UMA | AECOM

Defence Construction Canada

Project Description for the Clean Up of the

FOX-2, Longstaff Bluff DEW Line Site

Prepared by:
UMA Engineering Ltd.
2540 Kensington Road NW
Calgary, AB T2N 3S3

Project Number: 0171-137-01-08

August 2007

Disclaimer

The attached Report (the “Report”) has been prepared by UMA Engineering Ltd. (“UMA”) for the benefit of Defence Construction Canada (“Client”) in accordance with the agreement between UMA and Client for the services described in the Report (the “Agreement”), and is subject to the budgetary, time and other constraints and limitations set forth in the Agreement.

The information and data contained in the Report, including without limitation the results of any inspections, sampling, testing and analyses and any conclusions or recommendations of UMA (the “Information”), represent UMA’s professional judgement in light of the knowledge and information available to it at the time of preparation of the Report. UMA has not updated the Report since the date that the Report was prepared. Further, UMA has relied upon the accuracy of the information provided to it by Client in order to prepare the Report and UMA has not independently verified the accuracy of such information, nor was it required to do so. Thus, UMA shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared which may affect the information contained therein, or for any inaccuracies contained in information that was provided to UMA by Client.

UMA makes no guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof and UMA shall not, by the act of preparing or issuing the Report and the Information, be deemed to have represented that the Report or the Information is accurate, exhaustive, complete or applicable to any specific use.

Except as required by law, the Report and the Information are to be treated as confidential and, unless otherwise agreed to by UMA and Client, may be used and relied upon only by Client and its officers and employees, subject to the foregoing limitations. UMA accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information unless those parties, prior to using or relying on the Report or the Information, have obtained the express written consent of UMA and Client to use and rely on the Report and the Information, and signed an Authorized User Agreement in a form provided or agreed to by UMA.

This Disclaimer is attached to and forms part of the Report.

Table of Contents

List of Appendices

List of Tables

List of Figures

1.0 Site Description

1.1 Location

The FOX-2, Longstaff Bluff DEW Line Site is on the south-western coast of Baffin Island, near the tip of the Baird Peninsula. The exact location is 68°53'49" N and 75°09'37" W. The station is located 15 km inland from the airstrip, on the southern end of a small peninsula jutting into Nauja Bay. The nearest community is Hall Beach, 245 km to the west.

1.2 History

The FOX-2 site was constructed in the 1950's as part of the Distant Early Warning (DEW) Line, which provided radar surveillance of the northern approaches to North America. In March 1985, Canada and the United States agreed to modernize the North American Air Defence System by closing the remaining 21 DND DEW Line sites by the early 1990's, and build the North Warning System (NWS).

In 1992, the DEW Line Clean Up Protocol was developed by the Environmental Sciences Group (ESG) of the Royal Military College of Canada and was reviewed and approved by federal and territorial environmental officials. The protocol includes procedures for dealing with contaminated soil, waste oil, landfills, wastewater, debris and hazardous materials. In 1998, the Environmental Provisions of the Cooperation Agreement between DND and the NTI were implemented to provide the approach necessary to restore the sites to an environmentally safe condition and prevent the migration of contaminants into the Arctic food chain.

1.3 Project Activities

The purpose of the proposed project is to provide remedy for previous activities that occurred as a result of the operation of the former DEW Line site. Specifically, the clean up is to prevent the release of physical debris and/or contaminants into the environment.

During the construction phase of the clean up, existing facilities no longer required for the operation of the NWS will be demolished. The demolition wastes will be segregated into hazardous and non-hazardous materials and disposed of appropriately. Contaminated soils identified during the field investigations will be excavated and properly disposed of in on-site engineered landfills or at off-site facilities if characterized as hazardous. Scattered surface debris and partially buried debris will also be collected and disposed. New landfills will be constructed to contain the non-hazardous contaminated soil and demolition waste generated during the clean up. Existing landfills within the site will be remediated, as required. Disturbed areas will be physically restored to a stable condition shaped to match the existing terrain. The detailed clean up program is provided in Section 5.

1.4 Schedule

FOX-2 underwent a detailed site investigation in 2005, and is scheduled for clean up beginning in 2008 as part of the DLCU project, with completion expected in 2012. The contractor will mobilize to the site in August 2008, by barge or airlift and set up a temporary construction camp. Clean up activities are expected to continue through to 2012, depending on the contractors' approach and weather conditions.

The expected duration of annual clean up activities on site will generally be from June to October. During the winter months, work will cease and equipment and facilities on site will be winterized. It is expected that the contractors' workforce and accessory personnel will mobilize to and from the site from nearby northern communities. Completion of the clean up and demobilization of the contractors' facilities and

equipment is anticipated for October 2012. Long-term monitoring of the landfills will begin once clean up is completed and will continue for a 25-year period. After 25 years, the monitoring requirements are re-evaluated.

2.0 Background Information

2.1 Contact Information

Defence Construction Canada
(on behalf of the Director General Environment, Department of National Defence)
Constitution Square, Suite 1720
350 Albert Street
Ottawa, ON K1A 0K3

Contacts regarding this submission for the DEW Line Clean Up Project are provided in Table 1.

Table 1: List of Submission Contacts

Defence Construction Canada		
Project manager: LCol. David Eagles	(T) 613-998-9523	(F) 613-998-0468
Environmental Officer: Douglas Craig	(T) 613-998-7288	(F) 613-998-0468
UMA Engineering Ltd.		
Environmental Scientist: Eva Schulz	(T) 403-270-9220	(F) 403-270-0399

2.2 Lead Authorizing Agencies

The lead agency for this project is the Department of National Defence, represented by the Director General Environment. The management of this project is being provided by Defence Construction Canada. These agencies will be responsible for obtaining permits, except in those cases where the clean up contractor is required to do so by legislation.

2.3 Environmental Assessment Process

The initial environmental assessment was completed under the Environmental Assessment and Review Process Guidelines Order (EARPGO) and updated in accordance with the requirements of the Canadian Environmental Assessment Agency (CEAA) and the Nunavut Impact Review Board (NIRB), in support of this project. The potential environmental impacts were assessed based on the valued ecosystem components identified during the initial scoping exercise.

The following sections provide a summary of the activities that were undertaken during the completion of the environmental assessment.

2.3.1 Scoping

As a self-directed environmental assessment, the initial step was to conduct a series of social and ecological scoping exercises designed to:

- Determine the temporal and spatial boundaries of the assessment; and
- Focus the analysis on the environmental issues directly related to the clean up project itself (i.e., identification of valued ecosystem components).

In scoping the project, clean up activities to be assessed were identified. Possible additional activities were examined using the Canadian Environmental Assessment Agency's "Principal Project/Accessory" test, which is used to determine if other activities demonstrate an interdependent linkage and/or geographical/ecological proximity with the primary clean up.

The assessment scope included a determination of the environmental effects to be assessed and the effects that are to be considered in making decisions regarding the project. The following table provides an outline of the scope of the project and of the assessment.

Table 2: Project Scope and Assessment

Project	FOX-2 Site Clean Up
EA Trigger	Funding from the Department of National Defence Federal permits required
Scope of principal project	Physical clean up of the FOX-2 site, including: demolition of facilities, removal of waste materials (including hazardous), contaminated soil removal, debris disposal, and construction of landfills and landfarms.
Accessory physical works	Mobilization and demobilization of equipment and personnel, and temporary construction camp set up.
Other undertakings	None.

The scope of the environmental assessment is to consider the effects of all project related activities (i.e., those related to the clean up of the site) and associated physical works on both biophysical and socio-economic factors.

The following factors were identified for assessment:

- Evaluation of environmental effects of the project, including those relating to cumulative effects that are likely to result from carrying out this project.
- Project undertakings performed in conjunction with other off-site projects/activities that have been or will be carried out.
- The relative levels of significance.
- Public comments.
- Mitigation measures deemed to be technically and economically feasible.

Interested parties were identified and consulted during the development of the project definition process including:

- 'Expert' federal departments (Environment Canada, Department of Indian Affairs and Northern Development, Government of the Northwest Territories Department of Natural Resources, and Government of the Northwest Territories Department of Health);
- 'Other' federal departments (DND, DCC, Parks Canada);
- Aboriginal organizations (NTI, Nunavut Planning Commission) and the Regional Inuit Associations; and
- Community leadership of the various Arctic hamlets.

Section 4.0 of this Project Description provides a detailed outline of the Public Consultation Process.

2.3.2 Assessment of Environmental Effects

The initial step following the scoping exercise was to determine the possible environmental effects of the project. This assessment involved providing a detailed overview of the project, a description of the existing environment (including inventories and ecological processes) and the identification of project-environment interactions.

The aim of describing the project was to clearly outline the constituent components and activities that were to occur at the FOX-2 site. Activities include mobilization, project layout and design, plans and scheduling, specifics related to each of the activities (i.e., how would contaminated soil be identified, excavated, transported and disposed), operating procedures, control procedures and demobilizations plans.

During the scientific studies described above, the relevant information concerning the existing environmental components of the study area was collected. This information included a description of the physical, biological and social characteristics of the study area.

Using the information that was obtained on the project and the existing environmental setting, the assessment study determined interactive links between these two components. Particular concern focused on the location, sensitivity, seasonal presence and the abundance of these components. Also included in the assessment of the environmental effects were possible impacts relating to socio-economic factors (heritage, culture, archaeological, employment, and business opportunities), and human health. During the assessment stage, conclusions were made as to the type of impact and its level of significance based on scientific judgement and comments received during the public consultation process.

2.3.3 Identification of Mitigation Options

The third stage of the assessment process was identifying mitigation measures that would result in a reduction or elimination of potential environmental effects associated with the clean up of FOX-2. In the case of this project, all potential adverse effects were addressed, not just those deemed to be significantly adverse. Mitigative actions now form part of the overall project design and planning documentation, which resulted in the preparation of an Environmental Protection Plan (EPP) in Section 8.0. The requirements for on-site personnel to adhere to these mitigative measures are part of the clean up contract.

2.3.4 Significance

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

- Loss of rare or endangered species;
- Reduction in biological diversity;
- Loss of critical/productive habitat;
- Fragmentation 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.

2.4 Regulatory Overview

2.4.1 Introduction

The clean up will comply with all applicable environmental laws, regulations and requirements of Federal, Territorial and other regional authorities, and any permits, approvals, and authorizations that may be required. The contractor is subject to and must comply with all permits and approvals obtained on behalf of and by DND to conduct this work. Throughout all project phases, the project will work in close cooperation with regulatory authorities and compliance will be enforced .

2.4.2 Federal Acts, Regulations and Guidelines

Several Federal Acts, regulations and guidelines affect project activities across all Canadian jurisdictions. The most relevant to the DLCU are outlined below:

The **Canadian Environmental Protection Act** regulates toxic substances from their production or import, to consumption, storage and disposal. This Act also incorporates, amongst others, the Temporary PCB Storage Regulations.

The **Transportation of Dangerous Goods Act and Regulations** promotes public safety in the transportation of dangerous goods. The Act applies to all handling, offering for transport and transporting of dangerous goods by any means of transport whether or not the goods originate from or are destined for any place or places in Canada.

The **Fisheries Act** protects fish and fish habitat from pollution, harmful alteration, disturbance and destruction, and impediments to fish movement.

The **Arctic Waters Pollution Prevention Act and Regulations** govern development and shipping activity in Arctic waters adjacent to the mainland islands of the Canadian Arctic to ensure the continuing welfare of the residents of the areas, and to protect the ecological balance in water, ice and land areas.

The **Migratory Birds Convention Act** provides for the protection of designated migratory species, their habitats, and the regulated harvest of certain species.

The **Canada Wildlife Act** provides for the involvement of the Government of Canada in cooperative research and management programs involving wildlife species normally the responsibility of provinces or territories. This is particularly relevant to rare and endangered species or species such as the Peary caribou, which seasonally move across various regulatory boundaries.

The **Species at Risk Act** aims to protect wildlife from becoming extinct or lost from the wild, with the objective of helping the numbers recover. The act covers all wildlife species listed as being at risk nationally and their critical numbers.

The **Canada Shipping Act** regulates shipping activities under the jurisdiction of Canada. Regulations cover technical standards of operation safety and pollution aspects related to shipping activities in Canadian waters.

The **Navigable Water Protection Act** pertains to the erection of structures or facilities used to support or impede navigation in waters under the jurisdiction of Canada.

The **Territorial Lands Act** provides the authority for administering and protecting lands under the direct control of the Minister of Indian and Northern Affairs Canada (INAC). The following regulations are pursuant to this Act:

- The **Territorial Land Use Regulations** provide regulatory control for maintaining sound environmental practises for any land use activities on Territorial lands. These regulations require that land use permits be issued for such operations as work involving the use of heavy equipment, establishment of camps, use of explosives, and clearing of lines, trails and rights-of-way, including construction of access roads.
- The **Territorial Quarrying Regulations** establish the procedures for extracting Crown-owned limestone, granite, slate, marble, gypsum, loam, marl, gravel, sand, clay or stone from Territorial lands. The regulations specify permits, applications, staking and dimensions of quarries.

The **Nunavut Land Claim Agreement Act** provides for the use, management and conservation of land, water, and resources of Nunavut.

The **Nunavut Waters and Surface Rights Tribunal Act** provides the Nunavut Water Board with the power to issue water use licenses. The NWB evaluates the potential for detrimental effects occurring because of the use of water or a deposit of waste in water on other users.

Canada Labour Act and Regulations contains the labour code for all Federal employees or activities on Federal owned or controlled land. Private Provincial or Territorial employees are governed by the Provincial/Territorial Labour Acts, even when working on Federal lands or facilities. The Labour Acts control such things as statutory holidays, maximum work hours and minimum wages.

Atomic Energy Control Act and Regulations describe the packaging requirements and approvals needed for the transportation of radioactive materials.

Explosives Act and Regulations define explosives, the permitting requirements needed to use explosive substances, packaging, handling and transporting requirements, and safety requirements.

National Fire Code (NFC) established the standard for fire prevention, fire fighting and life safety in buildings in use, including standards for the conduct of activities causing fire hazards, maintenance of sire safety equipment and egress facilities, standards for fire extinguishers, etc. In addition, the NFC established the standard for prevention, containment and fighting of fires originating outside buildings which may present a hazard to a nearby community, and sets the standards for the storage and handling of dangerous goods, flammable liquids and combustible liquids.

The following guidelines were used as a reference in the development of the DEW Line Clean Up Protocol and contract specifications. These guidelines are identified as reference materials only.

Freshwater Intake End-of-Pipe Fish Screen Guidelines provide instructions for the protection of anadromous and resident fish where freshwater is extracted from fish-bearing waters.

National Guidelines for the Landfilling of Hazardous Waste is to be used by regulators, designers, owners, and operators of hazardous waste facilities. They cover site selection, design, construction, closure and post-closure care, monitoring and operation. They are intended for new, not existing facilities.

Guidelines for Preparation of Hazardous Material Spill Contingency Plans identify factors that should be considered in the development of hazardous material spill contingency plans and the information that should be incorporated into a comprehensive contingency plan.

Code of Good Practise on Dump Closing or Conversion to Sanitary Landfill at Federal Establishments outlines the guidelines to improve operation and properly close existing dumps. It is intended to promote a consistent approach to the clean up of existing dumps to prevent contamination of water, air, and land and to ensure that the best particular control technology is used.

Code of Good Practise for Used Oil Management in Canada described environmentally sound options for the handling, storage, collection, transportation, recycling, reuse and disposal of used oils in Canada. It is intended to provide guidance for used oil generators and to regulatory authorities in the formulation of provincial or regional used oil management strategies.

Canadian Environmental Quality Criteria for Contaminated Sites, compiled by the Canadian Council of Ministers of the Environment (CCME) provide numerical limits for contaminants in soil and water intended to maintain, improve, or protect environmental quality and human health at contaminated sites. The criteria are intended to provide general technical and scientific guidance to provincial, federal, territorial and non-governmental agencies in the assessment and remediation of contaminated sites across Canada. They serve as benchmarks against which to access the degree of contamination at a site.

Canadian Drinking Water Guidelines are also complied by CCME for Canadian Drinking Water Quality and provide criteria for water that are protective of human health and also meet aesthetic objectives.

Technical Guidance on the Land Treatment of Petroleum Hydrocarbon Contaminated Soils at Federal Government Facilities or on Federal Crown Land provide information on the required design parameters for landfarms at federal facilities.

Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils was developed to provide guidance for landfarming.

The **Canada-Wide Standard for Mercury** applies to incineration activities on site.

2.4.3 Nunavut and Northwest Territory Acts, Regulations and Guidelines

In addition to the Federal Acts and Regulations identified in Section 2.4.2, the clean up of the FOX-2 site is governed by the following:

Guidelines for the Discharge of Domestic Wastewater in Nunavut, by the Nunavut Water Board, outlines the requirements for water quality effluent from facilities in Nunavut.

Environmental Guidelines for Industrial Waste Discharges establish standards that should be followed when discharging waste from an industrial operation on Commissioners Land or lands administered by municipal governments in Nunavut.

The **Explosives Use Act** provides controls for surface blasting other than for mining purposes.

The **Nunavut Wildlife Act** provides for the protection of wildlife and wildlife habitats as well as regulated harvest of selected species.

The **Nunavut Environmental Protection Act** provides for the protection of the environment from the discharge of contaminants, clean up of contaminants and unsightly premises. In addition, the powers of inspectors as well as offences and penalties are defined. The Act applies only to situations not authorized by other Canadian Acts in the Nunavut Territory. The following guidelines under the Nunavut Environmental Protection Act may be applicable to the clean up of the FOX-2 site:

- Contingency Planning and Spill Reporting
- Disposal Guidelines for Fluorescent Light Tubes
- Guideline: Dust Suppression
- Guidelines for the Management of Waste Asbestos
- Guideline for the Management of Waste Antifreeze
- Guideline for the Management of Waste Paint
- Guideline for the Management of Waste Solvents
- Guidelines for the General Management of Hazardous Waste in Nunavut

The **Nunavut Environmental Rights Act** provides the people of Nunavut the right to access information concerning the release or potential release of contaminants into the environment, and also the right to prevent the release or potential release of contaminants into the environment.

The **Spill Contingency Planning and Reporting Regulations** outline requirements for filing a contingency plan and for reporting spills.

The **Nunavut Fire Prevention Act and Regulations** provides for the regulation of the decommissioning of fuel lines and fuel tanks.

The **Pesticides Act and Regulations** specifies the requirements for use storage, handling and disposal of pesticides.

The **Nunavut Territorial Archaeological Sites Regulations**, pursuant to the Nunavut Act, protects archaeological sites in Nunavut from disturbance and prohibits the removal of archaeological specimens, except under permit.

The **Safety Act: Occupational Health Regulations** outline the health and safety standards to be maintained at workplaces to ensure the health and safety of persons.

Guidelines for the Removal of Materials Containing Friable Asbestos outlines the procedures for the removal of friable asbestos.

2.4.4 List of Approvals, Permits and Licenses Required

The following is a list of permits required for the clean up of the FOX-2 site:

Land Use Permit: As per the Territorial Land Use Act and Territorial Land Use Regulations, a Class A permit issued by Indian and Northern Affairs Canada (INAC) is required for the activities associated with the clean up of FOX-2. Contact: INAC Land Administration, Iqaluit, NU (T) 867-975-4283.

Quarry Permit: As per the Territorial Land Use Act and Territorial Quarrying Regulations, a Quarry Permit(s) issued by INAC is required for the extraction of granular material required for the clean up. Contact: INAC Land Administration, Iqaluit, NU (T) 867-975-4283.

Water Use License: As per the Nunavut Land Claims Agreement Act, a water use license issued by the Nunavut Water Board, is required for camp operations and construction activities associated with the clean up of the FOX-2 site. Contact: Nunavut Water Board, Gjoa Haven, NU (T) 867-360-6338.

In addition, the successful contractor may require a number of other permits or license. These permits or licenses pertain to the operation and maintenance of the contractors' camp or relate to his/her status as an employer. Examples of these permits include those related to the possession of firearms, day-to-day camp operation and federal/territorial labour codes. A partial list of these and other requirements is presented in Table 3.

