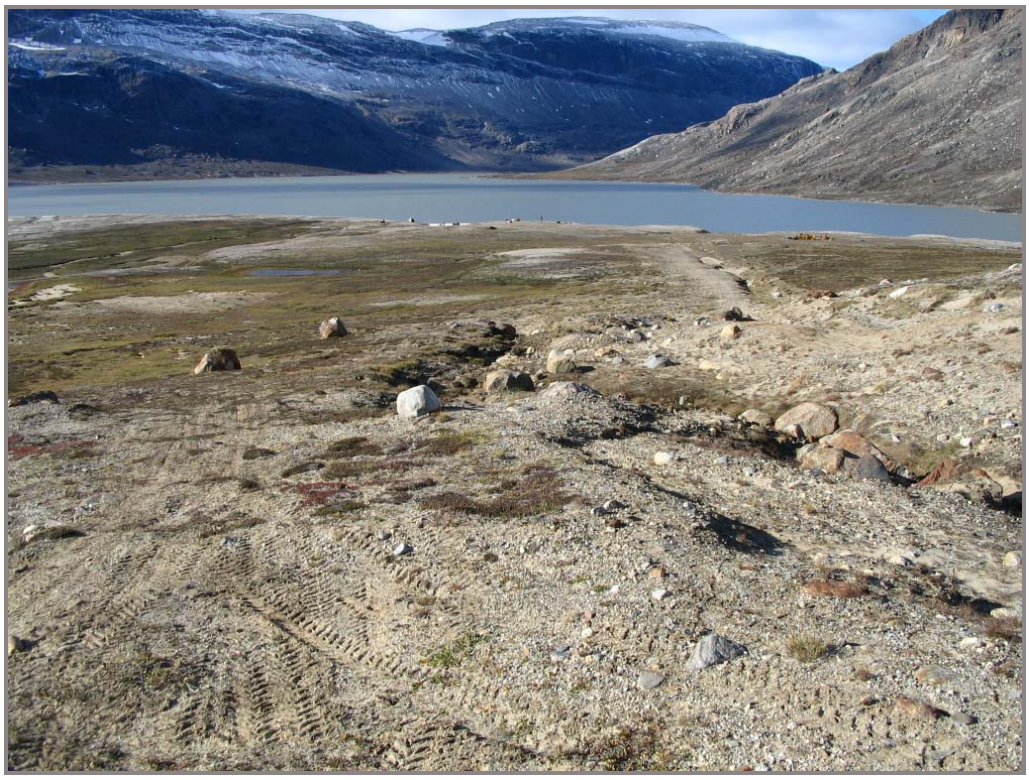


Photo 3 - Lake Area

Photo 4 - Major Washout near Intersection

Photo 5 - Main Access Road

Photo 6 - Quonset Hut Areas South of Mid-Station

Photo 7 - Barrel Dump Area at Mid-Station

Photo 8 - Mid-Station Dump

Photo 9 - Module Train

Photo 10 - Sewage Outfall from Module Train

Photo 11 - Main Dump

Photo 12 - Warehouse

Photo 13 - Garage

Photo 14 - Garage Dump

Photo 15 - Collapsed Antenna

Photo 16 - Inuit House and House Dump

APPENDIX B

Environmental Protection Plan:
Removal of Fuel Drums Within Watershed
and
Culvert Installation
Ekalugad Fjord
Fox C Dew Line Site

ENVIRONMENTAL PROTECTION PLAN

REMOVAL OF FUEL DRUMS
WITHIN WATERSHED
AND
CULVERT INSTALLATION

EKALUGAD FJORD
FOX C DEWLINE SITE

Prepared By:

Public Works and Government Services Canada
Environmental Services
Western Region

Prepared For:
Indian and Northern Affairs Canada
Nunavut

Distribution To:
Department of Fisheries and Oceans
Nunavut Region

TABLE OF CONTENTS

1.0 INTRODUCTION

Indian and Northern Affairs Canada (INAC) has retained Public Works and Government Services Canada (PWGSC) to complete a remediation program at the decommissioned Intermediate DEW Line site at Ekalugad Fjord, Territory of Nunavut.

The following tasks will be completed in order to achieve remediation at the site:

- Existing site infrastructure will be demolished and the demolition wastes will be segregated into hazardous and non-hazardous materials and disposed of appropriately;
- Contaminated soil areas, identified during the previous field investigations, will be remediated;
- All hazardous materials and soil will be disposed of at an off-site licensed disposal facility;
- Scattered surface debris and partially buried debris at the site is to be collected and disposed of;
- New landfills will be constructed to contain the non-hazardous contaminated soil and demolition waste generated during the clean up;
- Existing landfills, on this site, will be remediated, as required; and
- Disturbed areas will be physically restored to and shaped to match the existing terrain.

Included in the above tasks is the removal of fuel drums that have been dispersed throughout the site principally by wind action. The drums extend throughout the site and are strewn into the flood plain and within a river that connects the ocean with a freshwater lake, and a glacial stream that discharges from the adjacent mountains. The freshwater lake also contains drums and debris deposited along the beach and embankments.

Culverts will be required to permit heavy vehicle to cross the the glacial stream

Removal of the drums and placement of the culverts will be completed in a single summer, tentatively set for 2006. To proceed with the permitting and approvals for the proposed activities, a environmental protection plan is required. In order to accomplish this the following tasks will be completed:

- Review available information applicable to the project area (including correspondence, photographs, previous fisheries studies ect.).
- Consolidate details in support of appropriate techniques for instream works of the project.
- Assess any potential habitat changes to the river and glacial stream as a result of the activities noted above;
- Prepare an Environmental Protection Plan (EPP). This will follow the Fisheries and Oceans Canada (DFO) *Application Requirements for Works*

That Have the Potential to Impact Fish or Fish Habitat and include information from other applicable guidelines as necessary to meet both federal and territorial regulatory requirements. The EPP will also include contingency plans for accidental events that could potentially affect fish or fish habitat during the construction activities;

- ❖ Carry out environmental monitoring during the actual work period (part of the EPP).

This document will present the EPP, assess the potential impacts to fish and fish habitat, and provide mitigation measures.

2.0 FISHERIES

2.1 Site Description

The site is located on Ekalugad Fjord, Baffin Island, approximately 195 km south of Clyde River. The upper or main station area of Fox-C overlooks the Ekalugad Fjord at 770m above sea level, and is connected to the lower site, Qarmaralik Cove by a gravel road. The landscape is rugged and partially ice covered mountainous terrain composed of Precambrian bedrock hills with lowland plains covered with extensive glacial moraine and sand outwash. A glacier fed freshwater lake is situated north west of the main station area. This lake is connected to Qarmaralik Cove (Arctic Ocean) by a 1 km stretch of meandering river. A glacial stream also runs through the site and empties into the freshwater lake, along which the upper road parallels and frequently crosses.

2.2 Environment

A characterization of the natural environment at Fox-C was completed on August 26th and 27th 2004 by Jacques Whitford to determine the extent of fish habitat in the freshwater lake, Qarmaralik Cove and the river connecting these two water bodies. There was limited information in the report on the glacial stream.