Table 3: Authorizations

Authorization	Authority	Activity to Authorization Applies
Land Use Permit (Crown Lands)	Indian and Northern Affairs Canada	All land use activities on Crown land
Quarry Permit (Crown Lands)	Indian and Northern Affairs Canada	Granular material extraction activities on Crown land
Water Use License	Nunavut Water Board	All water use activities
Archaeological Research Permit	Nunavut Land Claims Agreement Act	Investigation of archaeological sites, mitigation, monitoring
Transportation Permits	Transportation of Dangerous Goods Act	Shipping
Transportation Permits	International Air Transport Association Dangerous Goods Regulations	Air transport
Fishing Licenses	Department of Sustainable Development	Recreational fishing
Firearms Acquisition Certificates/ Firearms License (course required)	RCMP	Use and storage of firearms

2.5 Previous Environmental Assessments

As a federal proponent, the Department of National Defence (DND) is required to conduct an environmental assessment for the clean up of each DEW Line site. As a planning tool, these assessments were drafted in 1994 by DND under the auspices of the Environmental Process Guidelines Order. These assessments were preceded by extensive on-site environmental and engineering investigations completed by the Environmental Sciences group (ESG) at the Royal Military College and UMA Engineering Ltd. (UMA). The initial investigations, which took place from 1989 to 1994, were used to provide a baseline study of the existing environment (both biological and physical) and ecological pathways and possible transport mechanisms that will exist during the clean up. As well, studies of socioeconomic aspects, in particular a detailed archaeological survey of the sites, were completed during this time. The protection of the food chain from DEW Line contaminants was established as the aim of the clean up. These studies confirmed that physical restoration would involve considerable quantities of materials, including limited quantities of hazardous materials such as waste oil, batteries and asbestos. Conclusions reached by independent analyses indicated that inorganic elements (principally copper, lead and zinc), hydrocarbons and polychlorinated biphenyls (PCBs) pose the greatest risk to the biophysical environment. Therefore, the clean up approach was geared towards removing these contaminants from contact with the environment.

Subsequent changes to overall project planning have been assessed over time and the assessment document updated. The Environmental Screening Report was updated for 14 of the 15 DEW Line sites in Nunavut (DCC-DLCU, 1998). This report was submitted with the Project Description of the 15 DEW Line sites in the Nunavut Settlement Area to the Nunavut Impact Review Board (NIRB) in June 1998.

In 2005, further investigations were conducted to delineate contaminated areas and obtain environmental and engineering information required to finalize the clean up plans. This information was reviewed and an updated Project Description with an environmental screening report section was prepared.

Other investigations included:

- An initial environmental clean up study of the DEW Line sites in Canada carried out on behalf of the United States Air Force by a consortium of Canadian consultants. The objectives for this study included: identifying and investigation areas impacted by past waste disposal practises and spills; determining and evaluating remediation alternatives for the waste disposal and spill areas; and developing disposal options for debris arising from the demolition of DEW Line structures. This study provided information on the presence of hazardous materials, the biophysical environment, facility details, and the existing landfills.
- An environmental study of 10 of the 21 sites in 1989/90 for the DND. This study provided a detailed physical and chemical inventory of the stations and considered the impact of chemical contaminants in the Arctic ecosystem. This study provided information on the debris found on site, contents of landfills, fuel spills, and patterns of contaminant dispersal and impact from the use of drums.
- Two studies designed to assess the impact of the historically common practise of disposing debris into the ocean through ice were carried out in 1994 and 1995 by a consortium of several Canadian government departments. These studies concluded that there were no significant chemical effects arising from the presence of debris on the ocean floor. A summary document of this investigation is provided in Appendix E.
- During the final site investigations conducted in 1996 at BAR-3, Tuktoyaktuk and PIN-M, Cape Parry, the DND investigation team discovered that the paint on many of the buildings contained PCBs in excess of 50 ppm. PCB amended painted materials (PAP) are defined as material that is coated with PCB amended paint, and has been analysed and the materials (including the paint) determined to contain PCB concentrations in excess of 50 ppm. These PAP materials are regulated under the Canadian Environmental Protection Act. Currently, the PAP materials cannot be placed in a landfill in the north, and are being packaged and transported to a southern disposal facility for destruction and disposal. Prior to transport, PAP material is being stored temporarily at the site in accordance with the Temporary Storage of PCB Materials Regulations.

2.6 Contract Award Process

The following steps outline the contract award procedures:

- A tender package is produced with includes ALL of the work to be completed at the site during the clean up. A tender package includes instruction for the contractor to attain Minimum Inuit Contractor Content (MICC) in the workforce, as well as Minimum Inuit Employment Content (MIEC), as specified in the DND/NTI Economic Agreement.
- The tender award goes to the most competitive bidder who fulfills all of the requirements as stated in the tender package.
- Once the contract is awarded, the successful contractor can begin plans to start the clean up work.

3.0 Project Planning

3.1 Rationale for the Project and Primary Goals

The aim of the DLCU Project is to decommission those facilities used by the former DEW Line which have been declared surplus to the requirements of the North Warning System and to restore the sites to an environmentally safe condition. Environmental restoration includes setting remediation objectives that are designed to preclude migration of contamination (and hence biomagnification) into the Arctic ecosystem/food chain. To accomplish this, remediation will include:

- The excavation of soils in cases where parameters exceed those that have been set for the project (i.e., believed to cause significant input into the lower levels of the food chain, for example, plants and detritus); and
- The remediation of landfills, which may serve as a source of contamination.

The process of biomagnification is defined as positively sloped variation in concentrations through increasingly higher trophic levels of the food chain. The process of biomagnification is particularly important in Arctic ecosystems, because of the dependency on a high fat content in the diet; organisms are extremely sensitive to contamination inputs, especially chlorinated contaminants such as PCBs. Given the nature of the Arctic ecosystems, it is important that past anthropogenic activities, such as the operation of the DEW Line, not continue to cause any significant adverse effects on any one level of the Arctic food chain. Specifically:

- The limited availability of species at any one given trophic level leaves little opportunity for another species to offset the effects of a loss of another.
- Negative biological effects (i.e., plant loss) may lead to physical disturbances, such as damage to permafrost.
- These unmanned sites pose a risk to human and animal health and safety through the presence of physical hazards.

3.2 Evaluation of Alternatives to the Project

As a project strictly dedicated to the clean up of military establishments, the range of alternatives to the project is limited. Two alternatives to the clean up of these sites can be identified, and are as follows:

Commercial or other Government use of the facilities: This alternative involves the sale of those facilities no longer required by the DND to commercial interests. Two possibilities are present, namely on-site commercial development or sale of the capital assets themselves and movement off-site.

No clean up action (Null alternative): The second alternative involved examining the environmental impact of maintaining the status quo at the sites. It was quickly realized that failure to address the environmental problems identified during the site investigations could lead to the following:

- Placing the Arctic environment/food chain at risk;
- Possible future legal liabilities for the federal government; and
- Greater clean up costs in the future.

3.3 DEW Line Clean Up Protocol

The purpose of the DEW Line Clean Up Project is to:

- Demolish and remove existing facilities that are not required for the operation of the North Warning System.
- Removal contaminated soils from contact with the Arctic food chain.
- Stabilize existing landfills.
- Clean up surface debris.
- Physically restore the site to as natural a state as practical.

3.3.1 Protocol Development

In cooperation with several federal departments and the Government of the Northwest Territories, DND originally drafted the General Protocol for the DEW Line Clean Up in 1991. This protocol served as the basis for the DND/NTI Agreement on environmental provisions for the clean up of the sites (see Appendix B). At the time of implementation, there were no established environmental standards for the Arctic. As a result, existing federal guidelines, such as the Interim Canadian Environmental Quality Criteria for Contaminated Sites (1991) were modified to reflect both the sensitivity of the Arctic food chain to ecological processes such as biomagnification and the close dependence of the Inuit on the land for food. In addition, a barrel specific protocol was prepared that outlined the process for dealing with barrels and barrel contents found on the DEW Line sites.

3.3.2 Criteria

The protocol outlined in the DND/NTI Agreement was developed from the results of the biophysical, socio-economic, and engineering site assessments. The DLCU Protocol documents the contaminant clean up criteria and specific physical actions that are to be undertaken, which are specific to the DEW Line sites. These criteria were developed based on existing federal and territorial criteria in conjunction with studies that show the functional relationships and/or pathways for biological uptakes from soil. The resulting protocol defines two concentration tiers of soil contamination. Soil substrates containing Tier I concentrations may be placed in an appropriate on-site landfill, while those soils in excess of the Tier II standard are to be disposed of in a manner that provides additional measures to permanently segregate these contaminants from the Arctic ecosystem. Soils exceeding federal legislative limits (i.e., Canadian Environmental Protection Act and Chlorobiphenyl Regulations) will be disposed of off-site at a licensed disposal facility.

3.3.3 Environmental Working Group

In 1997, the DND and NTI agreed to form an Environmental Working Group (EWG). The EWG is comprised of scientific and technical experts representing both the Inuit (NTI) and DND. The purpose of the EWG is to examine environmental issues related to the DLCU project and to provide recommendations to a joint DND/NTI core group consisting of senior management from both organizations. Specific tasks that have been assigned to the EWG include:

- Development of a landfill risk evaluation matrix.
- Evaluation of recommendations for a post-construction/remediation landfill monitoring program.
- Identification of hydrocarbon clean up requirements.
- Establishment of confirmatory testing protocols.
- Preparation of a list of items suitable for landfilling at the DEW Line sites.

3.4 Final Investigation and Delineation

Prior to the clean up of each site, the DND undertakes a comprehensive final site assessment. The aim of the final investigation is several-fold, including:

- To fully delineate the extent of contaminated areas in order to prepare accurate construction documents.
- To confirm the structural and environmental status of buildings and other facilities that are to be demolished.
- To confirm the baseline environmental conditions at the site prior to implementation.
- To examine existing landfills and identify new landfills to confirm details pertaining to the required remediation strategy.

4.0 Public Consultation Process

As part of the DLCU project, public consultations have been carried out in communities across the north since 1992. In 1992 and 1993, teams from the DND and other federal departments conducted a broad range of public consultation sessions to confer with the local residents about the project and to obtain input regarding specific concerns about the work. Public consultations continue for each site prior to construction.

4.1 Inclusion of Traditional Knowledge

One of the guiding principles of the DLCU project is to ensure the meaningful participation of local residents in both the planning and execution phases. One way of ensuring this is to incorporate traditional knowledge into the site clean up plans. An Inuit representative who is familiar with both the DEW Line site and traditional use of the area is chosen by the Regional Inuit Association to be on-site during the site investigation phase prior to the clean up. The Inuit representative works closely with the EWG to identify Inuit use of the area, wildlife patterns, past activities, and any information relating to dumping, hazardous waste storage, and natural occurrences. This traditional and local knowledge is used to refine clean up activities by including unknown issues or adjusting environmental protection plans.

Additionally, DND and the NTI establish a community DEW Line Clean Up committee to facilitate the flow of local knowledge to the EWG prior to and during each site visit. To accomplish this goal, the EWG visit local communities most affected by each DEW Line site and conduct one on one interviews with a number of residents, the Hamlet Administrative Officer and Mayor, the local Hunters and Trappers Association and other relevant community organizations.

4.2 Initial Public Consultation

DND tried to integrate the views of all interested stakeholders, including individuals or groups, into the decision-making process for the DLCU Project. The approach to public involvement in environmental assessments for this project included two major elements: adequate public notification and appropriate public consultation.

The purpose of public notification is to provide information regarding community meetings, environmental assessment results, site activities and upcoming decisions. Public notification is used mainly for notifying the public of the results of previous environmental assessments and clean up plans.

Public consultation has been used to involve the public in the environmental assessment process through dialogue between northern residents and the project representatives. This dialogue has proven useful in identifying public concerns, needs and values before final decisions on courses of action were made.

Public consultation meetings were held in those communities in the vicinity of the DEW Line sites. Briefings to government officials were also held in Iqaluit, Cambridge Bay and Yellowknife. Advertisements and information packages were provided in English as well as Inuktitut. Minutes were recorded at each of the meetings and action items passed on to the responsible agencies.

Various communities were visited in 1992, 1993 and 1994 as part of the public consultation program. The primary objectives of the initial meetings were to:

- Provide general information to the community regarding the status and schedule for the project.
- Provide information regarding the process for closure and clean up of the DEW Line.

- Present environmental information regarding the demolition/disposal of facilities.
- Obtain information regarding public concerns through discussions at the meetings and through questionnaires.
- Obtain information regarding local labour and contracting capabilities to assist in developing implementation strategies.

4.2.1 2005 Site Investigation

In the summer of 2005 during the delineation investigations for FOX-2, further consultation was conducted to ensure local knowledge was collected and incorporated into the final delineation investigations. Local knowledge is important for uncovering location(s) of contamination that had not been previously assessed, as well as information required for completing the Landfill Risk Evaluation Matrix for each landfill site. Involvement of the local community and Inuit representation (NTI) included discussions with long time residents and community officials, including Hamlet Administrative Officers and senior members of the Hunters and Trappers Association; and a site visit by an NTI technical representative with a local community representative.

The NTI technical representative and the local representative were on site during a portion of the site investigation. During this time, the NTI representatives were able to observe the site and note any technical concerns that may have been overlooked by the site investigation team. The local community was able to provide much information on past disposal practices. Concerns and comments were gathered and incorporated into the delineation investigation plans and the clean up plans. Sections of a report pertaining to the detailed observations of the NTI while on site at FOX-2 are provided in Appendix C.

4.2.2 2008 Pre-Construction Consultation

Public consultation meetings regarding the clean up program will be held in the communities of Hall Beach, Igloolik and Qikiqtarjuaq in 2008. The meetings include a presentation of the proposed clean up plans and design, as well as a question and answer period in which the community's issues and concerns will be heard. Copies of the presentation and question and answers can be provided once the meetings have been completed.

4.3 DND/NTI Project Review Committee

As part of the Agreement between the Department of National Defence and Nunavut Tunngavik Incorporated, there are regularly scheduled meetings between these two organizations. These meetings, which involve senior management from both organizations, are designed to provide a regular forum to discuss the clean up program within the Nunavut Settlement Area and to resolve concerns relating to environmental and/or socio-economic issues.

5.0 Implementation and Design/Engineering

The clean up plans and procedures are outlined in the following sections. Selected photographs of the clean up areas at FOX-2 are in Appendix D.

5.1 Site Access and Transportation Methods

Off-site activities in support of this project will be in the form of transportation associated with the movement of materials, equipment and personnel to the site. These activities are described below.

Air transport – transport of personnel to and from the site, and weekly domestic supplies (i.e., food) will be completed using charter aircraft.

Marine transport – it is anticipated that the contractor will mobilize bulk materials and equipment to/from the FOX-2 site via sea-lift or barge.

Ground Transport – existing roads at FOX-2 will be used.

5.2 Contractor Support Activities

The following activities will occur on-site to support the clean up work:

- Use of existing airstrip and roads at site for equipment transport, movement and access to work areas.
- Set up of site for camp equipment and storage.
- Set up primary sewage treatment (settling tank and lagoon) for the camp.
- Development of domestic waste disposal (either as is or incinerated and then landfilled) in the Non-Hazardous Waste Landfill.
- Demobilization of the clean up camp following the end of the project.
- Vehicle traffic to work areas is to be supported by the existing access roads that traverse the site.
- Labour and equipment requirements are anticipated to include 40-60 personnel, 20 pieces of heavy construction equipment and 6 support vehicles.
- Duration of work is anticipated to be approximately 4 months/year, not including winter shutdown period, over a timeframe of 3 years.

5.3 Development of Borrow Areas

Borrow quantities were investigated as part of the geotechnical field investigation completed by EBA in 1993 and 2005. Nine borrow areas have been identified at FOX-2. The definition of the types of granular materials is as follows:

Type 1: well graded gravel to be used for regrading and erosion protection requirements.

Type 2: generally consists of pit-run comprising sand and gravel with a trace of fines used for construction of landfill berms and cover and grading requirements.

Type 3: granular pit-run material generally used for regrading low areas, backfill of contaminated soil and landfill waste excavations and general site grading requirements.

Type 4: A non-saline, well graded sand and gravel with some fines used for the construction of landfill containment berms and backfill of the key trench excavation for the Tier II Soil Disposal Facility.

Type 5: Rounded sandy material to be used as an embedment material for geomembranes and sand component in the sand-bentonite levelling course. Also used as a protective later for geomembranes.

Type 6: Selected material from excavation or other sources approved by the DCC Contract Coordinator, generally consisting of screened stone, gravel or sand in an unfrozen state. It is used as an intermediate cover within the landfills.

Approximately 230,600 cubic metres of granular material has been sourced for the clean up. Granular material is required for closure of landfills, upgrading the access roads during construction, backfilling contaminated soil areas and general site grading purposes. Additional granular fill is required for the development of the new Non-Hazardous Waste Landfill and Tier II Soil Disposal Facility. Table 4 outlines the borrow areas and potential volumes of granular material to be extracted from each area.

Table 4: Summary of Granular Material Requirements

Borrow Area	Granular Material Quantity (cubic metres)
BA #1	10,000
BA #2	36,000
BA #3	23,400
BA #4	17,500
BA #5	11,700
BA #6	9,000
BA #7	85,000
BA #8	17,000
BA #9	21,000
Total	**230,600**

5.4 Contaminated Soil Disposal Requirements

All contaminated soil found at FOX-2 has been divided into one of five categories depending on the type and severity of the contamination. Generally, non-hazardous surface contaminants, if less than three square metres, are graded whereas more extensive contaminated soils are excavated. Excavations left by soil removal are backfilled with granular fill. Table 5 outlines the contaminated soil disposal requirements.

Table 5: Contaminated Soil Disposal Requirements

Designation Co-Designation	Tier I	Tier II	Type A	Type B	Hazardous
None (no co-contaminants)	Non-Hazardous Landfill	Tier II Disposal Facility	Non-Hazardous Landfill	Landfarm	Containerize for off-site transport and disposal by others.
Type A	Non-Hazardous Landfill	Tier II Disposal Facility			Containerize for off-site transport and disposal by others.
Type B	Landfarm	Tier II Disposal Facility			Containerize for off-site transport with hydrocarbon resistant liners for disposal by others.

The locations of the contaminated soil areas are shown on the drawings in Appendix A.

5.5 Contaminated Soil Types

DCC Tier I and Tier II Contaminated Soil: Defined as soils containing concentrations equal to or in excess of any or all of the contaminants listed in Table 6. A detailed investigation of contaminated soil areas was conducted at FOX-2 in 2005, in addition to a detailed background geochemical investigation. Based on the results of the 2005 background geochemical investigation, it was determined that several inorganic elements regularly exceeded the DCC criteria in the overall Longstaff Bluff area. These elements included arsenic (As), copper (Cu), cobalt (Co), and nickel (Ni). Site-specific clean-up criteria were therefore developed for these parameters, and approved by the EWG. Additionally, it was determined that within certain areas of the site, geochemical "hot spots" are present where the natural soil geochemistry commonly exceeds the site specific criteria. The "hot spots" are a result of specific hydrogeochemical and geochemical conditions that focus water run-off and chemical weathering of bedrock. The two primary areas where this effect was noted are the Airstrip and the West Landfill areas, although in general, the effect is present in all areas of the site where the steep bedrock uplands meet the flat, low-lying marine lowlands near the coast.

Table 6: DCC Tier I and II Criteria for FOX-2

Contaminant	Tier I Criteria	Tier II Criteria
Arsenic	-	228 ppm*
Cadmium	-	5 ppm
Chromium	-	250 ppm
Cobalt	-	93 ppm*
Copper	-	407 ppm*
Lead	200 ppm	500 ppm
Mercury	-	2 ppm
Nickel	-	142 ppm*
Zinc	-	500 ppm
PCBs	1 ppm	>5 ppm to <50 ppm

* Denotes site specific criteria

Hazardous Contaminated Soil: Contaminated soil is classified as hazardous in accordance with the Transportation of Dangerous Goods Act and Regulations.

CEPA Contaminated Soil: Soil containing concentrations of PCBs equal to or in excess of 50 parts per million. Materials contaminated with PCBs at concentration levels equal to or in excess of 50 ppm (mg/kg) are legislated as hazardous materials. Storage, handling, and disposal of PCBs are regulated under the Canadian Environmental Protection Act and the Federal Transportation of Dangerous Goods Act.

Leachable Soil: Soil containing contaminants that when subject to the leachate test prescribed in the TDGA and Regulations, leaches contaminants in excess of the concentrations listed in Part V of the regulations. Handling and disposal are regulated under Federal, Territorial and Provincial Regulations.