Two other reports were completed in 2004 for geotechnical investigations as well as a Phase III Environmental Site Assessment. Sediment samples were taken during the assessment in 2004 in the area of the fuel drums at both the lake and river. Laboratory analyses were conducted on the sediments and included metals, PCBs, PHCs and PAHs. There were no exceedances noted in the chemical results received for these samples.

Terrain

The terrain at Fox-C consists of high rugged hills with exposed rock outcrops. The three primary areas of past activity at the site include the Beach Area, the Lake Area, and the Upper Station. The Beach Area is located on Qarmaralik Cove. The Upper Station overlooks Ekalugad Fjord and is 770m above sea level approximately 3 southeast of the Cove. The Lake area is located 1 km directly south of Qarmaralik Cove.

The terrain and respective soil conditions at Fox-C are varied. Soil conditions observed in the Beach Area are clayey silt in the outwash valleys. Sand and gravel were noted in the area of Lake Road, and boulders and weathered bedrock are dominant at the Upper Station. Baffin Island is part of the northeastern Canadian Shield and is underlain with granitic rock assemblages. The bedrock geology of this site is primarily granite and quartz monsonite. Permafrost is continuous and widespread in the Quaternary deposits which mantle Baffin Island.

Surficial geology at higher elevations of the Upper Station are comprised primarily of bedrock and colluvium. At lower elevations surficial geology units include bedrock, moraines, alluvium, and beach sediments.

The Fox Charlie Glacier is situated some 1.5 km south of the upper site. One branch of the alpine glacier flows down to about 1 km south of the lower site. The whole icefield spreads from Ekalugad Fjord in the north to Kangok Fjord in the south.[1]

Hydrology

Drainage systems associated with the fjords on the north coast of Baffin Island are generally short and steep.

High elevation development at Fox-C is located on a narrow summit and drainage divide.

Most of the development in the lower elevations is located between the ocean and a fresh water lake. The lake is mainly fed by melt water from the glacier, by snow melt, and by a larger lake situated approximately 2 km to the west. The lake itself is approximately 3 km long and 1 km wide and discharges into the ocean through a river approximately 1.5 km long.[2]

[1] EBA Engineering Consultants, 2004
[2] EBA Engineering Consultants, 2004

Topography

The topography of Ekalugad Fjord is characterized by high rugged hills with numerous rock outcrops. The upper site is located on the summit of one of these hills which drops steeply on all its faces. The upper site is situated about 3 km from and 770m above the beach area. The beach area is located on the south shore of the fjord in the lower reaches of an outwash valley.[3]

Flora

A significant portion of the lower site was surveyed for plant and animal life to characterize the main ecosystem components of the site. In this region, the climate is harsh, restricting plant growth to only a few months per year. Generally, the lower site is characterized by undulating terrain formed by eroding glacial moraines composed mostly of sand and gravel with occasional floodplains. On the surfaces and in the crevices of most rocks, lichens and mosses were common at both the upper and lower sites. Many areas indicated extensive and ongoing erosion, causing significant substrate disturbance preventing the establishment of plants. In gently sloping areas, cotton grass and arctic heather were the dominant vegetation. In the exposed rocky areas, arctic willow, purple bladder campion, and mountain sorrel were found. Vegetation in the area is typical of plants found in tundra regions of the Arctic Cordillera.[4]

Fauna

There were six bird species observed and identified at the site including rock ptarmigan, snow bunting, raven, snow goose, Iceland gull, and the white-rumped sandpiper. Due to food requirements, bird species identified at the lower site would not likely occupy any potion of the upper site.

A polar bear and collared lemming were noted at the site during Jacques Whitford's investigation. Several caribou tracks were also noted along the sandy portion of the lake shore.

Many insect species live in the Arctic and show a wide range of adaptations to its extreme severity and seasonality. Four species were identified at Fox-C. The flat-backed kelp fly and an arctic wooly bear were observed. Two other species of arachnids were seen however, the species could not be identified.

2.3 Aquatic Habitat

The freshwater lake is approximately 40 hectares in size and is surrounded on three sides by large bedrock hills. Several glacially fed tributaries provide

[3] EBA Engineering Consultants, 2004
[4] Jacques Whitford Limited, 2004

sediment rich water to the lake, causing turbid waters. The shoreline is mainly gravel and sand with moraines near the waters edge. It was apparent that ice melt would supply significantly more water to the lake during peak flows, noted by extensive washout areas spanning approximately 14 meters wide with the existing watercourse approximately 3 meters wide. Field investigations indicate that considerable runoff into the lake would cause a high flushing rate. Outflow from the lake is located on the southeast corner and discharges along a braided river approximately 1 kilometer into Qarmaralik Cove on the Arctic coast. The river can be characterized by steep and eroding meandering banks primarily composed of sand and gravel. The river flows over relatively steep topography causing moderate to fast water velocities. Substrate on the riverbed is composed mostly of boulders, cobble and gravel indicative of a fast flowing stream with large sediment transport capacity. Ice was protruding from the river bank approximately one meter below grade at the outflow into Qarmaralik Cove at the time of the inspection indicating the approximate depth of gravel and sand are spread along the shore and into the deeper waters. Fine silt and rock flour are transported further into the ocean.[5]

There is limited information on the glacial stream that runs from the mountain and deposits into the freshwater lake. In the report on the natural environment, one of the unidentified streams that flow from the mountain to the lake indicated juvenile charr at the outlet into the freshwater lake. The glacial stream that PWGSC is concerned with has a very steep gradient that is unlikely to support fish habitat other than at the outlet. The outlet of the stream consists of flat alluvial fan formation with sand and gravel substrate. In speaking with the Jacques Whitford biologist that completed the *Natural Environment Report* for the site, he described the stream as “non-fish bearing in the upper reaches due to gradient however, fish bearing for the first 10m from the lake”. The biologist also noted that there was a large moraine located 10m in stream from the lake that provided an obstacle for fish. Therefore, PWGSC will treat the stream as fish bearing within the lower reaches of the stream. The onsite environmental monitor will also make additional assessments of the stream prior to construction activities.

To assess the presence of fish habitat at lower areas of FOX-C, sections of the lake, river and Qarmaralik Cove were visually inspected and fished using a rod and reel. In addition, Inuit were consulted to determine if these water bodies are fished for food. Overall, field investigations of the water bodies determined that Arctic Charr (*Salvenlinus alpinus*) do occupy the fresh water lake and that the river provides a channel for the migration of Arctic Charr from the ocean to the freshwater lake. In addition, gravel substrates in the lake provide good spawning habitat for Arctic Charr. During the site visit, one adult charr was observed swimming upstream approximately 50 metres downstream of the lake and a second smaller charr (15cm) individual was observed at the mouth of the river. In tributaries surrounding the lake several juvenile charr were observed,

[5] Jacques Whitford Limited, 2004

indicating that this lake is providing spawning habitat for adult Arctic Charr. Juveniles observed were in good health and measured 4-15 cm in length. Within the lake, one adult charr was caught, indicating the presence of either resident or migrating fish in the lake. This individual appeared healthy and had no skin abnormalities.

Discussions with several Inuit people confirmed the presence of fish in the freshwater lake. During winter months, Inuit are known to come to the lake to ice fish when charr are spawning in the lake.

2.3.1 Arctic Charr biology

Arctic Charr are circumpolar in distribution and have the most northern range of any North American freshwater fish. They can spend their life in land locked lakes or in salt water making them an anadromous fish species. In Canada, Arctic Charr occupy coastal drainage areas of the Atlantic, Arctic and Pacific Ocean to a distance of 300 km from shore. During summer months anadromous Arctic Charr often leave their native lake and migrate to the sea for feeding. Unlike salmon, charr do not range far from their home rivers. For example, salmon will migrate hundreds of miles from their home river where as Arctic Charr seldom venture more than 100 km. Juvenile charr feed on bottom invertebrates and larger charr feed on other fishes, such as smelts or juvenile charr (Scott and Crossman 1973).[6]

2.3.2 Breeding

Females will build spawning redds (gravel pits) during the months of October to December in shallow water (1.0 – 4.4m depth) of lakes. Males may fertilize the eggs from more than one female. Preferred spawning temperatures are approximately 4.0 °C. Depending on conditions in the lake, Arcitc Charr can remain in freshwater during winter months before returing to the ocean (Scott and Crossman 1973).[7]

2.4 Summary

Based on a field reconnaissance of the freshwater lake, it is known that juvenile Arctic Charr occupy tributaries to the freshwater lake during summer months and would live in this lake throughout much of the winter months. Adult charr spend most of their time at sea only returning to the rivers and lakes to avoid low seawater temperatures. Female adult charr are known to potentially occupy the freshwater lake year round during the year that they spawn.

[6] Jacques Whitford Limited, 2004
[7] Jacques Whitford Limited, 2004

For the river, field surveys and known information on Arctic Charr biology indicate that the river outflow to Qarmaralik Cove serves only as a corridor for the migration of adult Arctic Charr into the freshwater lake for spawning. Fast flowing water over cobble does not provide good habitat for Arctic Charr spawning or year round occupancy of the river system.

Any activities requiring in water works should be undertaken so as to minimize interaction with the Arctic Charr in the freshwater lake and charr migrations in the river flowing from the freshwater lake. Since Arctic Charr are present year round in the freshwater lake and at the outlets of the surrounding tributaries, suitable mitigation measures will be required if in water works are to occur. No in water works should occur in the freshwater lake during potential spawning which would occur between October and December. Any potential in water activities in the river outflow to Qarmaralik Cove should be done prior to late August when fall migration into the freshwater lake occurs.[8]

3.0 Description of Proposed Activities

3.1 Removal of Fuel Drums

3.1.1 River Area and Flood Plain

The river area between the lake and Ekalugad Fiord has banks scattered with drums and domestic garbage. This area includes the riverbed and banks and two separate dump areas. The riverbed and banks contain approximately 200 rusted empty drums with no visible labels. Approximately 400m downstream of the lake there is an area containing tin cans, glass, wood, old newspapers and empty drums. Further down the river on the east slope there is another fuel drum dump with 175 drums scattered over the east bank above the high water mark.[9]

3.1.2 Glacial Stream

In the area leading from the mountain to the lake there is a braided glacial stream with approximately 100 barrels scattered throughout the floodplain. Approximately 15 of the drums were noted to be full to partially full at the time of the site inspection. These drums were identified and marked with orange spray paint. Fluids within these drums were identified as diesel, jet fuel and gasoline as well as mixtures containing mostly water. The majority of drums were empty.[10]

[8] Jacques Whitford Limited, 2004
[9] Earth Tech Canada Inc, 2004
[10] Earth Tech Canada Inc, 2004

The site has been abandoned for many years and although a site investigation has indicated that those drums within the water are heavily corroded and are unlikely to contain product, all drums will be assessed separately, prior to removal, to ensure that there is no product still contained within the drum.

3.1.3 Freshwater Lake

There is a fuel drum dump located near the beach at the lake. This area contains approximately 250 empty drums and some scattered wood debris. Labels on the drums indicated that they previously contained fuel, lubricating oil, and other hydrocarbon projects. Most of the drums were empty. During the inspection earlier this year, there were no fuel drums noted within the lake.

3.1.4 Summary

The fuel drums must be removed from the floodplain areas, river, and the glacial stream. According to the report written by Jacques Whitford in 2004 all of these water bodies contain, or have the potential to contain, Arctic Charr. An excavator will be used to provide additional manpower during removal of the drums from the sediments. This excavator will be on the shoreline and will not be entering any of the watercourses during mobilization, demobilization or operation. A suitable approach to removing these barrels follows below.

The following table summarized the areas requiring removal of fuel drums and the process involved.

Site	Location	Identification	Removal Process
River	Floodplain dry	Determine contents	Drums will be removed by hand and consolidated with other barrels. Any contents will be drained and disposed prior to handling. Absorbant materials will be at site in the event of a discharge to soils/sediments. Any soils/sediments with product will be removed and disposed.
	Floodplain wet	Determine contents	Drums will be removed by hand with assistance from an excavator (lifting requirement only). The excavator itself will enter the floodplain only as required on a case-by-case basis and it will not enter the wetted portion of the river/stream. Area will be boomed off upstream of the drums as well as another boom located downstream. Absorbant materials will be at site in the event of a discharge to the water column.
Glacial Stream	Floodplain dry	Determine contents	Drums will be removed by hand and consolidated with other barrels. Any contents will be drained

			and disposed prior to handling. Absorbant materials will be at site in the event of a discharge to soils/sediments. Any soils/sediments with product will be removed and disposed.
	Floodplain wet	Determine contents	Drums will be removed by hand with assistance from an excavator (lifting requirement only). Area will be boomed off at drums as well as another boom located downstream. Absorbant materials will be at site in the event of a discharge to the water column.
Lake	Floodplain dry	Determine contents	Drums will be removed by hand and disposed. Any contents will be drained and disposed prior to handling. Absorbant materials will be at site in the event of a discharge to soils/sediments. Any soils/sediments with product will be removed and disposed.
	Floodplain wet	Determine contents	It is not anticipated that the lake has drums that require removal as they were not noted during the on site inspection however, in the event that drums are encountered in the lake the following applies. Drums will be removed by hand with assistance from an excavator (lifting requirement only). Area will be boomed off at drums as well as another boom located downstream. Absorbant materials will be at site in the event of a discharge to the water column.

3.2 Placement of Culverts

The culverts will be placed at various sites along the glacial stream that runs from the Fox Charlie Glacier into the freshwater lake. These crossing are required to place an access road to allow remediation of the site. Most of these crossings currently have structures that are not suitable for the stream during spring freshet. This has resulted in the erosion of the current access road and structures due to blockages and failures.