Petroleum Hydrocarbons: Hydrocarbon products include those described by laboratory analysis as lubricating oil and Grease, fuel oil, diesel and/or gasoline.

Hydrocarbon Contaminated Soil: Soil containing concentrations of Total Petroleum Hydrocarbons (TPH) in concentrations considered to create a risk to the environment (2500 ppm).

Type A Contaminated Soil: Hydrocarbon contaminated soil in which the primary petroleum hydrocarbon product present in the soil as determined by laboratory analysis consists of lubricating oil and grease. For remedial purposes, Type A contaminated soil shall be treated as Tier I contaminated soil containing hydrocarbon contamination.

Type B Contaminated Soil: Hydrocarbon contaminated soil in which the primary petroleum hydrocarbon present in the soil as determined by laboratory analysis consists of fuel oil, and/or diesel, and/or gasoline.

Type B – Tier I Contaminated Soil: Type B contaminated soil containing concentrations of lead between 200 and 500 ppm and PCBs between 1 and <5 ppm. Type B and combinations of DCC Tier I and Type B contaminated soil shall be excavated and treated onsite in a landfarm.

Type B – Tier II Contaminated Soil: Type B contaminated soil containing contaminants in excess of DCC Tier II criteria shall be treated as DCC Tier II contaminated soil containing hydrocarbon contamination.

Clean Soil: Soil that has been sampled, analyzed, and determined to have contaminant concentrations below DCC Tier I contaminant levels, TPH concentrations less than 2500 ppm and lead and PCBs in concentrations less

5.5.1 Tier I Contaminated Soil Disposal Requirements

Soils exceeding Tier I contaminated soil criteria, but not classified as Tier II contaminated soil do not pose a leachate risk and therefore may be disposed of in an on-site, non-hazardous waste (NHW) landfill. Typical construction of a NHW Landfill consists of gravel perimeter berms surrounding layers of interbedded waste and intermediate cover soil. A layer of granular material, minimum 1 metre thick, is placed as final cover for the landfill and graded to promote positive drainage. A more detailed description of a NHW Landfill is provided in Section 5.7.1.

5.5.2 Tier II Contaminated Soil Disposal Requirements

Based on the engineering field surveys conducted at the sites in 1992 and 1993, it became apparent that a potentially large volume of Tier II contaminated soil at the 21 DEW Line sites would require segregation

in a manner which precludes their continued contact with the Arctic ecosystem. A number of disposal options/technologies were considered by the DLCU project team. Of the options, the most environmentally and economically feasible was determined to be the development of engineered Tier II soil disposal facilities. These facilities utilize a double-containment system consisting of permafrost to limit leachate generation and synthetic liners to prevent migration of contaminants into the surrounding environment. A detailed description of a Tier II Soil Disposal Facility is in Section 5.7.2.

5.5.3 CEPA Contaminated Soil Disposal Requirements

Contaminated soils which contain levels of contaminants in violation of the Canadian Environmental Protection Act (CEPA) and associated regulations are considered hazardous material and will not be placed in the Tier II Soil Disposal Facility. These materials are to be excavated, removed from the site and transported to a licensed disposal facility. Some of the soils may also contain petroleum hydrocarbons, often where lead and PCB contaminants have also occurred as a result of waste oil and/or fuel spills. These hydrocarbons are contained within the soil matrix and do not exist as free liquids which could potentially leach. Leachate testing has also been conducted on the more highly contaminated soil samples as set forth in Ontario Regulation 347. Wastes determined to be leachate toxic under this test are not placed in the Tier II Soil Disposal Facility, but are instead removed from the site to a licensed disposal facility.

5.5.4 Hydrocarbon Contaminated Soil Disposal Requirements

In 1998, the DLCU Protocol was revised to address hydrocarbon contaminated soils at the Nunavut sites under the environmental provisions of the DND/NTI Agreement. Under the amended protocol, hydrocarbon contaminated soil is divided into two types based on common sources at the DEW Line sites. In Type A hydrocarbon contaminated soil, the primary petroleum product present is lubricating oil and grease. Due to the low leachability of this type of hydrocarbon, these soils are generally deemed safe for disposal in a NHW Landfill. Soils where the primary petroleum hydrocarbon contaminant was fuel oil are classified as Type B hydrocarbon contaminated soils. Due to the concern of leachate generation and migration from Type B contaminants, these soils are not placed in the NHW Landfill. Several options for disposing of Type B contaminants have been employed based on location and site specific factors. The most feasible and environmentally sound disposal option is passive land treatment (landfarming).

5.5.5 Contaminated Soil Volumes

Volumes of contaminated soil to be excavated were calculated using the results from the 2005 site investigation, as summarized in Table 7. The volumes in Table 7 include area specific contingencies, which were rounded to the nearest 100 cubic metres in the case of CEPA and hazardous soils.

Table 7: Summary of Contaminated Soil Volume Estimates

Contaminant Designation	Soil Volume (cubic metres)
Tier I Contaminated Soil	1660
Tier 1/Type A Co-Contaminated Soil	230
Tier 1/Type B Co-Contaminated Soil	40
Tier II Contaminated Soil	3480
Tier II/Type A Co-Contaminated Soil	120
Tier II/Type B Co-Contaminated Soil	20
Type A Hydrocarbons	520
Type B Hydrocarbons	11,700
CEPA/Hazardous Soil	110
TOTAL	**17,880**

5.5.6 Selection of Contaminated Soil Disposal Facility Locations

Site selection for new landfills and/or landfarms must consider a number of factors that impact the ability to achieve the long-term performance and minimize construction cost. Selection of sites considers:

- Geotechnical suitability;
- Accessibility;
- Proximity to work areas; and
- Environmental suitability.

Geotechnical suitability considers topography, soil conditions, natural drainage in the area, depth to bedrock or permafrost, groundwater, and adverse soil conditions that may affect permafrost and potential containment. Environmental considerations include the presence of existing contamination and sensitivity of the receiving environment.

Another environmental concern during the development of these facilities is the possible requirement for use of explosives in some extraction activities. In addition to the obvious danger to human health, other possible impacts could include damage to surrounding areas (including water bodies, environmentally sensitive areas and hazardous material storage facilities) from shock waves and blasting scatter, and the disturbance of nearby wildlife by sudden peak noise levels. Blasting, if required, will be conducted by authorized personnel in accordance with all required permits, licenses and applicable laws and regulations, and as dictated by regulatory authorities.

5.6 Proposed Construction

Several specialized facilities are to be constructed to dispose of waste generated on-site due to the demolition of existing structures, removal of contaminated soil and site debris, and landfill excavation. Only materials exceeding CEPA standards and those deemed hazardous according to TDG Regulations will be disposed of off-site.

The new facilities are sited following the completion of the detailed engineering investigation. As new roads will have to be constructed to access, these areas, the contractor may be required to make special

provisions to protect tundra vegetation. It is also assumed that the contractor will have to provide adequate drainage for all excavations.

5.6.1 Non-Hazardous Waste (NHW) Landfill

5.6.1.1 Description

The Station NHW Landfill will be is located directly southeast of the module train and has an available surface area of 6,900 m^2. The area is relatively level with bedrock refusal ranging from 0.05 m to 0.5 m. A short access road will be required from the station area. The Airstrip NHW Landfill will be located 130 m north of the Hangar.

5.6.1.2 Construction

The NHW Landfill is designed on the premise that it will contain non-hazardous materials only and will not generate leachate. Therefore, it is not necessary to eliminate all moisture migration into and out of the landfill. The NHW Landfill is also not designed to maintain the contents in a perennially frozen state.

The following materials will be disposed of in the NHW Landfill:

- Tier I and Type A hydrocarbon contaminated soil;
- Non-hazardous demolition debris;
- Non-hazardous site debris;
- Non-hazardous debris and Tier I soils excavated from landfills;
- Creosote treated timbers wrapped in polyethylene sheeting; and
- Double-bagged asbestos.

The NHW Landfills will consist of a perimeter containment berm and granular cover to minimize erosion and infiltration in order to provide long-term stability. The NHW Landfills will be established on native ground, stripped of any organic matter which will be stockpiled and used in the closure of the landfill. No base cover or liner is required for this landfill. Development and closure of the NHW Landfills includes the following work:

- Construction of exterior berms;
- Placement of Tier I contaminated soil and non-hazardous demolition waste and site debris in the landfill;
- Placement of Tier I contaminated soil and non-hazardous demolition waste and site debris in the landfill;
- Compaction of landfill debris;
- Placement and compaction of intermediate granular cover in the landfill;
- Placement and compaction of final granular cover over the landfill;
- Grading to promote drainage away from the landfill;
- Supply and installation of groundwater monitoring wells in and around the landfill as indicated on the drawings; and
- Survey of the location of asbestos and creosote-treated timbers.

For further design details of the NHW Landfill, please refer to Drawings H-L133/1-9101-102, 104, 106, 110, 119, 120, 123, and 124 in Appendix A.

5.6.2 Tier II Soil Disposal Facility

5.6.2.1 Description

The Tier II Landfill will be located directly northeast of the station and covers an estimated area of 3600 m^2 in a relatively undisturbed area, and is greater than 1 km distant from the ocean.

5.6.2.2 Construction

A Tier II Soil Disposal Facility is designed to contain contaminated soil exceeding Tier II Criteria. The design of this facility is based on the characteristics of the contaminants in the soils, the geothermal properties of the area, and the local permafrost regime. The design utilizes permafrost as the primary containment barrier. Both the Tier II contaminated soil and the wet, silty gravel perimeter berms are designed to be continuously frozen. A geothermal analysis was conducted to determine the time required for freezeback of the facility and the long-term geothermal regime of the facility. The thickness of the cover material was calculated to prevent thaw of the contaminated soil, even after 10 consecutive 1 in 100 warm years.

A high-density polyethylene (HDPE) liner is placed at the base and side slopes of the facility to provide secondary containment. The liner is chemically compatible with the contaminated soils and will prevent the potential movement of contaminants during the period required for permafrost aggradation. A second HDPE liner is to be placed over the contaminated soils and seamed to the base liner to prevent precipitation from percolating down through the cover fill and into the Tier II contaminated soils. The development and closure of the Tier II facility at FOX-2 will include the following work:

- Construction of exterior berms with saturated silty gravel;
- Supply and installation of HDPE liners;
- Placement of Tier II contaminated soils in the landfill;
- Placement and compaction of intermediate granular cover over the soil.
- Installation of the top HDPE liner;
- Placement and compaction of final granular cover on the landfill;
- Grading to promote drainage away from the landfill; and
- Supply and installation of thermistor strings and groundwater monitoring wells in and around the landfill.

During construction of this facility, the gradation, moisture content and compaction are monitored to ensure compliance with the design.

It should be noted that water management during key trench construction will not be a concern as the facility is located in an area that is free of debris and soil contamination. Any water encountered will be pumped away from the area, without the requirement for testing.

Further details on the design of the Tier II Soil Disposal Facility, including the height of the perimeter berms, thickness of cover material and location of monitoring wells can be found in Drawings H-L133/1-9101-104, 110, 125-126 in Appendix A.

5.6.3 Landfarm

5.6.3.1 Description

The proposed landfarm is located 260 m northeast of the airstrip and covers an estimated area of 17,500 m^2. This proposed area is greater than 600 m from the ocean, which lies to the southwest.

5.6.3.2 Construction

The landfarm will be located at least 100 metres away from any water body, and in an area free of ponded water. The landfarm will be sited to provide for the convenient access of equipment and will be at least 300 metres from the construction camp, offices and laboratory. The area is relatively free of boulders and is generally level. Development, operation and closure of the landfarm will involve the following work:

- Ground 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 Type B contaminated soil in the landfarm.
- Placement of Type B contaminated soils co-contaminated with Tier I contaminants in a separate area of 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.
- Closure and removal of all equipment and materials following confirmation that treatment has remediated the contaminated soil.

During the landfarm operation, granular nutrients are to be distributed evenly over the surface of the contaminated soil, at rates that will provide the minimum nitrogen loading. Moisture conditioning of the landfarm will be conducted as required by application of water spray to maintain optimum water content within the soil.

After application of nutrients, the full thickness of the soil is to be tilled every 10 days. During periods of prolonged warm, dry weather, the tilling frequency will be increased to every 5 days. During periods of precipitation, tilling of the soil will be delayed until the soil is considered damp to a depth of 100 mm.

All contact water in the perimeter collection system is to be collected and tested to ensure it meets the wastewater discharge criteria prior to the end of each operational season. If the contact water does not meet these guidelines, it will be treated so that it does meet the guidelines.

At the conclusion of the final treatment season, the following tasks are to be completed to close the landfarm:

- Confirmatory testing of the soils to ensure the remediation objectives have been met;
- Place and compact granular material from the berms to provide a cover over the remediated soils containing Tier I contaminants. Additional cover material is to be placed to provide a 300 mm minimum depth of compacted granular fill as cover over this soil area. All granular fill is to be compacted to 95% Maximum Dry Density.

- Grade the surface of the area, as required, to promote surface water runoff.
- Decommission the groundwater monitoring wells, including backfilling with appropriate grout, removal of the protective casing, lockable cap and well pipe to within 300 mm from the ground surface, and backfill and compact all voids with granular fill material.

Further details on the design of the landfarm facility are in the Supplemental Landfarm Questionnaire and on Drawings H-L133/1-9101-102, 106, 117-118 in Appendix A.

5.7 Landfill Closure and Grading

There are five landfills at FOX-2 to be closed, which are described in detail in Section 5.9. The following work will be completed as part of the closure:

- Removal of surface debris and compaction of the surface.
- Supply and installation of geomembranes and geotextiles as shown on the drawings.
- Supply, placement and compaction of additional gravel over the landfills.
- Grading to promote surface water runoff from the landfills, and
- Supply and installation of groundwater monitoring wells and thermistor strings (if required).

5.8 Landfill Excavation

Landfills considered a high potential environmental risk, or those landfills located in close proximity to water bodies are being excavated at the FOX-2 site, which include the Airstrip Landfill (Lobe A), Airstrip Landfill – West, and the Upper Site Landfill (Lobe B). Primary landfill excavation includes excavation of all materials to the lateral and vertical extents of the designated landfill area. The depth of the primary landfill excavation extends to competent bedrock or where debris is no longer visible. Secondary landfill excavation includes the excavation of the landfill area beyond the primary landfill excavation limits.

Landfill excavation includes the following:

- Installation/construction of erosion, drainage and sediment control, as required.
- Development of the landfill survey grid.
- Excavation of all waste material from the landfills.
- Removal of all surface debris from the landfill area.
- The development, operation, closure and removal of a Material Processing Area (MPA).

Once excavated, the landfill wastes are transported to the MPA for sorting into hazardous and non-hazardous components. Soils excavated from the landfill are sorted into the contaminated soil classifications, based on the results of sampling and analysis. Clean soil/gravel is placed in the excavated landfill area, once all confirmatory samples have been collected and analysed. The landfill area is then reshaped to match the existing terrain.

During the landfill excavation, the slope stability is to be inspected and maintained. When excavating in the vicinity of a drainage course or a body of water, silt fences, floating silt curtains and/or containment berms are to be constructed to prevent the release of sediment or deleterious substances into the water. Water quality monitoring will be conducted during fishery sensitive construction activities. In the event that water quality monitoring indicates the potential for, or a definitive impact as outlined in the EPP,

immediately suspend operations. Mitigation measures, as outlined in the EPP are to be implemented immediately.

Any ponded water in the landfill excavation area will be dewatered. Prior to dewatering, a sample will be collected and analysed to ensure it meets the discharge criteria. Any melt water/groundwater/leachate will be collected at the low point of the excavation. The water will be allowed to settle prior to sampling and testing of the water.

During landfill excavation, a volatile organic compound (VOC) instrument capable of measuring in parts per million (ppm) and Lower Explosive Limit (%LEL) will be used to continuously measure the concentrations of VOC during landfill excavation operations, and prior to the removal of debris from the landfill.

A full range of clean up and protective equipment will be maintained at the landfill excavation site in the event of a spill. The clean up equipment is to include booms (sorbent and containment), sorbents for cleanup, fire extinguishers for A-B-C fires, overpacks for barrels and contaminated soils, pumps, hand shovels, picks, and containment barriers, such as liner material. Personal protective equipment is to include clothing, protective suits, respirators, etc. to comply with potential emergency conditions and in accordance with NIOSH guidelines.

At the completion of work in the area, sediment and erosion controls will be removed from the water bodies. At the conclusion of the landfill excavation, all sediment, erosion and drainage control measures will be removed from the worksite.

5.9 Description of Existing Landfills

Five existing landfills were investigated during the 2005 site investigation. They are:

- Airstrip Landfill;
- Airstrip West Landfill;
- Airstrip Camp Landfill;
- West Landfill; and
- Upper Site Landfill.

A description of each landfill area is presented in the following sections.

5.9.1 Airstrip Landfill

The Airstrip Landfill is located 650 m northeast of the hangar and is accessed by a trail from the south end of the airstrip. Based on historical air photo review, material was deposited into a topographic low at the base of the bedrock outcrop, where a seasonal water course was located. The area observed comprises Lobes A and B, with a combined size of 1050 m^2. There is ponded water present along the western margin of the lobe and the seasonal water course continues to the north. There is minimal surface or exposed debris present on the landfill surface; the majority of exposed debris is located along the east toe of the lobe. Several small (0.3 m diameter) sinkholes were present on the landfill surface.

The Airstrip Landfill sits at the junction of the rocky, steep, bedrock uplands terrain and the lower-lying, gently sloping marine deposits that are situated closer to the existing shoreline. As such, bedrock outcrops rise up fairly steeply upgradient of the landfill. Lobe B ties into an existing outcrop, while at Lobe A, there is a narrow gap (5 m or less) between the landfill toe and outcropping. Lush moss is present within this gap indicating the area likely accumulates precipitation. Thick snow drifts were observed at the bedrock outcrops upgradient of the landfill throughout the course of the site investigation with significant

water migration through the bedrock fractures during the heavier snow melt in July, either discharging at the base of the bedrock outcroppings, or further away within the marine deposit. Despite the runoff volume, no erosion was noted at the landfill. It appeared that much of the water migrating through the bedrock fractures travels through the landfill at depth, discharging near the toe, as evidenced by the oxide and carbonate precipitates on surface and the ponded water against the toe.

Both lobes are covered in sandy gravel and have minimal surface debris, mostly located along the east toe. The debris included a vehicle part, some barrels, an electrical box and cables, wood, angle iron, braided metal cable, and rope. Some minor debris was also noted in the adjacent ponds.

There is 10% vegetation on and immediately adjacent to the landfill. However, the surrounding area has 20-75% vegetation cover. A fox and wolf were spotted at the Airstrip Landfill, and several species of birds were observed near the landfill, including plovers and snow geese. Ponds at the landfill toe are shallow (approximately 0.5 m deep) and are therefore not considered to be fish-bearing. This landfill is 770 m from the ocean, indicating the primary receptors of concern are terrestrial.

Through the sampling conducted for the environmental investigation, the Airstrip Landfill was noted to be located in a geochemical hot spot on the site, where there are naturally higher concentrations of inorganic elements. A localized area of Tier II copper and zinc is present on the surface of Lobe A near the south end, in an area of iron oxide precipitate. Elevated levels of copper nickel, cobalt, cadmium, lead and zinc were noted at the landfill site. While the majority of observed concentrations were assessed as natural, some concentrations did not correlate well with observed background conditions. It was therefore unclear whether this was an indication of contaminant migration. To be environmentally conservative, the landfill was assessed as though there was contaminant migration.

In anticipation of the need to pump water from the ponded water along the toe during remediation, a surface water sample was collected and assessed against the discharge criteria – no exceedences were identified.

Based on the results of the engineering and environmental investigations, Lobe A is classified as a moderate potential environmental risk. Although the evaluation indicates that the landfill should be leachate contained, because of its small size and the constructability issues associated with the pond at the toe, the recommended remediation plan for this lobe is complete excavation. Lobe B is classified as a low environmental risk, therefore, the remediation plan is to regrade it.

5.9.2 Airstrip West Landfill

The Airstrip West Landfill consists of seven lobes and is located approximately 300 m northwest of the hangar and 300 m west of the airstrip. The landfill is accessed by a poorly developed trail from the hangar pad. Five of the lobes consist of topographic highs raised above the surrounding grade, while two lobes are located level with the surrounding grade within the active beach ridge. The landfill encompasses an area of 2670 m^2. Based on depth of test pit refusal and topography throughout the area, the depth of debris is estimated to range from 0.5 m to 2 m. Cover material consists mainly of sand with some gravel and trace cobbles to mainly cobbles in some areas. There is exposed debris at all lobes.