3.2.1 Beach Road

Beach Road extends approximately 2.2 km inland from the ocean. Three of the road failures were at areas that historically had culverts constructed out of 205L drums welded together. One of the failures is at an area where no culvert had been installed. The local soils at these sites are fine-grained and are therefore, extremely erodible. All of these crossings are over the glacial stream that flows from the Fox Charlie Glacier. Areas of the road adjacent to the glacial stream will require stabilization to enable the passage of heavy equipment.

3.2.2 Station Road

This access road runs approximately 5.9 km to the Upper Station. There are two river crossings in this section of road. Both crossings were constructed in the 1960‘s using culverts. The culverts are not large enough to accommodate the flow of the glacial stream and have since eroded and washed out.

There are 5 washout areas along Station Road that require attention. These washouts are the direct cause of failed culverts and the roadway being situated in the natural path of the glacial stream. These areas will require installation of new culverts and stabilization of the stream banks.

3.2.3 Summary

Currently, areas of the site have eroded and as a result, portions of the access roads have been washed out. Some of these areas are now inaccessible and require access to complete remedial activities. The placement of culverts will be required in order to accommodate the passage of heavy equipment to the upper Station. As many as 8 culverts will be required for the glacial stream due to its meandering nature. Some areas of the access roads will require stabilization due to erosion of the stream banks during high flow periods. Stabilization will include the use of riprap and gravel sources that are available on site.

4.0 IMPACTS TO FISHERIES RESOURCES

FOC (1990) has identified a series of options in addressing the impacts of instream activity to the aquatic environment. In order of decreasing preference, they are:

- Relocation: Relocate the activity so there is not impact to the aquatic environment;
- Redesign: Redesign the activity to reduce overall impacts, particularly to critical or important habitat;
- Mitigation: Incorporate mitigative measures in the design to reduce impacts;
- Compensation: When residual impacts remain, which cannot be addressed through any of the preceding options, compensation measures are required to replace the productive capacity of the habitat altered or lost as a result of project activities.

4.1 Drum Removal

Unfortunately, the nature of the activity is such that the drums require removal, as they are a potential impact to the surrounding environment if left in-situ. Therefore, the only options are to mitigate and provide any compensation for habitat that has been altered or lost.

One of the greatest impacts that this type of project can have on the aquatic environment is the introduction of sediment during drum removal and the potential for product release that may be trapped within the surrounding sediments, or residual product within the drum. Most of the drums are severely corroded and it is unlikely that there would be a large amount of product left within the drums however, each drum will be assessed individually to determine its integrity. Removal of the drums will be conducted at low water, in order to ensure as many drums as possible, are located outside of the wetted area.

4.1.1 Control of Hydrocarbons

With the use of heavy equipment near a watercourse, there is the potential for introduction of hydrocarbons to the aquatic environment. To minimize the risk of an accidental release of hydrocarbons, the following procedures will be undertaken:

- All equipment will be maintained and in good working order;
- Appropriate spill containment kits must be on site and ready to use before work commences;
- Refueling operations must not occur within 100m of a watercourse; and
- Maintenance and parking areas must not be within 100m of a watercourse.

4.2 Culvert Placement

The culverts are to be redesigned to improve the current situation. Currently, the culverts that were historically placed (1960's) are beyond their lifespan or were not of sufficient capacity for the glacial stream during spring freshet. Placing new culverts will ensure that the stream does not undermine or erode its current pathway. Properly installed culverts will also ensure that sedimentation from erosion is not released into the stream. These culverts are scheduled to be installed during low flow and, removed prior to spring freshet.

The glacial stream is on a steep gradient and it is unlikely that it would support fish in the upper reaches however, the habitat report written for the site indicates "in tributaries surrounding the lake, several juvenile charr were observed….". Due to a glacial moraine located 10m in from the freshwater lake, fish cannot

migrate into the upper reaches of the stream and are restricted to the lower 10m reach of the stream.

4.3 Timing of Instream Works

Arctic Charr spawn during the months of October to December in the shallow water of the lake. Construction activities will have to be completed prior to mid-September to allow for the removal of culverts prior to spawning activities. At this point it is still unknown if the glacial stream can support fisheries as there is a very steep gradient along most of the stream length. The current assumption is that at least the lower reaches do sustain juvenile charr on a seasonal basis.

Drum removal along the river will have to occur prior to August when the charr start to migrate from the fjord into the lake. Given the potential for sediment introduction associated with this activity, it is recommended that the removal be completed during low flow season. Low water occurs at this site from approximately July 15th to August 21st.

4.4 Residual Impacts

4.4.1 Fuel Drums

It is not anticipated that the residual impacts will be sufficient enough to require a fisheries compensation plan. The removal of the drums will ensure that no further product is released to the environment. There is the potential that the drums would have become fish habitat in another vicinity however, it is unlikely in this location due to the velocity of flow. This river is currently utilized by the charr as a corridor to move between the lake and the ocean. It is unlikely that the river is used as a spawning or habitat area with the exception of the inlet and outlet. As well, any structures placed to compensate the loss of fish habitat would be washed out during spring freshet.

During removal of the fuel drums, it will be necessary to place booms across the river for containment in the event that a spill occurs. These booms will have attached silt fencing and will be placed around the drums as well as downstream, in the event of failure to capture product within the first boom. Absorbent materials will be stationed at the work area to absorb product should a ruptured drum be encountered. All drums will be inspected prior to any removal process and at this time it will be determined if there are contents within the drum. Most of the drums that are within the river itself have likely corroded and ruptured due to continued submergence in the water.

4.4.2 Culverts

There may be some residual impacts from the placement of the culverts. When first installed, there will be a release of sediments to the water column. Due to the size of the stream, it is recommended that they be placed without a diversion channel being established during installation, as this is likely to cause more disruption to the streambed. A release of sediments will also occur when the culverts are decommissioned at the end of the construction period. The installation method for the culverts will ensure that the plume will be limited in duration. Silt fencing will be placed downstream of the culvert to minimize the release of sediments to the lower reaches.

Work will be completed at low water and prior to the spawning period. Placement of the culverts is expected to commence around July 15th with removal of the structures prior to any fish spawning activities at the end of September.

5.0 ENVIRONMENTAL MONITORING

An environmental monitor will be at site during all in-stream construction and activities. The monitor will liaise directly with the contractor and will have the authority to temporarily suspend activities if it is anticipated that adverse environmental effects may result from construction activities. The monitor will also consult with the contractor in order to modify (to the extent feasible) the construction activity. The monitor will also be in direct contact with contractor personnel, and, in the event of an unforeseen impact or potential for impact, will notify the appropriate representative. The chain of command for providing feedback and incident reporting will be clearly defined as directed by DFO.

The environmental monitor will:

- Assist in the removal of drums within the water bodies and within the flood plain;
- Assist in the placement of culverts silt fencing the lower reaches of the stream area when installing the culverts and making the necessary fish salvages if required;
- Install silt fencing;
- Monitor water bodies during culvert and drum removal for excess sedimentation;
- Assess requirements for erosion and sediment control;
- Make a final assessment of erosion and sediment control and site stabilization before equipment leaves the site.