During the early part of the 2005 site investigation, there was a high volume of rapid surface water runoff through this landfill area. Much of the regional drainage to the east (upgradient) is directed towards the landfill through two large diameter culverts that run through the airstrip. Water migrates through the culverts discharges into several well-developed braided channels, which drain west towards the landfill. Evidence of ponded water around the toe, with some cover reworking was noted in some areas, while

other areas of the landfill are located within the existing beach ridge and are subject to storm surge action. Distance to the shoreline high water mark from the landfill toe varies from 0 to 30 m.

Given the observed geotechnical instability of the landfill and its close proximity to the ocean, it was identified during the investigation that this landfill would likely be excavated. The environmental investigation was therefore tailored based on this information. Minimal environmental sampling was done to investigate whether there was contaminant migration from the landfill, and sampling focussed on surface investigation for contaminated soils to help determine contaminated soil quantities to be expected during excavation. No contaminated soil was identified at the landfill during the 2005 site investigation.

The results of the engineering and environmental evaluation for this landfill indicated is was identified as a moderate potential environmental risk. The driving factors for this are the proximity to the ocean, high receptor sensitivity, high potential for erosion and runoff, and high likelihood of human contact because of use of the area by locals for camping during hunting and fishing trips. Based on the landfill evaluation and high potential for erosion, the Airstrip Landfill West is to be excavated.

5.9.3 Airstrip Camp Landfill

The Airstrip Camp Landfill is located 380 m northeast of the hangar, and is accessed by the same trail that leads to the Airstrip Landfill. The landfill sits within the footprint of the former construction camp. Observations from the air photos noted activities such as camp takedown, earthmoving, material storage, and trenching.

Based on the geophysical survey, the Airstrip Camp Landfill is comprised of one area with an aerial extent of 1170 m^2. There is a subtle topographic expression of the landfill; with an estimated depth of debris is 1.0 m. There was little to no surface debris. A fair bit of settlement was observed in the southern half of the landfill with numerous sinkholes present in the landfill cover and barrels exposed within the holes. Cover material is comprised of cobbles with sand and silt. The airstrip drainage diversion berm is located 15 m west of the landfill with some shallow ponded water between the landfill toe and berm. Run-off is directed to the west towards the berm and to the south towards a larger area of ponded water against the berm. No evidence of erosion was observed at the landfill.

Some iron oxide precipitate was present on the landfill surface near the south corner where groundwater was discharging. However, no surface contamination or evidence of contaminant migration was detected. Caribou have often been observed at the landfill, and a fox and several species of birds including plovers, snow buntings, snow geese and ravens were also seen in the vicinity.

The results of the engineering and environmental investigation found that this landfill was identified as having a low environmental risk, therefore the remediation plan for this landfill is regrading. However, because of the existing settlement, the landfill surface will be compacted prior to regrading.

5.9.4 West Landfill

The West Landfill is located 0.9 km southeast of the beach POL area and 1.4 km west of the Station Area within an old borrow area. The landfill is accessed by a road extending from the main station road into the landfill/borrow area. The landfill consists of four lobes with a total area of 2305 m^2. The main area of the landfill is located within a small overburden terrace, at the junction of the rocky, steep bedrock uplands terrain and the lower-lying, gently sloping marine deposits that occur near the existing shoreline. The landfill toe is raised up to 1.5 m above grade. Bedrock outcropping is fairly continuous east (upgradient) of the landfill, while outcrops occur more sporadically downgradient and at a lower elevation above surrounding grade. Drainage is primarily subsurface, through near-vertical bedrock fractures, and in particular, through a bedrock shear zone located immediately east of the landfill. Groundwater

migrating through the upgradient bedrock fractures discharges along the toe, where the terrain flattens out. One main discharge and surface drainage channel, with strong iron oxide precipitate, is located in the central downgradient portion of the landfill, downgradient of the shear zone.

The overall grade of the landfill area is approximately 10%. Landfill cover is good and consists of gravel with sand and has minimal exposed debris. The limited debris includes some partially exposed barrels along the northwest toe. No erosion was noted at the landfill, likely because the majority of drainage through the landfill area is subsurface.

The West Landfill is located in one of the primary geochemical "hot spots" on the site. The subsurface water migration through the shear zone, with subsequent surface discharge, results in precipitation of iron oxide precipitates, with associated co-precipitation of other metals because of a rapid change in redox conditions. The strong iron oxide precipitates, with associated higher levels of other metals, gives the appearance that the landfill is leaching. However, additional samples were collected in the bedrock shear zone upgradient of the landfill and downgradient drainage channel, and along the same geologic setting south of the landfill to better characterize the area's natural geochemical conditions. A review of the analytical results from these areas and other geochemical "hot spot" areas lead to the conclusion that the landfill is not leaching. Applying the site specific criteria, one downgradient location was noted to have zinc and nickel values at or slightly above the criteria. However, the levels were marginally higher than surrounding sample concentrations, and concentrations of other metals were also relatively consistent, providing strong evidence that the observed concentrations were natural. This area is therefore not considered as being contaminated. Two other areas were found to have elevated levels of arsenic; however, these concentrations were below the site specific criteria and are considered to be naturally occurring. Contaminant migration is not suspected.

Based on the engineering and environmental investigations, the West Landfill was evaluated as a low potential environmental risk. Based on this evaluation, the landfill can be regraded. Because of the small size and impracticality of regrading Lobe D, this area will be excavated.

5.9.5 Upper Site Landfill

The Upper Site Landfill is 200 m east of the warehouse. It was the main disposal area for station operations, beginning in the 1950's. The main portion of the landfill is well defined topographically and there is another small lobe with shallow, spotty debris. The size of the landfill is 4630 m^2, with a estimated depth ranging from 0.5 m to 2.0 m.

Bedrock outcrops around the landfill were noted at the following locations: along the north toe and in spotty locations along the northeast toe, along the access road to the west, and south of the pond. Bedrock in the overall area has been glacially eroded such that the more resistant bedding planes occur as gently rounded, low, linear ridges. Looking perpendicular to the bedding strike (which is roughly east-west), the ground surface is gently undulating. The landfill access road is roughly in strike with bedding planes and occurs along a ridge, where some debris appears to have been pushed over the side. Where bedrock is not outcropping along the landfill toe, it occurs generally at shallow depth (maximum depth of 0.9 m at the eastern tip).

Cover at the landfill is generally good, with minimal exposed debris on the surface, and occasional exposed debris along the toe. There is a partially buried steel structure in the centre of the landfill with a 1 m deep void inside. There are surface stains and scattered debris on the landfill surface, as well as significant quantities of scattered debris beyond the landfill toe, extending out 200 m.

Several contaminated soil areas were identified on the surface including one area of leachable lead (hazardous soil); two areas of Tier II; two areas of Tier I; and two areas of Type A hydrocarbons. In

addition, multiple areas of contamination were identified downgradient. Although these contaminated soil areas are generally associated with surface debris or staining, because the impacts are so widespread, it was impossible to distinguish whether the landfill itself was acting as a contaminant source. To be environmentally conservative, the landfill was assessed as having evidence of contaminant migration.

In anticipation of the need to pump water from the ponded water along the toe during remediation, a surface water sample was collected and assessed according to the discharge criteria. No exceedences were identified.

Based on the results of the engineering and environmental assessment, the Upper Site Landfill was evaluated as having a moderate potential environmental risk. The remediation option is to leachate contain the landfill, with some areas being excavated.

5.10 Disposal of Site Debris

All site debris is to be disposed of in accordance with the DND/NTI Agreement. Debris will be sorted and classified as hazardous or non-hazardous. Hazardous materials will be shipped off-site for disposal, and non-hazardous debris will be placed in the NHW Landfill. Creosote treated timbers will be wrapped in plastic and asbestos will be double-bagged and disposed of in the NHW Landfill. PCB painted material will be segregated and disposed of at a licensed disposal facility.

Debris removal operations will be monitored to identify potentially hazardous materials. If suspected hazardous materials are identified, operations will be suspended until the nature of the material is confirmed. Any stained soils encountered during debris removal will also be excavated and tested for classification purposes. Where scattered or embedded debris is removed, the area will be reshaped if necessary and any voids left by removal of debris will be backfilled with granular material. When working in the vicinity of a drainage course or body of water, silt fences, floating silt curtains and/or containment berms will be erected to prevent the release of sediments or deleterious substances into the water. Table 8 provides a summary of all debris areas.

Table 8: Summary of Debris Areas

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
Airstrip Area					
104	102	North of Airstrip West Landfill, west of north end of airstrip - rusted out drums, scattered wood, metal pin with pipe sections, cans, glass, lighter fluid, pile of wood, campfire debris	39,448	2.5	Restricted access to area – widespread archaeological features to east and north.
201	102	North end of Airstrip - 31 pairs of marker barrels and strapping	5,000	10	Difficult access, wet and soft ground conditions
202	102 / 106	Proposed Landfarm Area 3 - scattered surface debris, including burn area, miscellaneous wood and metal, rope, tin cans, glass 250 m northwest of proposed landfarm area - surface and partially buried debris, including crushed barrel culverts, wire, pallet, 2 drums, pails, timber	TBD – includes SD 236	2.0	Limited access soft and wet areas - some scarring in area.
206	102	Extending southeast from the airstrip to the ocean - 9 pairs of marker barrels and strapping	2,600	2.5	Good access to most areas
207	102	East of hangar (650 m) north of road - scattered surface debris, including barrels, miscellaneous wood, sign posts, strapping, rope.	2,600	1.5	Road Access
208	102	West End of old airstrip connector road - paint cans, rebar, metal pipe, miscellaneous wood, timber, drums	10,000	1	Road access. 2 discrete areas. Note archaeological feature between two areas of debris.
209	102	Borrow Area and Emergency Shelter Area - scattered miscellaneous wood, metal, tin cans, fibreglass, metal sign posts, partially crushed drums, rebar, metal plate	15,000	1.5	Road access to most areas, some debris in shallow pond. 3 discrete areas.
235	102	200 m southeast of north end of airstrip - surface and partially buried debris, including crushed drums, crushed barrel culverts and pallets.	6,800	3	Vehicle access to most areas, some ponding, soft and wet areas.

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
237	102	North end of airstrip - 7 crushed/partly crushed drums, tin cans, timbers, wires, cables, miscellaneous wood and metal, 6 marker drums, rope	18,417	2.5	Six discrete areas. Vehicle access to most areas, some ponding.
304	102	300 southeast of hangar, NE of road, at culvert 7645891, 489085; in water - single partly crushed drum, and rebar	10	0.5	In water to a depth of 0.5m
109	103	Fishing Lake - boat with pontoons made of drums, wood, wood canoe, drums, pipe, rope, angle iron	87,747	10	Difficult access along shoreline, with the exception of boat. Slight trail to area, some debris (drums and wood) located further along shoreline from access trail point. Received approval from DCC to investigate area/include for cleanup.
210	103	850 m northwest of Beach POL, west of road - drums, cable, siding, timer, miscellaneous wood and metal, 2 4x4 timber posts	67,000	1.5	Good access archaeological features in area.
211	103	300 m northwest of Beach POL, west of road, overlaps with Borrow Area 8 - metal siding, timber, strapping, 2 crushed drums	20,000	1	Good access, 2 discrete areas at north and south end.
227	103	Emergency Shelter north of Beach POL - scattered metal, wood, wire	1,500	0.5	Road access.
219	104 / 109	Water Supply Lake – West End - scattered debris including chains, barrels (7+), miscellaneous metal and wood, electrical box, plywood, timbers, fibreglass insulation, dock along shoreline	13,181	10	Road access to the west side, difficult access to south and east sides of lake
226	104	Booster Pump Area, Borrow Area 6 - oil filters, cable, miscellaneous wood, rebar, glass, tin cans, rubber tube	300	0.5	Road access.
239	104	Low lying area at toe of slope below SRR - embedded grounding rods	5,500	0.1	Accessible from East Landing area, difficult access.

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
103	105 / 113	Airstrip West Landfill Area - 30+ partially buried and exposed barrels, metal siding (1X4m), wood (timber, pallets, plywood, timber), tin cans, rubber tire, rebar, chain, rope, cat track, pipe, stranded cable	18,400	11.6	Access to Airstrip West Landfill. Includes Airstrip West Landfill Lobes B1 to F.
105	105	Between Airstrip and Airstrip West Landfill - drum with intact bung, appears to have contents, rusty with no holes or bulges	10	0.1	
106	105	North northwest of Hangar - wood debris near ceiling projector (concrete base with cables emerging from top), electrical cable, drums, insulation, tin cans, oil filters	2,800	1.5	Ceiling projector base will need to be cut to grade
205	105	Emergency Shelter on south side of hangar and surrounding areas to the south and west of hangar pad - scattered and partially buried debris, including barrels, sign posts, strapping, pipes, tin cans, miscellaneous wood and metal, fridge, cable, domestic waste, plastic and rebar. Northwest of Hangar, near Apron Debris Lobes C & D - 2 empty drums, barrel culverts, wood (2X6"), cables Behind (west) of Hangar - 2 small partially buried debris piles containing wood crates, metal strapping, paint cans, metal cable, drums, tarp, 2 surface drums further to west and south	TBD includes SD 101 and 102	16.4	Road access. Widespread archaeological features to the west to be avoided.
238	105	South side of middle of airstrip - piece of exposed CSP culvert	150	1	Road access.

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
203	106	Airstrip Landfill - scattered surface debris including drums, miscellaneous metal and wood, tin cans, electrical panel, domestic waste, wheel rim, steel, strapping, steel pieces of machinery beyond toe	8,300	6	Good access, some ponding and bedrock. Includes debris from landfill lobes A and B. Minor debris in adjacent pond.
204	106	East of Airstrip, encompassing the old airstrip camp and proposed hangar NHWLF - scattered surface and partially embedded debris, barrel culverts, wood crates, tin cans, bbq's, 1 lb propane cylinder, cables, plastic, tarps, drums, timbers, parts of bladder, steel bar, valve, gasket, wood, pipe, strapping, rebar, glass, distance markers, sand bags, heavy steel fragments.	111,043	26.5	11 areas of debris within lobe. Road access to most areas.
212	107	Beach POL - scattered and partially buried debris, including refuel hose, drums (5+), barrel markers, timbers, metal grate, partially buried miscellaneous heavy metal.	18,168	4	Road access. Includes debris from Beach Refuel Debris area Lobes A and B.
215	107	West Landing Area - scattered surface debris, including burnt wood, strapping, cans, drums (4+), canvas, rope, pallet of steel strapping, timber, miscellaneous wood and metal, lamp post, steel frame. West Landing Area – Pallet Line - stockpiled debris including 56 marker barrels, drums, treated poles, timber, pallets, pipe fittings, valves, fuel hoses, metal box Pallet Line Area southeast of Beach POL, east of drainage channel - propane cylinders, 20L pails, 415 drums, marker barrels strapping, wood pallets, timbers, miscellaneous wood and metal, wire, rope	TBD – includes SD 213 and 215	182	Road access, pallet of steel strapping extremely heavy. Includes West Landing Debris Area Lobes A, B, D.
306	107	West Landing Debris Area - crushed barrels, wood fragments, metal strapping	215	1	Includes West Landing Debris Area Lobes E and F.

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
216	108	Northwest of Intersection to West Landfill - wood, timbers, steel strapping	200	2	Limited access, bedrock
217	108	60 m southwest of West Landfill Lobe A - scattered and partially buried debris, including wood box, crushed drums and timbers	1,500	4	Road access.
218	108	300 m east of West Landfill Lobe B, along communication lines south of road - timber	50	1	Good access from roadway.
230	108	West Landfill Lobes A and B - surface and partially embedded debris including miscellaneous wood and aluminium, metal, chair, steel, metal box, drums, strapping, web strapping, steel frame, tin cans, partially buried dozer tracks, 2 barrels	1,500	3	Road access.
231	108	West Landfill Lobes D and E - scattered surface debris, including miscellaneous wood, metal and 5+ drums	20,000	1	Road access.
107	109 / 110	Entire Upper Site including surfaces of landfill/debris lobes - rebar, bolts, metal siding, canvas, wood, electrical cable, insulated pipe conduit, tin cans, metal sign, strapping, cardboard, marker barrel, glass, timber pile, wire, rope, pail, copper pipe, mesh, paint cans, batteries, oil filter, metal grating, angle iron, electrical socket and panels, burn piles, mattress stuffing, metal bowl, foil, heavy duty cables, small drums, metal tracks, clamp, film, seat cushion springs, garbage can lid, 4 cut power poles with guy wires and anchors, wood shed, pallets, small communication tower, metal anchors, asbestos, electrical components, outfall lines and associated marker barrels.	344,400	105	Difficult access in outlying areas. Scattered and windblown debris within boulder fields.
220	109	250 m West of East Landing and Station Intersection - scattered wood and drum	500	0.5	Road access.

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
228	109	Emergency Shelter/Inuit House west of Station Area - scattered debris including miscellaneous wood, metal, tin cans, fibreglass and wire	2,000	1	Road access.
232	109	150 m Southwest of Old Construction Camp on Bedrock outcrop - PVC pipe – 1" X 12' long	200	0.1	Limited access, on bedrock outcrop.
234	109	North of POL line, 360 m south southeast of East Landing intersection - plywood	100	0.2	Limited access, exposed bedrock throughout area
108	110	At base of slope between Station and Water Lake along cliff/steep slope - 1 cut power pole, 3 sheets of plywood, 5 barrels, wood boxes, cables, rebar	14,235	2.5	Difficult access from east landing – some debris along very steep slope. Small amount of debris in shallow water.
225	111	100 m southeast of East Beach area Lobe B - plywood and timber platform, picnic table, chairs, miscellaneous wood.	400	8	Road access. Limited access to areas downslope, archaeological features nearby.
229	111	East Landing Area, East Beach Debris area Lobe B - scattered and partially buried debris including, strapping, miscellaneous wood and metal, tin cans, cloth, wire, grader blade, drums (5+), pulley, stranded cable, wheel hub, suspension	1,300	2	Limited access to areas downslope (channels and along toe), archaeological features nearby.
301	111	East Beach Debris Area Lobe A - 2 partially buried barrels	80	0.2	**Leave if <50% exposed.**
302	111	East Beach Debris Area Lobe C - 10+ exposed and partially exposed barrels	60	1	Archaeological features nearby, some barrels below roadway, limited access at low tide, steep grades.
303	111	East Beach Debris Area Lobe D - wood fragments, glass, tin cans, partially buried metal (cog and electrical cable)	50	0.5	Below roadway, steep grades.
305	111	Borrow Area 2, Lobes A and B - partially buried metal box, bed spring, glass fragments and angle iron	805	1.2	
222	112	200 m northwest of north end of East Landing are - crushed drum	175	0.1	Limited access, road washed out.

Site Debris Area	Drawing Reference	Approximate Location, Description, and Type of Debris to be Removed	Arial Extent (m^2)	Approximate Crushed Volume (m^3)	Comments
223	112	300 m north of East Landing area, along beach - miscellaneous wood	200	0.5	Limited access along shoreline, archaeological features nearby.
224	112	East Landing Area - scattered and partially embedded debris, including miscellaneous wood and metal, drums (5+), timbers, rope, wire, guy anchors, strapping, rubber, chain, aluminium box, copper wire, piece of tower (galvanized steel), partially buried construction equipment	35,000	15	Road access to most areas.
East Landing Debris Area Lobe D	112	East Landing Debris Area Lobe D - wheel hub	40	0.5	Along roadway.
Marker Barrels		Between Hangar and Station Area - 572+ marker drums for POL and communication lines	~7.5km	70	Difficult access in bedrock and low lying areas, barrel total excludes stockpiles at west landing area.