6.0 SUMMARY OF IMPACTS

Table 1 presents a summary of impacts to the aquatic environment as well as proposed mitigation and compensation. Impact areas are also identified. Many of the impacts can be mitigated with current methods and technology.

6.1 Fuel Drums

The proposed activities will be the removal and disposal of fuel drums that are scattered within the flood plain and in the stream and river. The removal of these drums will enhance the surrounding environment and will eliminate the threat of further product release within the system.

Removal of these drums will also cause some sedimentation and there is the potential for residuals and product to be dispersed into the water column. These impacts can be mitigated by providing booms as well as spill containing absorbent materials at the site. A drum by drum inspection will be conducted to ensure that those drums with the potential to contain product will be assessed prior to removal. Over pack barrels may be required if there are drums located at depth.

6.2 Culvert Installation

Other site activities will result in the placement and subsequent removal of culverts in order to complete remediation of the site. Impacts will be balanced by the removal of non-conforming or unsuitable structures currently utilized at the site to place conforming structures that will be removed prior to spring freshet. There will no longer be any obstructions for the glacial stream to circumnavigate and will therefore, not erode into the new access road running alongside the stream. This will result in less erosion and consequently sediment within the stream.

During installation of the culverts the on site monitor will establish if pumping sediment laden water is required. This will be dependent on the velocity and quantity of flow at the time of installation. A pump and generator will be made available at site as a contingency measure. If a pump is required, a pump and dam system will be set up. Sediment-laden water will then be pumped into a settling pond during construction and installation.

Release of sediment is likely to occur during removal of the obstructions and installation/decommissioning of the culverts. These releases will be temporary and will be completed prior to spawning season. Silt fencing will be placed down stream of the culverts during installation to ensure limited sedimentation is encountered in the lower reaches of the stream.

Table 1. Summary of Potential Impacts to the Aquatic Environment

Potential Impacts	Area Affected	Redesign	Mitigation	Compensation	Net Impact
Fuel Drums					
Loss of instream habitat	Localized		Replace loss of habitat with boulders at outlet of river.		0
Introduction of sediment			Can be mitigated.		0
Introduction of a deleterious substance			Can be mitigated.		0
Culvert Installation					
Introduction of sediment			Can be mitigated.		0

Photo 1: Barrels along the river and floodplain.

Photo 2: Barrels along the riverbank.

Photo 3: Barrels in the river between the Lake and Ekalugad Fjord.

APPENDIX C

Contingency Plans
for the Clean Up of Fox C
Intermediate Dew Line Site

CONTINGENCY PLANS

For the Clean Up of FOX-C Intermediate DEW Line Site

Submitted by: **Department of Indian Affairs and Northern Development**
Northern Affairs Program
Nunavut Regional Office

Prepared by: **Public Works and Government Services Canada**
Real Property Services
Architectural & Engineering Services
Environmental Services
Western Region

November 2004

Contingency Plans

1 General

1.1 The following contingency plans present the prescribed course of action to be followed in the case of unanticipated events during the site investigation such as fuel or chemical spills, potentially dangerous wildlife encounters, and the discovery of heritage resources. The plans will enable persons in a particular contingency situation to maximize the effectiveness of the environmental response and meet all regulatory requirements for reporting to the appropriate authorities. The plans also describe the locations where hydrocarbons (fuel) and spill response equipment will be stored at the site.

1.2 Spill contingency plans for the site will be included in the Site Specific Investigation Plans and will be posted on-site during the investigation. The following information will be included:

1. a description of pre-emergency planning;
2. personnel roles, lines of authority and communication;
3. emergency alerting and response procedures;
4. evacuation routes and procedures, safe distances and places of refuge;
5. emergency alerting and response procedures;
6. directions/methods of getting to the nearest medical facility;
7. emergency decontamination procedure;
8. emergency medical treatment and first aid;
9. emergency equipment and materials;
10. emergency protective equipment;
11. procedures for reporting incidents; and
12. spill response and containment plans for all materials that could potentially be spilled.

2 Fuel and Hazardous Material Spills

2.1 The objective of the fuel-related contingency plan is to protect the environment and human health by minimizing the impacts of spill events through clear and concise instructions to all personnel.

2.2 A variety of fuels (diesel, gasoline and lubricating oils) may be used during the site investigation of the DEW Line sites. As fuels are usually stored and transferred in barrels of 205 liters or smaller capacity, any spill quantity would likely be small.

2.3 Transportation of fuels must comply with the *Transportation of Dangerous Goods Act and Regulations.*

2.4 The most common pollution incidents would probably involve spills of diesel or gasoline onto land resulting from: human error during transfer, rupture of barrels from deterioration or damage, seepage from fittings or valves, or equipment failure. Daily checking of equipment and preventative maintenance would also identify damage to the fuel system and reduce the risk of spills or leaks.

2.5 In the event of a spill, protection of human health and safety is paramount. Contamination of personnel involved in clean up is a real possibility as is contamination of the surrounding workplace and environment.

The individual responding to a spill shall:

1. Ensure personnel are appropriately trained.
    a. All employees working on the FOX-C DEW Line Site Cleanup project, including contractors and sub-contractors, will be trained in the safe operation of all machinery and tools, as well as in the handling of materials to help prevent and respond to hazardous material spills in a timely and effective manner. All employees on site will also be trained for initial spill response in the event of a spill. The recommended training for these purposes consists initially of the 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) course offered by various environmental firms and the 8-Hour HAZWOPER refresher course every two (2) years thereafter.
2. Make use of materials and equipment available for adequate response to fuel spills, such as excavators for creating earthen dykes and hydrocarbon absorbent booms.
3. Warn people in the immediate vicinity and evacuate the area if necessary.
4. Wear protective clothing as required for handling spills.
5. Isolate and eliminate all ignition sources.
6. Identify the spilled material if possible, and take all safety precautions before approaching it.
7. Attempt to immediately stop the leakage and contain the spill, if safe to do so, by implementing the Spill Response Actions summarized in Section 2.5.1 below.
8. Report to the Field Team Leader the spill location, type of material, volume and extent, status of spill (direction of movement), and prevailing meteorological conditions.
9. Follow all applicable federal/territorial regulations and guidelines or the disposal of spill materials.
10. Document all events and actions taken. Include information required by applicable regulations and guidelines.

11. Notify appropriate government agencies using the contact list. Report spills immediately on the 24-Hour Spill Report Line (867) 902-8130.

2.5.1 Petroleum Hydrocarbon - SPILL RESPONSE ACTIONS

ON LAND

- Do not flush into ditches or drainage systems.
- Block entry into waterways and contain with earth, snow or other barrier.
- Remove small spills with sorbent pads.
- On tundra use peat moss and leave in place to degrade, if practical.