5.11 Demolition

The work to be conducted at the FOX-2 site includes the demolition, removal, disposal or containerization of all structures and utilities as shown on the demolition drawings (refer to Drawings H-L133/1-9101-201 to 213) and includes the following:

- Removal and disposal of all contents of buildings identified for demolition, including storage tanks. Tanks and pipes containing fuel must be pumped out or drained prior to cleaning and disposal.
- Removal, segregation and containerization of building facility components coated with PCB amended paint at PCB concentrations in excess of 50 ppm.
- Removal and disposal of asbestos material in accordance with the asbestos abatement program. Asbestos must be removed and disposed of in a method that eliminates the risk of exposure to friable asbestos. Proper personal protective equipment and specialized equipment is required when removing asbestos. Asbestos materials are bagged in polyethylene prior to placement in the NHW Landfill.
- Removal and disposal of concrete contaminated with PCBs at concentrations in excess of 1 ppm and less than 50 ppm.
- Removal and containerization of concrete contaminated with PCBs at concentrations in excess of 50 ppm.
- Removal and placement of hazardous demolition waste material in containers in accordance with the Hazardous Waste regulations. Hazardous demolition waste is segregated and disposed of according to CEPA guidelines.
- Removal, wrapping in plastic, and disposal of creosote treated timbers in the NHW Landfill. Creosote coated power poles or foundations are to be cut off 300 mm below ground level.
- Removal and disposal of drainage culverts.
- Disconnecting and capping of services, as required.
- Non-hazardous building materials require no special treatment and can be crushed and placed in the NHW Landfill.

Demolition debris to be disposed of on-site will be cut into shapes and sizes that minimize void space when landfilled. Concrete foundations are largely left intact except where coated with PCB paints. Following the removal of site structures, demolition areas are reshaped or backfilled with granular fill to a height flush with the remaining foundations. All voids or holes that are left by foundation or structure removal are filled with gravel.

A complete inventory of existing buildings, facilities and site debris was prepared during the 2005 Site Investigation. Combined with analytical results from a paint and painted substrate sampling program carried out by ESG, a summary of non-hazardous and hazardous demolition material volumes was developed. Non-hazardous waste materials generated through demolition, landfill excavation and site debris removal, are used in establishing a design capacity for on-site Non-Hazardous Waste Landfill(s).

The following table provides a summary of the demolition requirements.

Table 9: Demolition Requirements

Structure	Qty	Description	Hazardous Material	Building Contents (During Survey)	Systems (Mech.,Elect., Other)	Ref. Drawing	Remarks
Tower and Radome, Radar	1	18 m W x 18 m L x 20 m H Steel frame tower with 18 m diameter fibreglass dome (3 mm thick) on top.	None	Radar antenna 10 m H x 15 m L x 3 m W metal components inside dome.	Electric power and radar link through passageway linking dome and module.	201 & 210	Radome located directly above module train.
Module Train	1	8.5 m W x 132.9 m L x 3.5m H. 26 modules total. 23 modules with wood framed insulated plywood panels, metal sheathing on roof. 3 modules with fire barriers – steel box type with heated cross corridor. Post/timber sill foundation.	Asbestos: Type 3: 1456 1 m of pipe < 150 mm and 10 1 m of pipe > 150 mm. Type 1: 74 m^2 fire doors and duct cloth. PCB's in ballasts, furnace duct, voltage regulators, capacitors, and other electrical items.	Building contains electric power plant, water treatment and internal storage facilities, kitchen, bakery, offices, cold/dry storage, bedrooms, bath and laundry facilities.	Elec: From internal generating equipment. Mech: heat from circulating hot water utilizing power plant engine heat recovery system. In C & E modules, heat recovered from electronic equipment and is re-circulated via fans and ductwork. Internal plumbing system terminating at internal storage tank serviced by outfall line. Water and sewer via internal storage tanks. Duct forced air exhaust system for ventilation. Emergency dry toilet facility. Diesel supply via 2-1500 gallon fuel tanks.	201, 206 & 207	Surveillance radar antenna housed in rigid, unheated radome located on independent platform straddling module train.
Garage	1	12.8 m W x 25 m L x 4.9 m H. Rigid frame steel structure on concrete footings on fill. Exterior metal cladding, insulated. 5 overhead doors. Interior steel frame supporting overhead crane and mezz. floor.	Asbestos: Type 3: 10 1m pipe > 150 mm. Type 1: 1m^2 duct cloth. Lead paint with PCB's. Mercury vapour lights.	Survival electric power plant unit, equipment for MV maintenance and repair, emergency radio system.	Elec: External supply via station plant utility bus. Emergency lights, battery powered. Mech: Hot air, oil-fired furnace supplied by 2-275 gallon fuel tanks. No water and sewer.	201 & 205	

Structure	Qty	Description	Hazardous Material	Building Contents (During Survey)	Systems (Mech.,Elect., Other)	Ref. Drawing	Remarks
Fuel Tank – Diesel	1	500 US gallon steel tank on steel frame. 1.8 m L x 1.3 m Dia.	None	Empty	Filled via site POL pipeline.	201 & 212	Located adjacent to the garage.
Fuel Tank – Diesel	1	18,300 US gallon steel tank. 2.5 m Dia. x 13.6 m L.		Tank contains 4,500 Gallon – diesel.		203 & 212	Airstrip area
Fuel Tank – (JP-4)	6	18,300 US gallon steel tank. 2.5 m Dia. x 13.6 m L.		Airstrip tanks: 2,500 Gallon each. Beach tanks: 1,000 Gallon, 14,000 Gallon, 13,000 Gallon and 12,000 Gallon.		202, 203 & 212	Four at Beach area and two at Airstrip area.
Warehouse	1	12.6 m x 30.4 m steel frame with metal cladding, insulated. Concrete footings on fill supporting concrete slab 1.2 m above grade.	Asbestos: Type 3: 5 1m pipe >150 mm. Type 1: 20 m^2 of sheeting for furnace room. PCB's in ballasts and paint. Lead paint. Upper 10 mm of concrete floor.	Office, storage, receiving dock, security crib.	Elec: External supply via station plant utility bus. Emergency lights battery powered. Mech: Ducted forced air system, oil fired furnace supplied by 2-250 gallon fuel tanks.	201 & 204	Warehouse demolition to include floor assembly and columns below floor. Pad footings to remain.
Communication Dish	4	4.3 m x 5.4 m x 12 m H structural steel tower with 9.2 m dia parabolic dish. 2.9 m to U/S of dish.	None	Tower enclosed with metal cladding containing ducting and furnaces.	Two forced air furnaces used to deice parabolic dish.	201 & 211	
TV Satellite Dish	1	Parabolic dish with structural steel support frame.	None			201	
Stevenson Screen	2	400 x 600 x 1800 H timber construction enclosure for weather instruments.	None			201	

Structure	Qty	Description	Hazardous Material	Building Contents (During Survey)	Systems (Mech.,Elect., Other)	Ref. Drawing	Remarks
Hangar	1	36.6 m x 40.8 m with 2 door storage/furnace areas 8.2 m x 8.5 m. Steel frame building with insulated metal panels. Concrete footings on fill.	Asbestos: Type 3: 6 1 m pipe 150 mm. Type 1: 20 m^2 Fire doors and duct cloth.	Aircraft shelter and maintenance. Airstrip lighting controls.	Elec: External supply via station plant utility bus. Emergency lights, battery powered. Mech: Ducted forced air system from two oil fired furnaces supplied by 4-275 gallon tanks. Ducted system with exhaust fans for ventilation. No water or sewer.	203 & 208	Concrete floor slabs in storage/furnace rooms.
Weather Facility ATB Trailer	1	8.5 m x 2.8 m with 1.2 m x 2.4 m vestibule. Prefabricated unit, plywood and steel sheeting on welded steel frame. Timber sill foundation.	Asbestos: Type 3: 4 lm of pipe >150 mm. Other: 1 m2. Refer to Asbestos Survey Table.		Elect: External supply via hangar bus system. Mech: Forced air system from oil fired furnace. Portable commode, exhaust fan for ventilation.	203	
Weather Instrument Pole	1	15.25 m high creosote pole with weather instrumentation	None			203	
POL Line	4800 lm	50 mm O.D. steel pipe.			Including building feeder lines at Station and Airstrip.	201 & 202	From Station Area to West Beach Area
POL Pumphouse	2	2.4 m W x 2.4 m L x 2.5m H. Steel frame with metal cladding, no insulation. Concrete footings on fill.	Lead paint on piping.	7.5 HP electric transfer pump and piping.	Elec: External supply via station plant utility bus. Mech: Piping and pumps connected to oil storage tanks.	201 & 209	
Diesel Day Tank	2	500 US Gallon steel tank and stand. 1.2 m dia. x 1.8 m L.		Empty	Filled via site POL pipeline system.	201, 203 & 212	
Diesel Day Tank	1	1,500 US Gallon steel tank. 1.6 m dia. x 1.8 m L.		700 Gallon - diesel		201 & 212	
Fuel Tanks – Diesel	4	65,000 US gallon steel tanks. 5.5 m H x 7.8 m Dia. Steel plate tank on concrete slab foundation.	PCB's and lead in paint.	Tank # 10 – 15,000 Gallon – diesel. Tank #9 – Empty.	Hose connection from Station Tanks to SRR.	201, 202 & 212	

Structure	Qty	Description	Hazardous Material	Building Contents (During Survey)	Systems (Mech.,Elect., Other)	Ref. Drawing	Remarks
Fuel Tank – Mogas	3	6,000 US gallon steel tank. 2.4 m Dia. x 5.4 m L.	None	Empty	Valves and vents for fitting and emptying.	201, 202 & 212	Two at Beach Area and one at Station Area
Utility and Antenna Poles	13	Creosoted timber and steel lattice towers < 20 m high supporting various antenna and weather instruments. Poles guyed with steel cables. Includes H/F Air Ground Antenna.	None			201	
JP-4 Fuel Line	100 lm	150 mm dia.				202	JP-4 transfer line at Airstrip
Sewer Line	126 m	76 mm metal pipe from module train to outfall.	None			201	
Power/ Communication Cables	~ 7 km	10 power/cables from Station Area to Airstrip Area.	None			201, 202 & 203	
Runway Markers	8	Plywood and light angle framing denoting end of runway and 500 ft to go. 2.5 m L x 1.1 m H	None			203 & 213	
Runway Lights	37	White lights on side of runway, 0.9 m high.				203 & 213	
Taxiway/Apron Lights	6	Outlining blue lights, 0.9 m high.	None			203	
Runway Threshold Lights	20	Green marker lights, ten at each end of runway. 0.9 m high.	None			203	
Beacon Light	1	NX-4000 beacon light located on top of hangar.				203	
Runway Strobe Lights	4	2 at each end of runway to be removed.	None			203 & 213	
Drainage Culverts	38	Shallow buried CSP pipe of various length and diameter.	None			201, 202 & 203	

Structure	Qty	Description	Hazardous Material	Building Contents (During Survey)	Systems (Mech.,Elect., Other)	Ref. Drawing	Remarks
Wind Sock	1	Steel pipe mast with cloth wind sock illuminated with four white lights.	None			203 & 213	
Ceiling Projector	1	0.5 m high, 125 mm dia. steel pipe as support.				203 & 213	
Transformer Platform	1	Utility pole/timber, joist/plank construction.	None			201	Located outside of Module Train Power Plant.

5.12 Barrel Disposal Requirements

In order to determine the correct disposal method for barrels and their contents, the contents must first be identified by sampling and analyses. Analytical data obtained for the barrel samples at the site will be compared to the criteria included in Table 10. Barrel contents are identified as organic or aqueous and the concentrations of glycols, alcohols, PCBs, chlorine, cadmium, chromium, and lead are determined. Uncontaminated aqueous phases can be disposed of on the land; uncontaminated organic phases can be incinerated; contaminated aqueous material will be scrubbed free of organic material, and contaminated organic material will be disposed of as hazardous material.

Table 10: Barrel Disposal Requirements

Phase	% Glycols or Alcohols	PCB	Cl	Cd	Cr	Pb	Disposal
Organic	-	<2	<1000	<2	<10	<100	Incineration
Organic	-	>2	>1000	>2	>10	>100	ship south
Aqueous	>2%	>2	>1000	>2	>10	>100	ship south
Aqueous	>2%	<2	<1000	<2	<10	<100	Incineration
Aqueous	<2%	-	-	-	-	-	scrub & discard

Note: All concentrations are in mg/L.

5.12.1 Inspection

All barrels will be inspected to address the following items, which will be recorded and used as a guide prior to opening barrels.

- Symbols, works, or other marks on the barrel that identify its contents, and/or that its contents are hazardous, i.e., radioactive, explosive, corrosive, toxic or flammable.
- Symbols, words or other marks on the barrel that indicate it contains discarded laboratory chemicals, reagents, or other possibly dangerous materials in small volume containers.
- Signs of deterioration or damage such as corrosion, rust or leaks at seams, rims and V-grooves.
- Evidence of spills or discolouration on the top and sides of the barrel.
- Signs that the barrel is under pressure, such as bulging or swelling.

The area around the barrels that show evidence of holes, rust points, or openings will be tested using a Volatile Organic Compound (VOC) instrument prior to movement of the barrels. If the measured VOC levels exceed 20% of the Lower Explosive Limit (LEL), all handling, storage and transportation operations will be conducted in accordance with the appropriate sections of the National Institute for Occupational Safety and Health (NIOSH) guidelines, National Fire Code of Canada, and the TDGA for flammable and combustible materials.

5.12.2 Opening

If the bungs of a barrel can be readily moved, the barrel will be opened slowly, allowing time for any pressure in the barrel to be released before the bungs are fully removed. If the bungs of a barrel cannot be readily moved, or if the inspection suggests that opening of the barrel may present a special hazard, the barrel will be remotely vented to relieve any internal pressure that may be present prior to opening.

Pressurized barrels are extremely hazardous and will be opened with extreme caution. Only non-sparking equipment will be used. All personnel responsible for opening barrels will be provided with appropriate safety equipment and clothing. All barrels will be opened in accordance with the procedures outlined in the Occupational Safety and Health Administration (OSHA) Code of Federal Regulations Title 29, Part 1910, Section 120 (29 CFR 1910.120) Hazardous Waste Operations and Emergency Response (HAZWOPER).

5.12.3 Sampling and Testing of Barrel Contents

The barrels will be numbered and cross-referenced to sample numbers. The following is a summary of the procedures for sampling and testing barrels.

- Each barrel will be sampled using a dedicated drum thief.
- Barrels with less than a 50 mm depth of liquid contents may be combined with other barrels' contents with similar colour and viscosity prior to sampling.
- Barrel contents are to be consolidated in the MPA.
- Any barrel contents consisting of black oil are NOT to be consolidated.
- Barrel contents inferred to contain only water based on visual observation will be tested to confirm the presence of glycol and/or alcohol.

5.12.4 Disposal of Barrel Contents

Barrels containing rust and sediment may be shredded and placed in the NHW Landfill. Barrel contents consisting of water with glycol and/or alcohol or organic phases, and meeting the criteria listed in Table 10 may be incinerated on-site or packaged for off-site disposal. The contents of barrels containing water and less than 2% glycol or alcohol will be transferred to an oil-water separator. Small volumes may be agitated with oil-absorbent material to remove any organics. Barrel contents with concentrations of parameters in excess of the criteria in Table 10 will be packaged in accordance with the TDGA regulations and disposed of at a licensed off-site disposal facility.

A leachate extraction test will be completed on the solid residual material resulting from the incineration process. The leachate toxicity of the material will be determined in accordance with the TDGA. Materials found to be non-toxic will be buried in the Tier II Soil Disposal Facility. Toxic materials will be packaged and transported off-site for disposal in accordance with TDGA regulations, as required.

Used oil-absorbent material will be tested to determine treatment and disposal requirements. Oil-absorbent material which meets the criteria in Table 10 will be incinerated. If the criteria are not met, the materials will be packaged in accordance with TDGA regulations, as required, and disposed of off-site at a licensed disposal facility.

5.12.5 Cleaning and Disposal of Barrels

All empty barrels will be steam cleaned to remove any residual oil, wax, tar and other residue adhering to the surface. If a residue remains, a detergent cleaning solution will be applied by spray or brush and allowed to soak for 30 minutes. Barrels will be steam cleaned again after detergent application. Solvents will only be used if the detergent does not adequately remove the residue. The solvent rinsate material will be tested to determine disposal requirements. The steam cleaning rinsate may be recycled and will be directed to an oil-water separator. Oily waste residue may be removed by agitation with an oil-absorbent material to remove organic material. The resulting rinsate will be tested to determine if it meets the discharge criteria. If the rinsate does not meet the discharge criteria, it will be packaged in accordance with TDGA regulations and disposed of off-site at a licensed disposal facility. The used oil-absorbent material and/or oil liquid waste will be disposed of as described in Section 5.12.4. All empty barrels will be crushed or shredded prior to disposal in the NHW Landfill.

5.13 Removal of Hazardous Material

"Hazardous" waste materials are defined as waste materials that are designated as 'hazardous' under Nunavut or Federal legislation; or as 'dangerous goods' under the Transportation of Dangerous Goods Act (TDGA). The Canadian Environmental Protection Act (CEPA) regulates material containing PCBs at concentrations greater than 50 ppm. Specific hazardous materials may include: batteries, asbestos, fuel tank bottom sludges, solvents, PCB-containing fluids, fuels and lubricating oils, alcohols and glycols, and heavy metal contaminated liquids. Disposal requirements of these hazardous waste materials are presented in Table 11.

Table 11: Hazardous Waste Material Disposal Requirements

Hazardous Waste Material	Disposal Requirement
• Batteries • Heavy metal contaminated organic liquids • Liquids containing organic compounds with chlorine concentrations >1000 ppm • Liquids containing organic compounds with PCB concentrations >2 ppm and <50 ppm	• Off-site licensed treatment/disposal facility (by separate contract)
• Fuel tank bottom sludges • Fuels, lubricating oils, alcohols and glycols	• Off-site licensed treatment/disposal facility (by separate contract) **OR** • On-site incineration in accordance with the contract specifications
• Liquids and solids containing organic compounds with PCB concentration >50 ppm	• Off-site licensed treatment and disposal facility

5.14 Transportation of Hazardous Materials Off-site

Hazardous materials are placed in environmentally suitable containers (typically lined and braced sea-cans) at an approved containment facility on-site. A storage area is established and registered with Environment Canada. The hazardous materials are removed by sea-lift in accordance with the TDGA Regulations.

5.15 Grading and Addition of Granular Materials

There are numerous areas identified that require grading and possible addition of granular materials. These areas generally consist of piles of buried or partially buried non-hazardous debris that will be covered with additional granular material and shaped to blend in with the natural terrain and promote positive drainage. These areas are identified on the drawings provided in Appendix A.

5.16 Future Activities

The site was shut-down in the early 1990's, although there is a North Warning System Short-Range Radar site at the same location. There are no current plans to change this land use. The only planned future activity for this site is the landfill monitoring program, which was agreed to in the DND/NTI Cooperation Agreement.

6.0 Description of the Environment

6.1 Climate

FOX-2 is located on the west coast of Baffin Island approximately 162 masl. The mean annual rain and snowfall are 95.3 mm and 118.9 cm, respectively. The mean daily temperatures at FOX-2 range from 7.0°C in July to -28.7°C in February, with an annual average of -12.5 C. The winds are predominantly from the east and average 16.8 km/hr, and are slightly reduced in summer.

6.2 Geology

The Longstaff Bluff area is underlain by the Longstaff Bluff Formation of the Piling Group. The rocks of the Piling Group were deposited in middle Paleo-Proterzoic time on a continental margin that was evolving from a continental shelf (quartzites and marbles of the underlying Dewar Lakes and Flint Lake Formations) to a foredeep environment (Longstaff Bluff Formation). They were deformed and metamorphosed in the Trans-Hudson Orogeny (folding, faulting and mountain building event 1.8 billion years ago) and now constitute part of the Foxe Fold Belt. Just to the west of Longstaff Bluff on Baird Peninsula, the Proterozoic rocks are overlain unconformably by much younger, undeformed lower Paleozoic limestones.

The Longstaff Bluff Formation is described as interbedded psammite, semipelite, pelite, arkosic- and lithic-wacke with minor calc-silicate beds. These rocks originally varied in grain size from sandstone to shale and mudstone, and in composition from relatively pure quartz, through feldspar rich, to very dirty with mixed mineralogy and sand-sized rock fragments, and locally contained minor muddy limestones. At Longstaff Bluff, these rocks have been tightly folded into isoclinal folds (fold limbs nearly parallel). The axial planes of the folds, the rocks on the fold limbs and the cleavage developed in the rocks all strike east-northeast. The fold axes plunge gently to moderately to the northeast. The metamorphism that accompanied deformation produced coarser biotite, muscovite and locally garnets in the more impure rocks (less quartz-rich). There is a mappable increase in metamorphic grade northward in the Longstaff Bluff area, with the south tip of the peninsula containing only the above-mentioned minerals, and the rest of the peninsula being higher grade and also containing cordierite with or without andalusite. This change in metamorphic mineralogy is demarcated on the peninsula by an isograd. Near the south tip of Longstaff Bluff peninsula, this mineral isograd is offset in a right-lateral sense by a later northwest-striking fault.