ON SNOW & ICE

- Block entry into waterways and contain with snow or other barrier.
- Remove minor spills with sorbent pads and/or snow.
- Use ice augers and pump to recover diesel under ice.
- Slots in ice can be cut over slow moving water to contain oil.
- Burn accumulated diesel from the surface using Tiger Torches if feasible and safe to do so.

ON MUSKEG

- Do not deploy personnel and equipment on marsh or vegetation.
- Remove pooled diesel with pumps and skimmers.
- Flush with low pressure water to herd diesel to collection point.
- Burn only in localized areas, e.g., trenches, piles or windrows.
- Do not burn if root systems can be damaged (low water table).
- Minimize damage caused by equipment and excavation.

ON WATER

- Contain spill as close to release point as possible.
- Use spill containment boom to concentrate slicks for recovery.
- On small spills, use sorbent pads to pick up contained oil.
- On larger spills, use skimmer on contained slicks.
- Do not deploy personnel and equipment onto mudflats or into wetlands

RIVERS & STREAMS

- Prevent entry into water, if possible, by building berm or trench.
- Intercept moving slicks in quiet areas using (sorbent) booms.
- Do not use sorbent booms/pads in fast currents and turbulent water.

3 Wildlife Encounter

3.1 Bears are a potential hazard to workers at all times and the situation can be exacerbated by the presence of any substance that a bear perceives to be food.

3.2 EMPLOY DEDICATED WILDLIFE MONITORS AT ALL TIMES DURING CLEAN UP OPERATIONS.

3.3 Be familiar with bear deterrent procedures. Be familiar with the GNWT "Safety in Bear Country" manual and make available a reference copy at the site.

3.4 Operators of vehicles and equipment shall make every effort to avoid encounters with large mammals. Congregations of animals near food or garbage are a potential problem, which can be overcome by proper disposal of food wastes. Concentrations of scavenging animals, such as wolves, foxes and bears, increase the risk of diseases, particularly rabies, and danger to personnel. The following precautions and actions are to be taken at each site:

1. The killing of wildlife for any reason at variance with the Wildlife Act and regulations is an offence. Co-ordinate procedures for handling wildlife problems and incidents with the regional Nunavut wildlife office.
2. Use vehicle, noisemakers and, if necessary, a firearm to frighten the bear away from the site.
3. Shoot the bear only if the bear returns repeatedly, refuses to leave or directly threatens human safety. Killing is considered a last resort and, if at all possible, the appropriate wildlife officer should be contacted to alert them of the problem. If a bear is to be shot, assign the task only to a person familiar with and competent with the camp firearm. Wounded or otherwise aggravated bears can be extremely dangerous.
4. Report the death of a bear to the Field Team Leader and the appropriate wildlife officer who will issue instructions as to the disposal of the carcass and the formal reporting procedures to be followed.
5. Due to the possibility of rabies, shoot any animal that bites a human and retain the carcass intact pending instructions from the appropriate wildlife officer. If possible, notify the wildlife officer before any drastic action is taken. Seek medical advice from the appropriate medical facility for treatment of animal-inflicted wounds.

4 Heritage Resources

4.1 All site personnel are prohibited from knowingly disturbing any archaeological or other heritage site or collecting any artifacts. Removing artifacts is a criminal offence.

4.2 In the event of finding heritage resources:

1. Do NOT remove any artifacts or other associated objects from the site unless their integrity is threatened in any way.
2. Mark the site's visible boundaries and avoid the area.
3. Report the discovery of the site to the appropriate regulatory agency.
4. Document the discovery.

4.3 In the event of a discovery of human remains:

1. Advise the PMO of the discovery and they will contact the nearest detachment of the RCMP. The RCMP will make the decision as to whether the territorial coroner or archaeological department should be contacted.
2. Halt all activities around the area of discovery. Until determined otherwise, the remains should be treated as evidence in a criminal investigation. If the remains are found in the bucket of heavy equipment, the bucket should not be emptied, as physical evidence may be destroyed.
3. Secure the area and designate it as out of bounds to all personnel. Depending on weather conditions, the human remains should be provided with non-intrusive protection such as a cloth or canvas tarp (non-plastic preferred).
4. Document the discovery.

5 Key Contact List

5.1 24-Hour Spill Report Line

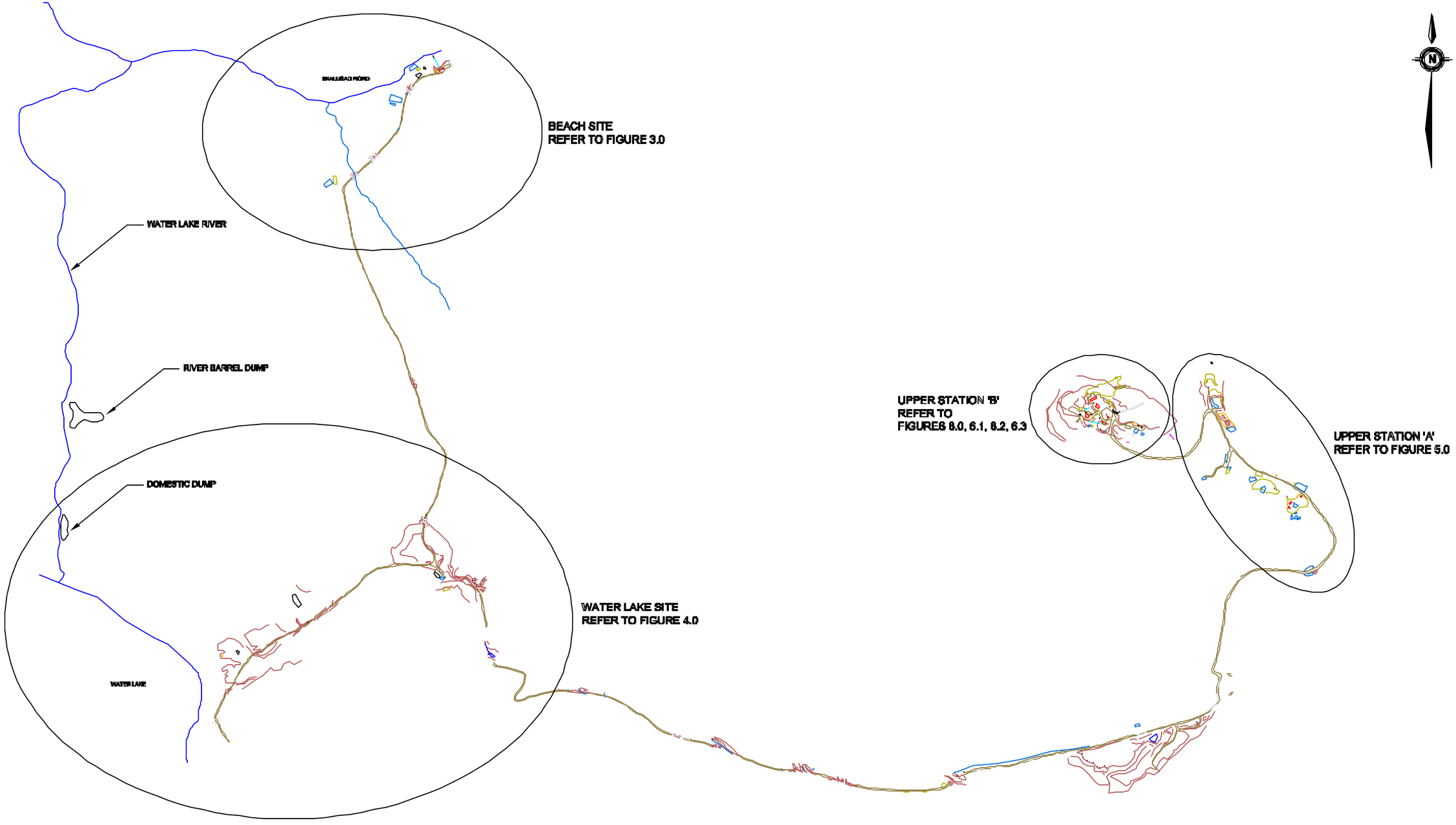
1. In the event of a spill, contact the 24-Hour Spill Report Line and provide them with all the relevant details.
   - Telephone: (867) 920-8130 Fax: (867) 873-6924
2. Environment Canada, as lead agency, shall then be contacted by officials to ensure the appropriate response. The lines are staffed 24 hours a day and can also be used to co-ordinate a response in the event of a non-spill emergency outside of normal working hours.

5.2 Other Contacts

1. In the event of a non-spill emergency (e.g. related to wildlife, fisheries, heritage resource, etc.), contacts are provided in Table 1.

Table 1: Contact List

Resource	Location	Phone Number
24 Hour Spill Line	NWT/Nunavut	867-920-8130
Local Fire Department	Gerald Pickett, Chief Fire Marshal Office of the Fire Marshal Nunavut Emergency Services Division Department of Community Government and Transportation Iqaluit, Nunavut	867-975-5310
Environment Canada, Enforcement Branch	Sid Bruinsma Environment/Emergencies Enforcement Officer Iqaluit, NT	867-975-4644
Indian and Northern Affairs Canada	Peter Kusugak Iqaluit Region District Operations Manager	867-975-4295
	Iqaluit Office	867-975-4500
Renewable Resources Officer Stations – Baffin Region	Gladis Lemus, Ph.D. Manager Pollution Control & Air Quality Environmental Protection Service Dept. of Sustainable Development Government of Nunavut Iqaluit, Nunavut	867-975-5907
Indian and Northern Affairs Canada – Project Proponent	Iqaluit Office	867-975-4500
	Robert Martin	867-979-7931
Public Works and Gov't Svcs. Canada – Project Management	Site Supervisor – Ken Gilmet	780-497-3883
	Program Manager – Jared Buchko	780-497-3886
	Project Manager – Brad Thompson	780-497-3862



Date: OCTOBER 05, 2004

0 200 400 600 800

Scale 1:15000

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PWGSC
FOX–C DEW LINE
SITE PLAN
Figure 1.0

EKALUGAD FIORD

CREEK

BA-1024
RRMC 46
RRMC 48
BA-1025
BA-1023
BA-1022
BARREL DUMP #1
RRMC 47
WELDED BARREL CULVERTS
TO WATER LAKE AND UPPER STATION
ROAD WASHOUT

BARREL DUMP #2
RRMC 45
BA-1021
BA-1018
BA-1017
RRMC 44
BA-1020
BA-1019
RRMC 43
CULVERT
ROAD WASHOUT
CULVERT

BARREL DUMP #3
RRMC 42
RRMC 40
VEHICLE AND EQUIPMENT DUMP
RRMC 41
PIPELINE
BAT-1016
BAT-1015
RRMC 37
BAT-1014
RRMC 38
BAT-1013
BAT-1012
BAT-1011
BAT-1010
GRAVEL PAD
ABOVE GROUND FUEL STORAGE TANK
BAT-1009
BAT-1008

POTENTIAL 2005 FUEL & SPILL CONTAINMENT EQUIPMENT STORAGE AREA*

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0 20 40 60 80 100

Scale 1:2000

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Legend

- SOIL SAMPLE
- RRMC SAMPLE
- PCBs EXCEEDANCE
- METALs EXCEEDANCE
- PHCs EXCEEDANCE
- PAHs EXCEEDANCE
- NONE
- PCBs CONTAMINATION PLUME
- METALs CONTAMINATION PLUME
- PHCs CONTAMINATION PLUME
- PAHs CONTAMINATION PLUME