The Longstaff Bluff formation is stratigraphically underlain by the Astarte River Formation. The latter varies in grain size from slate to schist with increasing metamorphic grade. It is rich in iron sulphides throughout and is locally graphite-rich. The Astarte River Formation is locally infolded and also structurally repeated by thrust faulting in areas of predominantly Longstaff Bluff formation. This is only apparent in areas of detailed bedrock mapping, yet likely in other areas also, such as the Longstaff Bluff region. The regional metamorphism has redistributed sulphide minerals (primary mineral sources of trace metals) in the Astarte River Formation and concentrated them into seams parallel to the cleavage and axial planes of the folds.

The area underwent significant deformation during the Trans-Hudson Orogen and is dominated by highly deformed and folded Precambrian metasedimentary bedrock outcrops consisting of interbedded sandstones of varying composition (psammite, arkosic and lithic greywacke), and mudstone/shale (pelite). The beds are steeply dipping and give an overall corrugated appearance to the site in air photos. Several north-south trending dykes and a system of fault-related lineations were also identified by air photo review, and several shear zones were noted during the course of the investigation.

Following retreat of the Laurentide ice sheet, rising sea levels and isostatic depression resulted in reworking of glacial deposits located at lower elevations. This marine transgression formed a discontinuous to continuous blanket of coarse marine and glaciomarine deposits. Above the level of marine transgression, the area is covered with a discontinuous veneer of till and felsenmeer deposits (rock fragments derived from frost shattering of bedrock) amidst glacially scoured bedrock outcrops. Generally, in lower elevations of the overall bedrock uplands (the area not subjected to marine reworking), bedrock outcrops form a rough, jagged, and highly irregular surface. At higher elevations, bedrock has been eroded more extensively and forms a surface gently undulating linear ridge and troughs.

6.3 Surficial Geology

With the retreat of the Laurentide ice sheet approximately 6,000 years ago, global sea levels began to rise along with the earth's crust through isostatic rebound. The marine water transgression within the project area reached an elevation as high as 99 m. Therefore, at elevations higher than 99 masl, till is the prevalent deposit type and is characterized as a well-graded, clayey, silty and sandy matrix with a gravelly, cobbly and bouldery content. It typically occurs as thin veneer over top of bedrock. Below 99 masl, marine-washed deposits dominate the present-day landscape and locally form discontinuous veneers and continuous blankets of predominantly coarse (cobbly and gravelly) marine and glaciomarine deposits.

Much of the topographic relief on site is made up of steeply sloped, rugged, exposed bedrock. Felsenmeer deposits (frost shattered bedrock), consisting of angular cobble, gravel and sand sized weathered material, form an extensive, thin discontinuous cover over much of the exposed bedrock.

Glaciolacustrine sediments composed of saturated silt and sand underlie portions of the terrain around the perimeter of two major unnamed lakes in the area. The sediments are likely ice-rich as indicated by polygonal ground. Other permafrost-related landforms include thermokarst lakes, patterned ground and some solifluction forms.

Soil was sampled at surface and at depths, where possible, to capture any changes in soil characteristics over the vertical soil profile. Some vertical variations in grain size and colour were observed in select test pits; however, statistical tests to determine variability with depth were conducted on each individual element, as well as for correlations between elements, resulted in patterns that were not consistent, systematic or significant.

6.4 Terrain Units

Air photo review was conducted by EBA Engineering Consultants Ltd. prior to the actual site investigation. Nine terrain units were identified at FOX-2 and are detailed below.

Mr – Beach sediments: cobble, gravel and sand

Mv – Marine veneer deposits: sand, gravel and cobble in varying proportions, trace silt, a discontinuous cover of littoral and off-shore sediment, including raised beach ridges and sea-ice rafted debris, mimicking the surface of underlying till or bedrock with patches of exposed bedrock.

Mb – Marine blanket deposits: thick deposits of sand, gravel and cobble in varying proportions, trace silt, with some sea-ice rafted debris, forming a continuous cover of littoral and off-shore sediment.

GM – Glaciomarine deposits: diamictic stony sand and mud with ice-rafted dropstones, forming undulating terraces.

GL – Glaciolacustrine deposits: sand, silt and mud with ice-rafted dropstones, forming flat to undulating plains with patches of exposed bedrock.

Tv – Till veneer: glacial diamicton (silt, clay, gravel, and cobble in varying proportions, bouldery), discontinuous cover mimicking topography of underlying bedrock with patches of exposed bedrock.

RL – Exposed metasedimentary bedrock: psammite, pelite, wacke and quartzite of the Longstaff Bluff Formation.

RLg – Exposed metasedimentary bedrock with patches of felsenmeer or till veneer or marine veneer.

RLs – Steep bedrock slope.

Three of these units, Mb (31%), RLg (21%) and Tv (20%), cover a significant portion of the site. The remainder of the site is made up of Mv (13%), RL (5%), GL (5%), GM (4%), Mr (1%), and RLs (<1%). Despite the potential correlation between bedrock and soil compositions in undisturbed areas, most of the areas investigated as part of the site investigation program are disturbed, such that contamination does not occur in unit-specific material of distinguishable composition. This is because building pads, roads and landfill cover are made of mixed material from more than one borrow area and geological unit, and even away from these features, construction and other work disturbed large areas and caused local mixing of surficial materials.

6.4.1 Magnetism

A gradient magnetometer was used during the geophysical survey to identify areas of buried debris. The method relies on the magnetic property of the largely ferrous debris. However, some difficulties were encountered during the FOX-2 site investigation in interpreting the results of the geophysical surveys. In a number of areas, the survey identified an anomaly, but ground-truthing revealed the area to be undisturbed, or very unlikely to have buried debris (based on topography). It was determined that in some areas of the site, the bedrock was showing up as an anomaly in the geophysical survey results. This was most marked at the upper site, but the bedrock-related anomalies generally showed up as linear features, all in strike with bedrock bedding planes, and therefore, were relatively easy to identify once the overall problem was recognized. The beds with a magnetic signature were typically weathered with strong iron oxide precipitation on surfaces, and are likely the pelites.

6.5 Hydrogeology and Geochemistry

Snow melt and run-off throughout most of the site is controlled by bedrock fracture and bedding planes, shear zones and faults. Precipitation percolates down into bedrock fractures or is funnelled within shear zones, and regionally flows towards the coast. Throughout the site, it was commonly noted that where the bedrock uplands met the marine deposits, groundwater discharged to surface as springs and seeps and then tended to flow more as surface water drainage. Groundwater discharge points were easily noted because they often had surface discolouration where iron oxides or carbonates precipitated. The discolouration frequently continued for some distance within the surface drainage channel. It is important to note that this sort of ‘staining’ is a natural occurrence related to the geology of the site. It occurred in both undisturbed areas as well as disturbed ones, generally in conjunction with specific bedding layers.

Previous investigations at the site and a regional overburden geochemical survey conducted by the Geological Survey of Canada (GSC) noted elevated arsenic and copper concentrations at the site. A soil sampling program was therefore conducted as part of the 2006 investigation to establish site background conditions. Results of the investigation noted naturally elevated levels of arsenic, copper, nickel, and cobalt at the site (frequently elevated above Tier II levels). Furthermore, preliminary results also showed

that elevated concentrations frequently occurred in areas where drainage had been focussed by bedrock features, with subsequent surface discharge of groundwater and iron oxide precipitation. Typically in these situations, groundwater leaches and carries the metals derived from the bedrock (including iron), and then, upon exposure to atmospheric conditions, the iron is oxidized and precipitates and with it, the other metals co-precipitate.

6.6 Hydrology

The FOX-2 site is located on a tip of land extending 16 km into Nuaja Bay below Baird Peninsula on Baffin Island. The topography in the vicinity of the main site and the lower site consist of a series of parallel ridges running east-west, with very few lakes or catchment areas. The lakes which do occur are generally located in natural depressions isolated from other water bodies. A small east-west oriented lake which served as the water supply for the site is located approximately 300 m south of the upper site, within a valley.

There are two large lakes located in separate valleys north of the access road between the upper site and the airstrip. These lakes drain toward the sea via streams through the grassed lowlands. The streams transmit significant quantities of flow during periods of high runoff in the springtime, and pass under the roadway through several culverts.

Drainage from the upper site is generally downgradient north and south away from the module train area. Drainage to the south may be intercepted by the water supply lake in the valley as previously described. Drainage to the north, which includes the sewage outfall, migrates through the bouldery ground surface and is quickly intercepted by roadway ditching several metres from the outfall. Drainage from the landfill area located approximately 350 m east of the module train is along the gently grading boulder covered slope in an easterly direction.

The airstrip receives drainage from a large upslope area to the northeast. This drainage is intercepted by a dyke paralleling the airstrip which directs the flow northwest to the end of the airstrip. This water then flows southwest in a stream towards the sea. Surface drainage southwest of the airstrip, including the hangar building and POL storage area, is toward the sea to the southwest.

Drainage in the vicinity of the bulk POL storage and beaching area along the southwest coast of the site is dictated by the topographic slope which grades southwest toward the sea.

6.7 Flora

Vegetation at the station area and other worked areas was sparse to continuous and consisted of wildflowers, grasses, sedges and moss, except in the sewage outfall and upper site landfill area. The vegetation cover in these areas was 70-90% and was dominated by mosses, grasses and sedges, willow, cotton grass, saxifrage, Arctic heather, Arctic poppies and mountain avens. The west beach area was heavily reworked and vegetation was sparse and consisted of moss, clumps of grass and sedges. At the east beach and airstrip area, 40-60% vegetative cover was present and consisted primarily of sedges, Arctic heather, willows, cotton grass and mountain avens.

6.8 Avifauna

A variety of birds are known to reside in the FOX-2 area and were observed by the field team in 2005 including ptarmingan, waterfowl (common eider, greater snow goose, lesser snow goose, tundra swan, brant, king eider, horned lark and old squaw) and shorebirds (snow buntings, plovers, gulls jaegers). Several ptarmigan families were noted at the upper site. Gulls and various types of plover, geese and snow buntings were also seen at the beach areas. Although the Ivory gull was not specifically identified

during the site visit, it is recognized that it is an endangered species and special attention should be paid to gulls during the clean up activities. The following raptors were not noted during the site visit; however, the Snowy Owl, Peregrine Falcon, Gyrfalcon and Rough-legged Hawks are known to occur in the region.

6.9 Terrestrial Fauna

Animals known to inhabit this region include barren-ground caribou, polar bears, Arctic fox, Arctic hare and lemmings. During the 2005 investigation, several caribou were observed around the site, as were lemmings, Arctic hare and an Arctic wolf. Specifically, caribou and Arctic hares frequented the station and airstrip area; the latter were also noted at the beach POL. Arctic foxes were observed near the airstrip and on the road that leads to the upper site, and a wolf was see around the airstrip area. Lemmings were present around the station area, as was evidenced by the presence of scat around the module train and in the sewage outfall. No polar bears were noted during the site visit.

6.10 Marine Mammals

A variety of marine mammals may be observed in the region of FOX-2. Beluga whales were sighted off-shore in 2005, as were ringed seals. Narwhal, bowhead whales, bearded seals and harp seals pass through Hudson Strait and summer in Foxe Basin. Walrus may follow this migration, or remain in Foxe Basin throughout the year. The following table provides a summary of those marine mammals.

6.11 Fish

Recreational fishing by former station personnel for arctic char was reported along the beach and at a small lake near the station.

6.12 Heritage Resources

An archaeological investigation was conducted in 2005 which identified more than 350 archaeological features spread over 17 locations in the Longstaff Bluff area. Features noted include tent rings, caches, stone shelters, cairns, hearths, quartz scatter, kayak rests, stone kayak models, possible festival houses and fox traps. Because of their magnitude and complexity, several sites have been assessed as highly significant. The majority of archaeological features are located between the site access roads and the shore on both the east and west sides of the site.

Features that are within proximity to work areas have been described in Table 12. At each location, where resources have the potential to be disturbed, the boundaries and setback distance must be clearly identified and maintained throughout clean-up activities. Typically, a setback distance of 30 m is implemented.

Only one area – NfFj-3 – is considered at risk by project activities. This area is located along the north end of the East Beach area. Features are located to the east and west side, and in close proximity, to the only access road to the area. Buried debris excavation and surface debris pick-up are required at the East Beach Area, and heavy equipment will be needed to complete the required remedial actions. It is expected that the road in this area will require upgrading for heavy equipment access. Any widening of the existing road will almost certainly result in disturbance to some features.

Table 12: Archaeological Resources in Proximity to Work Areas

Resource No.	Description	Location	Construction Considerations
NfFj-6	Tent rings, caches, cairns, shelters, kayak rests and quartz scatter. Site significance is rated as high.	East and northeast of the airstrip. In vicinity of Borrow Area 3; and near Site Debris Area 104	Flag off features for avoidance in advance of work in the area. Locations of archaeological features should not restrict development of Borrow Area 3. There is some overlap with Site Debris 104. Surface debris pick-up should be completed by hand in vicinity of features with vehicles remaining more than 30 m from features.
NfFj-15	Caches and a shelter. Site significance is rated as medium.	North and east of Airstrip West Landfill	Flag off features for avoidance in advance of work in the area. Erect barriers if 30 m buffer zone is not feasible.
NfFj-1	Tent rings and rectangular boulder structures. Site significance is rated as low, as all features are estimated as less than 50 years old.	In vicinity of Airstrip Landfill, Airstrip Old Camp area, Borrow Area 4 and Proposed Hangar Non-Hazardous Waste Landfill.	No protection required.
NfFj-7 NfFj-18	Caches, tent rings and kayak rests. Area NfFj-7 is ranked as high, and NfFj-18 is ranked as medium.	Hangar Area – NfFj-18 300 m east of hangar, NfFj-7 east and south of hangar along shore	Flag off features for avoidance. Surface debris pick-up – notably removal of old marker barrels and power lines to the hangar – will need to be done by hand in this area, with vehicles remaining more than 30 m from features.
NfFj-16	Collapsed inuksuk or hearth. The area significance is ranked as low.	East of the bay between the airstrip and beach POL areas, north of the access trail to the “fishing lake.”	Avoidance of area during travel along road to lake for surface debris removal (or leisure activities). The road is 30 m south of the feature.
NfFj-9 NfFj-8	Shelters, hearths, tent rings, caches, a stone kayak, stone houses, fox trap, and kayak rest. Significance of both areas is ranked as high.	From southwest corner of bay opposite hangar to Beach POL area, between Rushmore Bay and road. In vicinity of Borrow Areas 8 and 9 and several surface debris areas, and east of Beacon Debris Area.	Flag off features for avoidance. Locations of archaeological features should not restrict development of Borrow Areas. There is some overlap with surface debris areas 210 and 211. Surface debris pick-up should be completed by hand in vicinity of features with vehicles remaining more than 30 m from features. Beacon Debris Area is sufficiently removed from features.

Resource No.	Description	Location	Construction Considerations
NfFj-11	One shelter. Significance is rated as low.	Between the Beach POL pad and shore.	Erect barriers to ensure protection. Contaminated soil excavation required 30 m to southeast of area. Also, feature is located at western boundary of Site Debris 212. Any debris in this area should be removed by hand.
NfFj-12 NfFj-13	Tent rings and shelter. Significance is rated as medium.	To north and south of western edge of Borrow Area 5, along shoreline.	Flag features for avoidance. Location of features should not impeded borrow area development.
NfFj-3	49 features including stone houses, chamber blubber caches, meat caches, festival houses, tent rings, hearths, shelters and model kayaks. Site significance is rates as high.	At north end of East Beach area, between East Beach Debris lobes B and C. Features straddle and are in close proximity to the existing road.	Maintaining a 30-m setback distance will not be possible for some of the area because of the road and necessity of traffic to the East Beach area. Road upgrading will likely be required to allow heavy equipment access to the area. Placement of barriers will be required at minimum, with the potential for complete documentation, testing and, if necessary, excavation. An archaeological presence on site is recommended during work in this area.
NfFj-4	Quartz boulders, caches, fox traps, tent rings and children's play area	Two features in vicinity (south) of Site Debris Area 223. Majority of features are to north and well-removed from work areas.	Flag features at south end of area for avoidance. Surface debris pick-up should be completed by hand in vicinity of features with vehicles remaining more than 30 m from features.

(Thomson, 2006)

7.0 Identification of Environmental Impacts

An environmental assessment of the clean up of FOX-2 was completed in 1998. As part of the assessment, potential interactions between the project components and the environment were identified. The focus of the assessment was on the location, sensitivity, seasonal presence and abundance of these components. Through this assessment, Valued Ecosystem Components (VECs) were identified, which include physical, biological, socio-economic, historical or cultural components. An updated assessment is provided in the following sections.

7.1 Valued Ecosystem Components

Valued Ecosystem Components (VECs) are selected as components of the environment that are valued by society and are used as the basis of the environmental assessment. Potential environmental concerns associated with the project were through consultations with interested and expert parties, community meetings and previous project experience. The following VECs were identified:

Physical: Protection of soil and water quality, especially related to permafrost conditions and the drinking water supply.

Biological: habitat quality and availability including feeding and nesting areas for birds, feeding and calving areas for local wildlife, and local vegetation.

Socio-economic: Regional employment opportunities, regional business opportunities, regional training opportunities, and hunting and fishing in local areas.

Archaeological: Archaeological sites identified around the station and beach areas.

7.2 Impact of the Environment on the Project

The implementation of a clean up project in an Arctic environment such as FOX-2 brings unique logistical issues. The potential exists for delays in the clean up associated with bad weather, which may include work stoppage 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. Clean up activities which are best completed at maximum thaw may be delayed depending on seasonal climate changes.

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

Typically, labour required for clean up involved heavy equipment operators, general labourers, as well as environmental and engineering specialists. Other opportunities include cleaning and cooking staff and transportation. The main beneficiaries of the economic input from the clean up will primarily affect the nearby communities of Clyde River and Qikiqtarjuaq. As the contract for the clean up of FOX-2 has not yet been tendered or awarded, the requirements of the communities are not confirmed. A temporary,

self-sufficient construction camp will be established at the site to accommodate the contractor and other personnel.

7.3 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 on-going, 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).
- Spacial or temporal crowding.
- Growth induction initiated by the project.

7.3.1 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 spacial 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 work.

Analysis of Effects: The analysis includes an evaluation of baseline data and possible effects on VECs. The combined interactions between the clean up activities and future land use and those VECs which are similar are identified.

Mitigation Measures: Mitigation measures are identified for project-environment interactions.

Significance: The interactions are defined as having a low (L), moderate (M), or high (H) probability of occurring. The next step is to determine the likelihood of significant adverse effects, taking into account appropriate mitigation measures.

7.3.2 Identification of Mitigation Measures and Residual Impacts

Mitigation measures are identified that result in a reduction or elimination of likely environmental effects, including potential adverse effects, associated with the clean up. Mitigation measures are outlined in the Environmental Protection Plan for FOX-2 (see Section 8.0). The EPP forms part of the contract documents and requires all on-site personnel to adhere to the mitigation measures outlined in the EPP.

Table 13 provides a summary of the VECs, potential impacts, mitigation measures and overall significance.