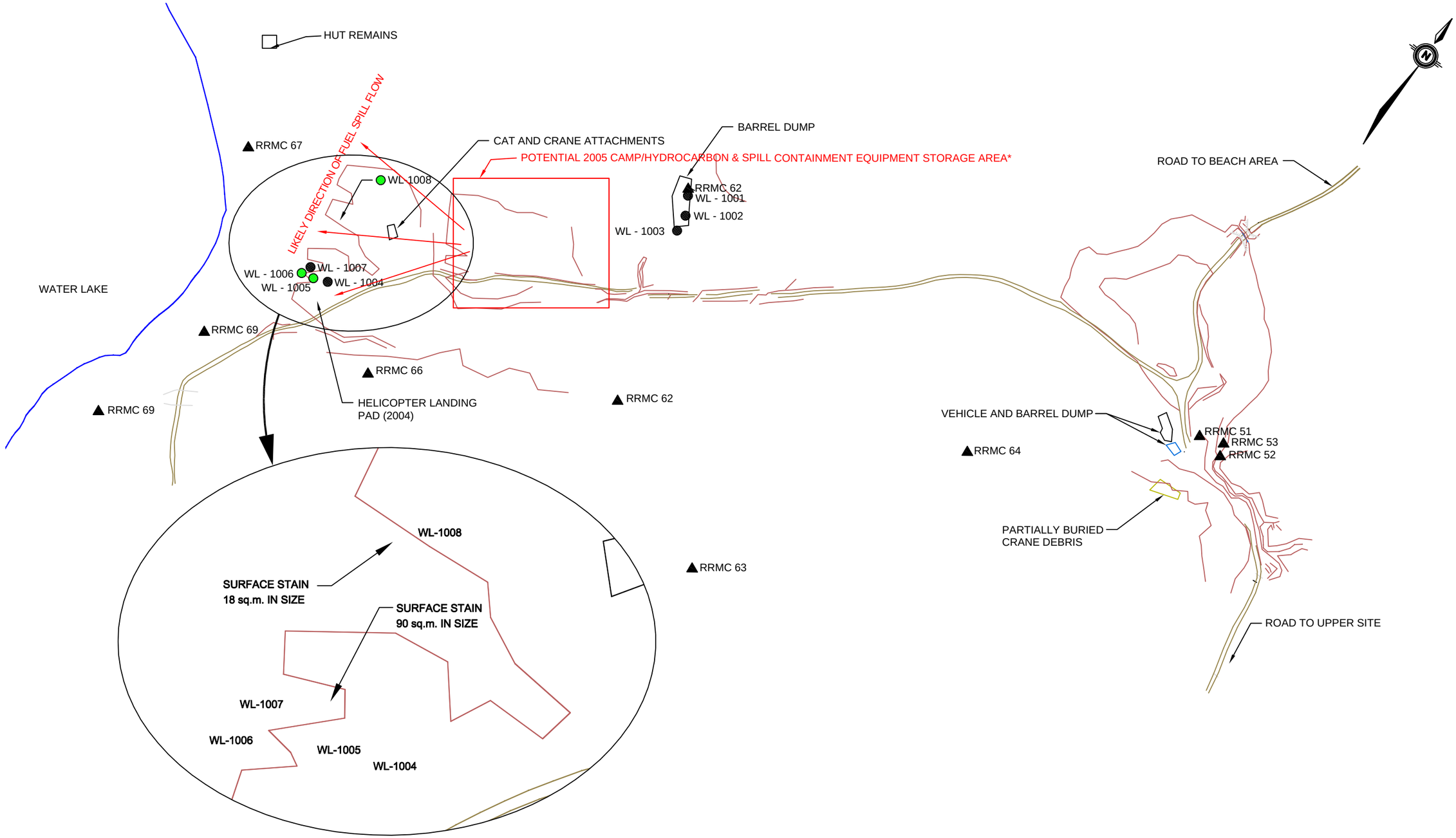
*SPILL KITS WILL ALSO BE CARRIED ON SUPPORT VEHICLES THAT SERVICE EQUIPMENT

PWGSC

FOX-C DEW LINE SITE - BEACH AREA

SPILL CONTINGENCY PLAN

Figure 2.0



Date: OCTOBER 05, 2004

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Scale 1:4000

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Legend

- SOIL SAMPLE
- RRMC SAMPLE
- PCBs EXCEEDANCE
- METALs EXCEEDANCE
- PHCs EXCEEDANCE
- PAHs EXCEEDANCE
- NONE
- PCBs CONTAMINATION PLUME
- METALs CONTAMINATION PLUME
- PHCs CONTAMINATION PLUME
- PAHs CONTAMINATION PLUME

*SPILL KITS WILL ALSO BE CARRIED ON SUPPORT VEHICLES THAT SERVICE EQUIPMENT

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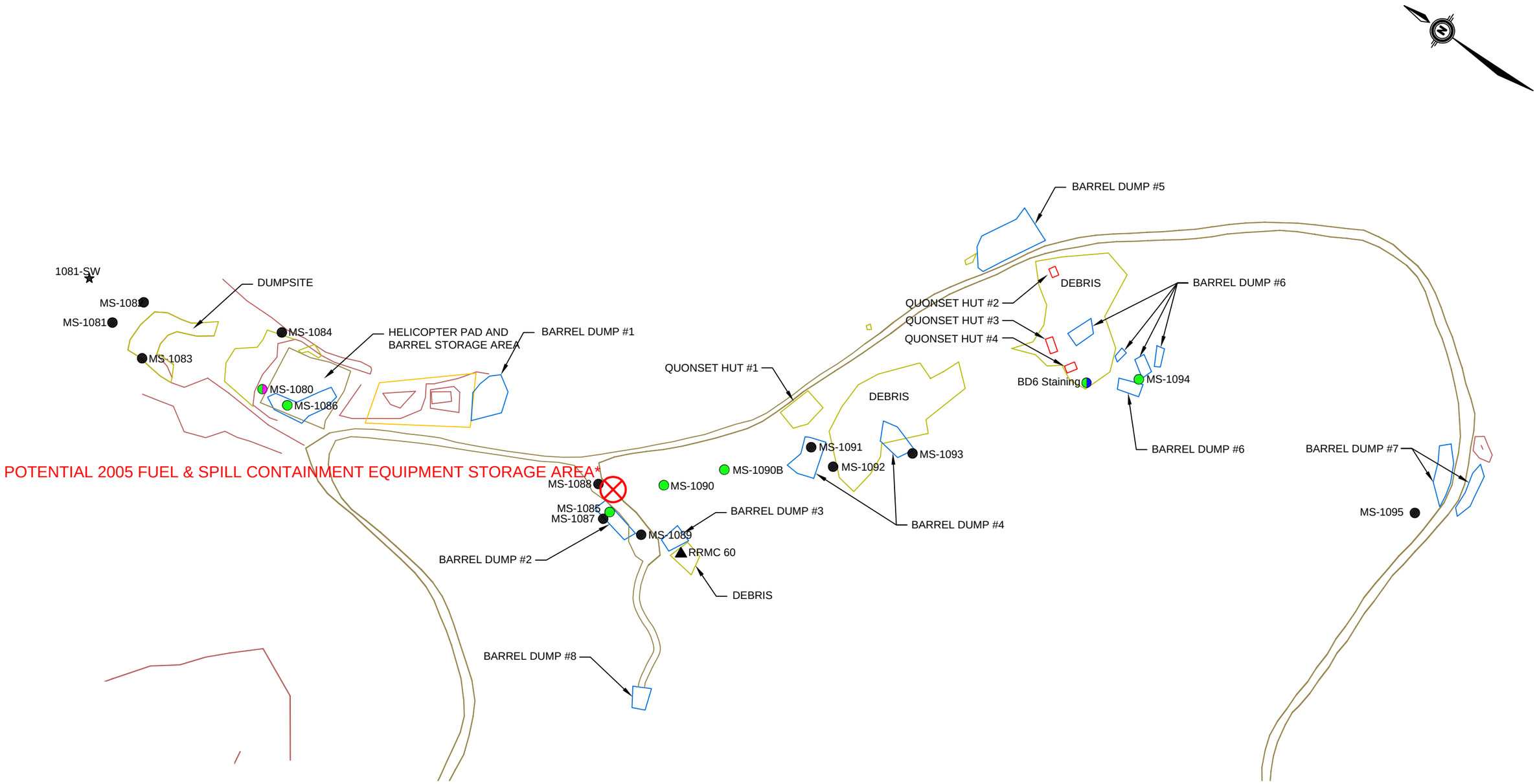
FOX-C DEW LINE SITE - WATER LAKE

SPILL CONTINGENCY PLAN

Figure 3.0



Date: OCTOBER 05, 2004

0 25 50 75 100

Scale 1:2500

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Legend

○ SOIL SAMPLE	PCBs EXCEEDANCE	PCBs CONTAMINATION PLUME
△ RRMC SAMPLE	METALs EXCEEDANCE	METALs CONTAMINATION PLUME
☆ WATER SAMPLE	PHCs EXCEEDANCE	PHCs CONTAMINATION PLUME
	PAHs EXCEEDANCE	PAHs CONTAMINATION PLUME
	NONE	

*SPILL KITS WILL ALSO BE CARRIED ON SUPPORT VEHICLES THAT SERVICE EQUIPMENT

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FOX-C DEW LINE SITE - MID STATION

SPILL CONTINGENCY PLAN

Figure 4.0