Table 13: Summary of Project Impacts

VEC	Activity	Description of Impact	Proposed Mitigation Measure	Overall Significance
Air Quality	Hydrocarbon Contaminated Soil Removal/Landfarming	• Air quality may be impacted by the removal of hydrocarbon-contaminated soils and landfarming.	• None. Impact is minimal and short-term.	L
	Site Grading/Borrow Source Development	• The extraction of granular materials and grading activities has the potential to create dust and impact air quality.	• Implement dust control measures. Only water and/or calcium chloride will be used for dust control.	L
Soil Quality	Landfill Development/Landfill Closure	• If not constructed properly, contaminants may migrate from the new landfills, potentially degrading soil quality. • The closure of the existing landfills will reduce the risk of impacting soil quality.	• New facilities will not contain hazardous materials. • The Tier II facility incorporates a double leachate containment, which includes a synthetic liner and freezeback of permafrost. • The landfill cover is graded to promote surface runoff.	M
	Contaminated Soil and Hazardous Materials Removal	• The removal of the contaminated soil and hazardous materials from contact with the environment will improve soil quality.	• n/a	L
	Transport of Hazardous Material, Fuel and Contaminated Soil	• The potential exists for accidental release of hazardous materials, contaminated soil and/or fuels during transport, which could impact soil quality.	• Proper handling, storage, and transportation procedures for hazardous materials to be implemented as per TDGA regulations. • All workers to be trained in proper handling procedures for all hazardous materials on-site. • Workers to follow the spill contingency plans. • All materials and equipment to implement contingency plans to be available on-site.	M
	Camp Operation	• The operation of the construction camp will include treatment and disposal of domestic waste, and could negatively impact soil quality	• Hazardous materials will not be disposed of in the camp waste system. • All sewage to be disposed of in accordance with Land Use Permit and Water Use License	L
Water Quality	Landfill Development/Landfill Closure	• If not constructed according to the specifications, leachate may be generated and migrate from the new	• The Tier II facility incorporates leachate containment, which includes a synthetic liner and freezeback of permafrost.	M

VEC	Activity	Description of Impact	Proposed Mitigation Measure	Overall Significance
		landfills during the construction/closure, which has the potential to degrade water quality, both surface and active layer water. • The development and closure of the landfills has the potential to disrupt drainage at the site and cause siltation of waterways.	• The landfill cover is graded to promote surface runoff. • New facilities are sited away from waterbodies and drainage courses so that drainage is not interrupted. • Prevent siltation by use of berms and/or silt fences.	
	Contaminated Soil and Hazardous Materials Removal	• Removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination to the surface and active layer water.	• Prevent sediments from entering waterbodies by use of berms and/or silt fences. • Implement other EPP measures as necessary.	L
	Transport of Hazardous Material, Fuel and Contaminated Soil	• The potential exists for accidental release of hazardous materials, contaminated soil, and/or fuels. An accidental release could impact water quality.	• Proper handling, storage, and transportation procedures for hazardous materials to be implemented as per TDGA regulations. • All workers to be trained in proper handling procedures for all hazardous materials on-site. • Workers to follow the spill contingency plans. • All materials and equipment to implement contingency plans to be available on-site. • Implement mitigation measures to prevent deleterious substances from entering the aquatic environment.	M
	Site Grading/Borrow Source Development	• Erosion and sedimentation of waterbodies during grading and gravel extraction activities has the potential to negatively impact water quality. • Drainage will be improved as a result of grading disturbed areas. • The extraction of granular material will alter the terrain of the borrow area and has the potential to disturb drainage.	• Prevent siltation by use of berms and/or silt fences. • Do not operate equipment within the wetted perimeter. • Disturbed areas adjacent to water are to be stabilized, if required. • Site to be graded upon completion to promote positive drainage and to match the existing terrain as much as practical.	M
	Camp Operation	• The operation of the construction camp will include treatment and disposal of waste. The potential	• Hazardous materials not to be disposed of in the camp waste system. • All sewage to be disposed of in	L

VEC	Activity	Description of Impact	Proposed Mitigation Measure	Overall Significance
		exists for waste to impact water quality.	accordance with Land Use Permit and Water Use License	
Terrain	Landfill Development	• Excavation is required for the development of new landfills and closure of existing landfills, which has the potential to degrade permafrost	• Minimize the time permafrost is exposed. • Minimize surface area of exposed permafrost or active zone.	L
	Landfill Development/Debris Disposal	• The development of new landfills and removal of site debris has the potential to disturb existing terrain.	• Regrade and reshape disturbed areas to match existing terrain and drainage paths. • Use existing roads for movement around the site wherever possible.	L
	Site Regrading	• Terrain and drainage will be improved as a result of grading disturbed areas. Previously disturbed areas will blend into the natural environment.	• n/a	L
	Borrow Source Development	• The extraction of granular material will alter the terrain of the borrow areas.	• Regrade and reshape disturbed areas to match existing terrain and drainage paths. • Use existing roads for movement around the site wherever possible.	M
	Contaminated Soil Excavation	• The excavation of contaminated soil has the potential to degrade the permafrost.	• Minimize the time permafrost is exposed. • Minimize surface area of exposed permafrost or active zone.	L
	Camp Operation	• Movement of contractor's equipment and personnel around the site has the potential to disturb the tundra.	• Regrade and reshape disturbed areas to match existing terrain and drainage paths. • Use existing roads for movement around the site wherever possible.	L
Terrestrial Animals	General Clean Up Activities	• The use of heavy equipment during the clean up has the potential to disturb wildlife.	• Avoid areas of known wildlife colonies or bird nesting areas. • Employ minimum distance requirements for transportation activities around the site.	L
	Contaminated Soil and Hazardous Materials Removal	• The removal of hazardous materials and contaminated soil from the environment reduces the risk of exposure to terrestrial animals.	• n/a	L
Terrestrial Habitat	Landfill Development	• Loss of habitat may occur as a result of the development of the new landfills in previously undisturbed areas.	• Regrade and reshape the disturbed areas to match existing terrain to facilitate recovery of ecosystem components.	M
	Facility Demolition	• The existing facilities may be used by wildlife as habitat (i.e., nests in	• Inspect facilities prior to demolition for use by wildlife. Do not demolish while birds	L

VEC	Activity	Description of Impact	Proposed Mitigation Measure	Overall Significance
		structures). The demolition of these facilities has the potential to impact availability of habitat.	are nesting. • Contact appropriate wildlife officer for additional guidance to ensure disturbance of wildlife is minimized.	
	Borrow Source Development	• The extraction of granular material will disturb the ground and has the potential to impact terrestrial habitat.	• Regrade and reshape the disturbed areas to match existing terrain to facilitate recovery of ecosystem components.	M
Aquatic Habitat and Animals	Landfill Closure	• The excavation of high risk landfill areas in close proximity to water bodies removes the potential for impact.	• During excavation, implement mitigation measures to prevent deleterious substances from entering the aquatic environment. • Prevent siltation by use of berms and/or silt fences. • Do not operate equipment within the wetted perimeter. • Disturbed areas adjacent to water are to be stabilized, if required.	M
	Site Regrading/Borrow Source Development	• The extraction of granular material and grading adjacent to waterbodies has the potential to impact aquatic habitat, and thereby affect aquatic animals, due to sediment entering the water.	• Prevent siltation by use of berms and/or silt fences. • Do not operate equipment within the wetted perimeter. • Disturbed areas adjacent to water are to be stabilized, if required.	M
	Contaminated Soil and 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. • The excavation of contaminated soils from the beach POL area has the potential to degrade the aquatic environment in the event of an accidental release and impact aquatic animals in close proximity to the aquatic environment.	• Implement mitigation measures to prevent deleterious substances from entering the aquatic environment. • Prevent siltation by use of berms and/or silt fences. • Do not operate equipment within the wetted perimeter. • Disturbed areas adjacent to water are to be stabilized, if required.	M
Health and Safety	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 the facilities and the general handling	• Transportation of any hazardous materials is to be in accordance with the TDGA Regulations. • Workers must wear and use appropriate personal protective equipment. • Workers are to be trained in the use of	L

VEC	Activity	Description of Impact	Proposed Mitigation Measure	Overall Significance
		of hazardous materials has the potential to impact the health and safety of workers.	personal protective equipment and proper handling procedures for hazardous materials. • Proper procedures for working around heavy equipment to be implemented.	
	Contaminated Soil and Hazardous Materials Removal	• The removal of contaminated soil and other hazardous materials from the environment reduces the risk of exposure to people.	• n/a	L
Archaeological	General Clean Up Activities	• The presence and movement of people around the site has the potential to disturb the archaeological resources identified around the site.	• Clearly mark and avoid all archaeological resources. • Contact authorities in the event a new resource is discovered or a know resource is disturbed.	L
Land Use	General Clean Up Activities	• Clean up activities may disturb traditional land use, i.e., hunting and fishing activities that would occur during the summer months.	• Contact the local hunters and trappers organization to coordinate clean up activities and traditional land use.	L
Aesthetics	General Clean Up Activities	• Generally, the clean up will improve the aesthetics of the site by removing unsightly debris and restoring the site to a more natural state.	• n/a	L
Economy	Contractor Support	• The contractor will be required to have a minimum Inuit content in the workforce for clean up. This will provide employment benefits and related economic benefits.	• n/a	L

8.0 Environmental Protection Plan

The main focus of the project's environmental protection program during the clean up is based on a site specific Environmental Protection Plan (EPP). The requirements outlined in the EPP are the end result of the environmental assessment process and include the mitigative measures designed to reduce or eliminate potential harmful effects. The EPP for FOX-2 is provided in the following sections.

8.1 Scope and Objectives

The EPP provides a description of the general environmental protection measures required to minimize or avoid potential adverse effects, a description of protection measures required for specific valued environmental components at the FOX-2 site, and details related to environmental inspection responsibilities and procedures.

The protection measures described herein are to be implemented by the contractor to minimize or avoid adverse environmental impacts. These procedures are considered appropriate for known and anticipated situations and conditions. However, should certain procedures or protection measures prove impractical, imprudent or insufficient in field situations, appropriate modifications or substitutions will be proposed by field personnel and then reviewed and approved by the DCC Contract Coordinator.

8.2 Environmental Inspection

As part of its general overall commitment to a strategy of environmental protection and quality assurance, DND employs dedicated environmental inspection staff to monitor its own compliance with the EPP and all applicable laws, regulations, permits, guidelines and standards. The environmental inspection staff is a part of the DLCU Project Management Office (PMO). The PMO was formed as per the Terms of Reference of the Memorandum of Understanding between the Director General Environment and Defence Construction Canada (DCC). The DND will be represented at the site by the Contract Coordinator, who will report to the DCC Contract Manager. The contractor will maintain regular contact with the environmental inspection/Quality Assurance team. This will include, but is not limited to:

- Attendance at regular meetings as scheduled with the inspector;
- Immediately reporting concerns over any aspect of the EPP; and
- Immediately reporting any spills or other event that may have an effect on human or environmental health and/or safety.

8.3 General Environmental Protection Measures

8.3.1 General

The lands associated with the FOX-2 site have distinctive biophysical characteristics associated with Arctic environments. Potential impacts related to the clean up of the site include degradation of the permafrost regime, disturbance of existing vegetation, uncontrolled erosion, point source contamination, disruption of terrestrial and wildlife populations, and human health impacts. The procedures and requirements provided in this section are intended to be protective of these ecosystem components.

8.3.2 Site Operations

The contractor will establish a construction camp on the site, which will be located in an area with minimal vegetative ground cover. The selected location will be in an area that is as close as practical to the main area(s) of clean up and where possible, on an existing gravel pad or former borrow area.

Surface drainage is not to be impeded, and a distance of at least 30 m from the nearest body of water is to be maintained. Ice-rich substrates will be avoided, where possible. Permafrost will be protected by construction of gravel pads, and/or elevation of heated buildings on wooden structures. Areas containing archaeological resources will be avoided.

Vehicle and mobile equipment travel will be restricted at the site to established roads, stream crossings and work pads unless specifically exempted by the DCC Contract Coordinator. Recreational use of vehicles, including all terrain vehicles (ATVs), is not permitted off of the existing road network. Overland movement of equipment and vehicles will be minimized where damage to the vegetation or underlying soils may occur. Following heavy rains, vehicle and heavy equipment use outside of road and work pad areas is not permitted until the soil has drained sufficiently to prevent excessive rutting, and until authorized by the DCC Contract Coordinator.

Mobile equipment and vehicle operators are to yield the right-of-way to wildlife where safe to do so. Vehicles will not be operated in a manner that harasses any species of wildlife. Vehicle and equipment servicing is to be performed in designated areas only, where special care can be taken to contain, handle, and dispose of maintenance fluids, parts and waste. Fuelling and lubrication of equipment is to be conducted in a manner that avoids spillage of fuels, oils, greases and coolants. When refuelling equipment, leak-free containers and reinforced rip and puncture-proof hoses and nozzles will be used. Drip trays will be provided and ensure that all storage container outlets are properly sealed after use.

8.3.3 Storage and Handling of Fuel and Other Hazardous Substances

Fuel is to be stored in self-dyking, double-walled containers, or positioned over an impervious liner and surrounded by an impervious dyke of sufficient height to contain not less than 110% of the capacity of the tank. Sites that slope towards waterways or other environmentally sensitive areas, exhibit ponding or flooding, or have high groundwater tables, excessive seepage, or ice-rich (thaw sensitive) soils will be avoided. Archaeological resources will also be avoided. Smoking is prohibited within 7.5 m of the fuel storage facility. Appropriate signage will be posted around the fuelling facility. Fuel storage facilities will be inspected once per day for the duration of the project and documentation of the inspection will be maintained. Fire-fighting equipment will be made available for immediate access at each fuel storage facility. All barrels containing fuel and other similar materials will be stored in an elevated position either on their side with the bungs facing the 9 and 3 o'clock positions or on pallets, in an upright position. All barrels will be individually identified with all information necessary for health and safety, and environmental purposes. Material Safety Data Sheets for all chemicals and fuels stored in the construction camp will be available to all personnel. All fuel spills will be dealt with according to the Spill Contingency Plan (see Section 9.0).

Regular inspections are to be conducted of all machinery hydraulic, fuel and cooling systems and any leaks will be repaired immediately. Emergency spill equipment will be pre-assembled and stored at all permanent fuel storage sites and work areas, including at least two fuel pumps, empty 200 litre barrel and absorbent material sufficient to clean up a 1000 litre spill. All barrels, redundant fuel storage facilities and associated materials and equipment are to be removed from the site at the conclusion of the clean up.

8.3.4 Surface Water Management

A water use license will be obtained from the Nunavut Water Board for the development of potential water sources, including the summer and winter water supply lakes. All conditions of the license must be complied with. Water withdrawals must not endanger fish or drawdown the water level so as to adversely affect fish habitat. Water withdrawal rates will not exceed 10% of total water body volume. All water hoses will be equipped with a mesh size of 2.5 mm or less to prevent the intake of fish as per the *Freshwater Intake End-of-Pipe Fish Screen Guidelines*.

8.3.5 Wastewater Management and Monitoring

DLCU construction activities generate wastewater from dewatering activities including contact water from landfill and contaminated soil excavations, new landfill operation, and contaminated soil treatment areas. Water management on-site is the Contractors' responsibility. However, given the nature of the Arctic terrain, site logistics and support, climate and weather makes the mitigation of discharge water a challenging task. Contact water associated with landfill and contaminated soil excavations, the operation of new landfills (Tier II and Non-Hazardous Waste Facilities) and landfarms potentially contain a number of constituents of concern.

The parameters selected for the monitoring plan are based on and are a reflection of the types of contaminants found at the sites during the environmental assessments, conducted over the last two decades. The criteria for the wastewater are considered conservative and appropriately protective of the arctic environment.

Wastewater may be temporarily stored in existing tanks while awaiting test results, which are designed for disposal, provided that it is not stored over the winter months. The volume of wastewater storage during any one construction season shall not exceed 50% of the total capacity of the tank, and shall not exceed the available treatment capacity during that construction season. The release of all water must conform to the Construction Wastewater Discharge Criteria, listed in Table 14. The basis or background for the choice of each criterion is also listed in the table.

Table 14 – Construction Wastewater Discharge Criteria

Parameter	Criteria
pH	6-9
Oil & Grease	5 mg/L
Arsenic (total)	0.1 mg/L
Cadmium (dissolved)	0.01 mg/L
Chromium (dissolved)	0.1 mg/L
Cobalt (dissolved)	0.05 mg/L
Copper (dissolved)	0.2 mg/L
Lead (dissolved)	0.05 mg/L
Mercury (total)	0.0006 mg/L
Nickel (dissolved)	0.2 mg/L
PCB (total)*	1 mg/L
Zinc (total)	0.5 mg/L

* In respect of application to a road surface.

Total Petroleum Hydrocarbons (TPH) and BTEX constituents were not included in the Wastewater Discharge Criteria for the FOX-2 site because the hydrocarbon contamination is typically the result of diesel fuel and/or lubricating oil spills. These hydrocarbon products consist of heavy end hydrocarbon chains, rather than the lighter end such as BTEX, and are not soluble in water. In addition, the hydrocarbon contamination at this site would have occurred during the operation timeframe from the mid 1950's to 1992, when the site was closed. As such, there would be very little if any BTEX present in the soils, as they are easily volatilized. Therefore, the most meaningful and practical parameter to monitor in the wastewater would be oil and grease.

For the PCB criteria in wastewater, the criterion of 1 mg/L (or 1 ppm) is proposed. This criterion is derived from the Chlorobiphenyls Regulations (CEPA 1991) Section 5 (2b), which states that: "the concentration that may be released is 5 ppm by weight of the liquid in respect if an application to a road

surface." We have chosen the criterion of 1 mg/L to provide a slightly more conservative value than CEPA requires.

The collected wastewater will be tested each time prior to discharge. Once it is confirmed that the wastewater meets the discharge criteria, it will be released onto the ground in an area that is at least 30 metres from natural drainage courses and 100 metres from fish-bearing waters.

The locations of the discharge areas will vary, depending on the work areas. For example, the barrel cleaning operations are typically located within the hazardous materials processing area. Wastewater that collects at contaminated soil excavations and landfill excavations is typically sampled and treated in place. In areas where the volume of wastewater is significant and affects the progression of work, the wastewater may be recirculated. For example, wastewater occurring during landfill excavation would be sampled and recirculated over the landfill surface.

8.3.6 Sewage Effluent Monitoring

The sewage lagoon at FOX-2 will be a simple facultative system where treatment is achieved by the natural degradation of organic substances or biogeochemical activity. Aerobic or anaerobic micro-organisms digest the organic solids and utilize the released energy and nutrients in the effluent to grow and increase in numbers, which in turn accelerates the process. In this type of system, aerobic respiration is the most complete and efficient degrader of organic solids and therefore the most important element in a stable and healthy biological treatment process. This method of treatment within the Arctic environment, combined with relatively short effluent retention times requires good management to achieve the desired level of treatment prior to discharge. See Table 15 below for a summary of the effluent discharge criteria, as provided by the Nunavut Water Board. These criteria were provided for other DEW Line sites and have been adopted as the discharge criteria or the FOX-2 site.

Table 15 – Sewage Effluent Criteria

Parameter	Criteria
pH	6-9 pH units
Oil & Grease	No visible sheen
Biological Oxygen Demand	120 mg/L
Total Suspended Solids	180 mg/L
Faecal Coliforms	10,000 CFU/dL

In order to maximize the performance of the system, the specifications (which are stamped by a qualified engineer) requires sewage lagoons to have sufficient volume to accommodate 100% of the camp water consumption for the duration of the construction season. Each of the two cells will hold 50% of the seasonal flow, to a maximum depth of 1.0 m. The required effluent volume per lagoon can be calculated as follows:

Effluent volume per lagoon = (200 litres/person day) X (number of people) X (construction duration days) X 50%

Effluent monitoring will be completed every 30 days and prior to discharge.

8.3.7 Domestic Waste Management

Kitchen wastes will be temporarily stored in metal, animal-proof containers to prevent scavenging of waste by wildlife and to reduce scattering of debris prior to daily incineration. All residual kitchen wastes

and other non-hazardous wastes will be disposed of in the existing site landfills unless otherwise specified.

8.3.8 Road Construction and Maintenance

Existing roads and trails provide access to most sources of granular materials. Emphasis on the preservation of the permafrost regime, vegetation patterns, existing surface drainage patterns, water quality and stream flows will be maintained. Establishment of new roads off-site is subject to the terms of the land use permit and the approval of the DCC Contract Coordinator. Roads will not be sites within 30 m of any ecologically sensitive areas. Ice-rich soils, especially peatlands, are also to be avoided during road construction. The road bed will be prepared with a sufficient thickness of fill to prevent terrain damage. Culverts, if required, will be installed to maintain natural cross-drainage and prevent ponding. Any culverts installed will be removed from the roads and drainage restored at the end of the clean up operations. Access roads will be monitored for signs of erosion and remedial action will be taken where necessary. Dust suppression, if required, will be maintained with water only.

8.3.9 Stream Crossing and Diversion

The contractor is to adhere to all government regulations, licensing requirement/procedures and inspections, regarding the protection of water quality and stream integrity to prevent destruction of spawning areas. Existing stream crossings will be utilized as required. Authorizations for any additional works employed are the responsibility of the contractor.

In the event a stream crossing is required, siltation of waterways and disruption of streambeds will be prevented using the following procedures:

- Activities adjacent to watercourses will be minimized.
- Cofferdams, silt barriers or other suitable barriers will be installed.
- Equipment is not to be operated in waterways.
- Streambeds are not to be used for borrow material.
- Excavated fill, waste materials and debris will not be disposed of in waterways.

It is not anticipated that any new, additional stream crossings will be required during construction.

8.3.10 Borrow Pit and Quarry Development and Operation

Environmental protection measures must be implemented for the purpose of minimizing the impact of development and extraction activities on surface drainage patterns, water quality, soil erosion, and in some cases, wildlife or fish. The number of borrow areas opened will be minimized by using existing borrow areas, roads and buildings pads where feasible. Use of alternative sources is subject to the approval of the DCC Contract Coordinator and acquisition of a quarry permit. All terms and conditions of the quarry permit are to be complied with, including the recontouring/reclamation of the borrow area and site clean up prior to site abandonment.

Borrow areas must be located at least 30 m from the nearest water body providing potential fish habitat, and other sensitive resources. In consultation with the DCC Contract Coordinator, a 30 m buffer zone will be marked out prior to commencement of gravel quarrying operations. Organic overburden, if present, will be stripped and stockpiled separately for use in restoring the borrow area. Following excavation, the area will be recontoured to restore natural drainage and overburden will be worked into the recontoured borrow area to prevent erosion. Drainage and run-off control will be provided using diversion ditches and sediment filters, as required, to prevent sediment laden run-off from reaching water bodies.

During aggregate extraction, vehicle and equipment operations will be controlled in areas adjacent to the borrow pit to minimize the extent of disturbance. Aggregate will be stockpiled on ice-poor, well-drained ground such that surface drainage is not impeded. The stockpile will be located in an area that is a minimum of 30 metres from archaeological resources, water bodies, and other sensitive resources. If archaeological features or artifacts are encountered during borrow pit operations, the DCC Contract Coordinator is to be notified, the area of the find avoided, and activities in other areas of the pit restricted until further instructions are received.

Development of additional borrow areas that are not identified on site plans will be at the discretion of the DCC Contract Coordinator and shall meet all siting criteria and permit requirements.

8.3.11 Hazardous Waste Material Processing Areas

A hazardous waste material processing area will be developed for the processing of excavated soils and demolition materials. The hazardous waste material processing area will be located a minimum of 30 m from any archaeological site or water body, on ice poor, well drained soil, and as close to the location of work as practical. Movement of vehicles and equipment between the hazardous material processing area and work site will be minimized to prevent the spread of potentially hazardous material along roadways.

8.3.12 Contaminated Soils

The locations of contaminated soil are shown on the drawings in Appendix A. Soils exceeding the criteria established for FOX-2 are to be removed. Disturbance to adjacent areas during excavation of contaminated soil will be minimized. Spillage of material during transportation between the excavation site and the stockpile/treatment location is to be avoided and any spillage will be cleaned up to the satisfaction of the DCC Contract Coordinator. Following excavation of contaminated soils, equipment will be decontaminated. All workers will wear appropriate protective clothing/equipment when handling contaminated soil. A program of sampling and confirmatory testing of specific contaminated areas will be carried out as part of the clean up program, as per Part 13 of the DND/NTI Cooperation Agreement – Environmental Provisions. A landfarm facility will be constructed for the treatment of Type B hydrocarbon contaminated soils.

8.3.13 Landfill Closure and Development

The landfills will be covered with gravel to provide a minimum cover thickness as indicated on the drawings. The landfill areas will be regraded and restored to natural drainage patterns and topography. Geosynthetic liners will be installed at the Tier II Soil Disposal Facility. High risk landfill lobes are being completely excavated and backfilled with granular material. Two new landfills are being constructed, the Non-Hazardous Waste Landfill for the disposal of non-hazardous wastes and debris generated during the clean up of the site and the Tier II Soil Disposal Facility for the disposal of Tier II contaminated soils.

Drainage controls such as diversion ditches and sediment filters will be provided, as required, to prevent runoff from reaching water bodies during closure, remediation and construction of landfills. Monitoring equipment will be installed as shown on the drawings, or as directed by the DCC Contract Coordinator.

8.3.14 Disposal of Site Debris

Site debris will be collected, sorted into hazardous and non-hazardous materials and disposed of accordingly. The contents of any intact barrels will be tested and disposed of as described in Section 5.12. Workers are to wear appropriate protective clothing when handling potentially hazardous waste material. Off-road activity will be minimized during collection of site debris. The spill contingency plan (Section 9.0) is to be followed in the event of a spill or other emergency.

8.3.15 Demolition of Buildings and Structures

Demolition, sorting and disposal of hazardous and non-hazardous waste will be carried out in accordance with Sections 5.8, 5.9, 5.10 and 5.11. All residual debris is to be removed from the site down to grade. Structures will be demolished to the top of concrete foundation level. Gravel pads and other foundations will be regraded to restore natural drainage patterns and to match adjacent topography.

8.3.16 Aircraft Movements

It is anticipated that fixed wing chartered aircraft will be used to transport personnel, perishable supplies and some construction materials and equipment to and from the site. Charter pilots will be advised to maintain an altitude of at least 610 m and preferably 1000 m above ground or water when passing over the site. Low-level flights to observe or photograph wildlife will not be permitted. Charter aircraft pilots will be informed of all applicable EPP requirements when scheduling arrangements are made or at other appropriate periods prior to the arrival of the aircraft on site.

8.3.17 Handling of Dangerous Goods and Hazardous Waste Materials

Treatment, disposal, and storage of hazardous and non-hazardous waste materials will be in accordance with Section 5.13. Each storage area will be separated from the nearest water body by a 30 m buffer zone.

Packaging: The Transportation of Dangerous Goods Act (TDGA) and Regulations govern the packaging and shipment of dangerous goods within Canada. If shipping out of Canada, Canadian regulations and the regulations of the destination country both apply. Requirements of the International Marine Dangerous Goods Code (IMDGC) must be addressed in international waters. Any material classified by the TDGA must be accompanied by the appropriate shipping documents. The documents must include: the shipper, the receiver and all carriers involved in the transport of the shipment. Non-hazardous materials are also to be accompanied by a document indicating ownership and responsibility of the receiver. The contractor should refer to the TDGA and regulations for more details regarding shipping document requirements. All dangerous goods will be packaged in accordance with the TDGA.

Waste manifests will be initiated for each shipment, specifying a unique reference number and DND's waste generator number to accompany the shipment to the final destination. Any waste of unknown TDGA hazard will be tested to determine whether any transport hazard exists according to the regulations. Any substance that is considered hazardous will be packaged under the TDGA in accordance with the regulations and the national standard Performance Packaging for Transportation of Dangerous Goods. The TDGA regulations specify the packaging requirements for dangerous or hazardous goods according to risk.

Labelling: Each item will be labelled and placarded according to its hazard class and division. A label or placard design is unique to each classification. Large containers will be placarded as defined by the class and division with the TDGA product identification number clearly defined. The product identification number is indicated by the substance name in the regulations.

Notification: The DLCU Environmental Officer will be notified twenty (20) days prior to shipment of any dangerous goods or hazardous materials.

8.3.18 Explosives

The use of explosives is potentially dangerous to human and animal health. If required, the following procedures will apply:

- Obtain all necessary permits and licenses.
- Handle, transport, store and use explosives and all other related hazardous material in accordance with all applicable laws, regulations and orders of regulating authorities.
- Electric detonation methods are prohibited.
- Restrict use of explosives to authorized and certified/licensed personnel who have been trained in their use.
- Minimize defacement of landscape features and other surrounding objects controlling the scatter of blasted material beyond the cleared working area.
- Minimize shock or instantaneous peak noise levels.
- Prevent blasting scatter from reaching fuel or hazardous substance storage locations. A minimum distance of 300 m in rocky terrain and 1000 m in the presence of metal is required.
- Blasting is not to be conducted in the vicinity of wildlife populations.
- Blasting is to be restricted to above water and a minimum of 100 m from fish populations.

8.3.19 Work Site Clean Up and Abandonment

The contractor must comply with all terms and conditions of the water use license and the land use permit. All temporary buildings, fuel barrels, vehicles, equipment, waste materials and surplus materials will be removed from the site following completion of the work. All large earthworks slopes will be stabilized. Gravel access roads required for operation and maintenance may remain. All disturbed areas will be graded to match natural drainage patterns.

8.4 Protection Measures for Valued Environmental Components

This section describes the required protection measures for the valued environmental components identified at the FOX-2 site. These protection measures must be complied with.

8.4.1 Human Health and Safety

Potential hazards to human health and safety are present at the FOX-2 site in the form of hazardous materials and contaminated soil, unpredictable weather conditions and wildlife encounters. Hazardous material and contaminated soil have the potential to enter water bodies and the food chain, and thereby affect vegetation, fish wildlife and the health of people who travel, hunt and fish in these areas. Site debris may present a physical hazard to people traveling though these locations.

All necessary precautions will be taken when handling and transporting hazardous material and contaminated soil to ensure that the materials do not come into contact with site personnel. Site workers will wear protective clothing when handling hazardous materials. All site personnel working on or in the vicinity of the clean up operations must be trained in, made aware of, and adhere to the requirements of the Workplace Hazardous Materials Information System (WHMIS) program.

Outdoor recreation activities of the site personnel have the potential to adversely affect nearby fish, wildlife and heritage resources. Subject to camp rules and the requirements of territorial fishing licenses and regulations, staff may be permitted to leave the site for recreational purposes. However, recreational use of vehicles, including ATVs, is not permitted off of the existing road network. Normal precautions for Arctic travel include: provisions for rapidly changing weather conditions; tactics for possible polar bear and other wildlife encounters; filing a trip plan, first aid kit, survival kit and insect repellent.

Personal firearms are not permitted in the construction camp. However, the contractors' site superintendent will keep sufficient weapons (including one for backup or replacement) for defence in the

event of a polar bear encounter that threatens human safety. When not in use, all weapons will be locked up as per all applicable legislation and access controlled by the site superintendent or the designate.

8.4.2 Local Economy and Contact With Local Residents

Employment and business opportunities in the north will be maximized as much as possible. Communication with the local communities of Hall Beach, Igloolik and Qikiqtarjuaq will be provided to keep them informed of contracts and significant project developments for which local businesses and individuals may be qualified to work. Regular briefing meetings will be scheduled with all camp personnel to discuss and explain camp rules.

8.4.3 Aesthetic Value

It is anticipated that the clean up activities will have an overall positive effect on the aesthetic value of the FOX-2 site in that redundant buildings and structures will be demolished, and all disturbed areas (landfills, debris piles, sewage outfall and borrow pits) will be restored as closely as possible to their original appearance. Construction personnel are to ensure that their activities do not contribute to any degradation of the local environment.

8.4.4 Surface Water and Fish Habitat

The following applies to work adjacent to waterways:

- Prevent siltation of water bodies supporting fish by the use of berms or silt fences as required, and by minimizing activities adjacent to watercourses.
- Do not operate equipment in waterways.
- Do not use streambeds for borrow material.
- Do not dispose of excavated fill, waste material or debris in waterways.
- Avoid areas of known fish congregations during culvert removal and work adjacent to waterways.
- Do not cross streams at or immediately upstream of locations containing fish populations.
- Where possible, conduct in-stream work during low flow periods.
- When removing culverts, slope banks to conform to the grade of the adjacent stream bank, as applicable. If required, stabilize the bank using erosion resistant material.

8.4.5 Permafrost Soils

Ice-rich soils are common in areas that have vegetation cover and are thus susceptible to permafrost degradation. The top layer provides a protective thermal barrier that prevents permafrost degradation. These soils are susceptible to erosion due to their fine texture. Erosion removed the thermal protection and causes permafrost degradation. Vehicle and equipment traffic, and soil excavation can disturb the surface layer and degrade the permafrost. Disturbance to permafrost soils will be minimized by restricting vehicle and heavy equipment traffic to existing roads and designated work areas unless approved by the DCC Contract Coordinator. Activity in areas adjacent to work areas will also be minimized. Vehicles or heavy equipment will NOT be operated off-road following heavy rain or melting snow until the soil has dried sufficiently to prevent excess rutting. Appropriate drainage and erosion control structures will be installed along access roads, where required. The following measures will be implemented during the site clean up operations to minimize disruption of permafrost:

- Facilities such as work camps and storage areas will be located such that they do not impede surface drainage or result in ponding.

- Gravel pads will be constructed and used to protect ice-rich soil from thermal or physical damage.
- Disturbance during excavations will be minimized.
- Excavated areas will be backfilled promptly with granular fill.
- Development of new borrow areas will be minimized.
- Materials will NOT be stored directly on unprotected ground surfaces.
- Disturbed areas will be regraded to restore natural drainage patterns.
- Any rutting that occurs and impedes local drainage or exposes permafrost in ice-rich soils will be repaired to the satisfaction of the DCC Contract Coordinator.

8.4.6 Coastal Marine Environment

The coastline adjacent to the FOX-2 site may be used by mammals and seabirds for feeding, breeding and migration. Where populations of mammals are known to be near construction sites, the charter aircraft pilots will be advised to maintain an altitude of at least 610 metres and preferably 1000 metres above ground or water when passing over these areas. Low-level flights to observe or photograph wildlife will not be permitted. It is not anticipated that the clean up activities will have an impact on coastal marine resources.

8.4.7 Terrestrial Wildlife

There is always concern over human/wildlife contact at DEW Line sites. This could include harassment by project personnel causing disruption of activities such as calving, breeding, nesting and rearing, all of which may take place on the site proper.

The following procedures will be implemented to prevent human/wildlife conflicts:

- Employ a dedicated wildlife monitor(s) at all times.
- All on-site personnel will be required to be familiar with the contents of “Safety in Bear Country”.
- Wildlife will not be fed, injured or harassed by site personnel.
- Do not disturb birds nesting on-site.
- Vehicle and aircraft movements shall conscientiously avoid all known populations of wildlife or areas known to be frequented by known populations of wildlife.
- Do not attempt to chase, catch, divert, follow, or otherwise harass wildlife by aircraft, vehicle or on foot.
- Control refuse and make it inaccessible to bears and other scavengers.
- In the event of an unanticipated or unavoidable contact with wildlife, act in accordance with the wildlife encounter contingency plan (see Section 8.5). Familiarize all individuals working at or visiting the site with this plan as part of their work site orientation.
- Equipment and vehicles shall yield to wildlife, where possible.
- Except in the vicinity of the airfield, advise charter aircraft pilots not to fly at elevations lower than 500 metres above ground or water.
- In the event that wildlife is spotted from the air, aircraft shall not make descents for observations or photography.
- Domestic or wild pets are not allowed in camps with the exception of controlled watchdogs.
- Project personnel shall not be permitted to possess personal firearms. The only firearms allowed on site shall be for protection from bears and shooting of animals exhibiting aberrant behaviour. The firearms shall be controlled by the contractor’s site superintendent.

8.4.8 Avifauna

Disruption of avifauna during the nesting period can result in reproductive failure. For this reason, populations of nesting birds should be avoided during this period. Impacts on these species can be minimized by scheduling disruptive activities outside of the nesting period and by discouraging nesting at work areas.

The arrival of avifauna at specific locations in the Arctic is influenced by weather conditions and a number of other factors. Inclement weather or a delayed spring melt may delay arrival by several weeks. In general, however, the chronology of arrival, nesting, and departure is relatively consistent. Typically within two week of arrival, nesting commences and continues for one to two months until the young leave the nest. Following this, the birds feed in preparation for the fall migration and depart by mid- to late September. Work will be scheduled to minimize impacts on these species.

8.4.9 Heritage Resources

DEW Line sites are often located in areas which have been seasonally settled or visited by Inuit over the past 1000 years; by their Paleo0Eskimo predecessors for as many as 3000 years before the Inuit; and by Europeans and Euro Canadians over the past four centuries. Archaeological sites and recent camps and cemeteries exhibiting evidence of the presence of the former occupants have been found on or adjacent to all of the DEW Line sites. Many of the sites have been disturbed by previous DEW Line activities. The traditional and scientific value of heritage resources is greatly diminished if they are disturbed or moved. Archaeological sites in Nunavut are protected by law, and disturbance of these sites and collection of specimens is prohibited except under the terms of an archaeological research permit.

In the event that heritage resources are discovered during clean up activities, the following procedures apply:

- Report the discovery immediately to the DCC Contract Coordinator.
- Do not disturb the site and cease work in that area until appropriate authorities with the Department of Culture, Language, Elders and Youth (CLEY) are notified.
- Reports if all archaeological finds shall include:
    - The identity of the person making the discovery.
    - A description of the site location, including topography, landmarks, etc.
    - The nature of the activity resulting in the discovery.
    - A description of the archaeological site, including size, features, or visible details, supplemented by sketches or photographs.
    - Actions currently undertaken to protect the archaeological features; and
    - Any extenuating circumstances.
- Do not resume activities in the vicinity of the find until confirmations and direction from the Department of CLEY is received.

8.5 Wildlife Encounter Contingency Plan

Polar bears are a potential hazard to workers at all times. The situation can be aggravated by the presence of any substance the bear perceives to be food. Dedicated wildlife monitors should be employed at all times during the clean up operations.

All staff should be familiar with bear deterrent procedures and at least one designated staff member should be competent with the camp firearms. Staff should also be familiar with the GNWT "Safety in Bear Country" manual and a reference copy should be available at the site office.

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 that can be overcome by proper disposal of food wastes. Concentrations of scavenging animals such as foxes and bears increase the risk of diseases and danger to personnel. The following precautions and actions are to be taken:

- The killing of wildlife for any reasons at variance with the Wildlife Act and Regulations is an offence. Coordinate procedures for handling wildlife problems and incidents with the regional Government of Nunavut (GN) wildlife office.
- Advise personnel to maintain watch for bears and other wildlife and immediately report any sightings to the DCC Contract Coordinator. Immediately notify all personnel of the sighting. If the threat of attack is considered significant, assign a full time wildlife monitor to the specific areas of activities at risk.
- Use vehicles, noisemakers and, if necessary, a firearm to frighten the animal away from the site.
- Shoot the animal only if it returns repeatedly, refuses to leave or directly threatens human safety. Killing is considered a last resort. Contact the appropriate wildlife officer and alert them to the problem, if possible. If an animal is to be shot, assign the task to a person familiar and competent with the camp firearm. Wounded or otherwise aggravated animals can be extremely dangerous.
- Report the death of a bear to the DCC Contract Coordinator and the appropriate GN wildlife officer who will issue instructions as to the disposal of the carcass and the formal reporting procedures to be followed.
- Due to the possibility of rabies, shoot any animal that bites a human and retain the carcass intact pending instruction 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 or animal-inflicted wounds.

8.6 Heritage Resource Contingency Plan

All archaeological sites at FOX-2 must be avoided during clean up activities. Unrecorded archaeological sites containing such remains as habitation structures, hunting blinds, food caches and graves, and objects such as tools, utensils and butchered animal bone may be inadvertently discovered and disturbed during clean up activities. All site personnel are prohibited from knowingly disturbing any archaeological or other heritage site or collecting any artifacts. Removing artifacts is a criminal offence. In the event of finding heritage resources:

- Cease work in the area immediately, do not remove any artifacts or other associated objects from the site unless their integrity is threatened in any way.
- Mark the site's visible boundaries and avoid the area during clean up activities.
- Report the discovery of the site immediately to the DCC Contract Coordinator and the Department of CLEY by phone or fax and comply with any site protection instructions issued. Do not engage in any excavation activities.
- Prepare reports of any discovery for the respective regulatory authority and the DCC PMO indicating:
    - The identity of the person making the discovery.
    - The nature of the material.
    - The nature of the activity resulting in the discovery.
    - The location of the find including a description of the site location, topography, landmarks, etc.

- A description of the archaeological site including size, features or details visible, supplemented by sketches or photographs.
- Protection measures instituted.
- The present location of any heritage material removed for safe keeping.
- Extenuating circumstances.

- In the event of a discovery of human remains:
  - Advise the DCC 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.
  - Halt all activities around the area of the 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.
  - Secure the area and designate it as out of bounds to all personnel. Depending on the weather conditions, the human remains should be provided with non-intrusive protection such as a cloth or canvas tarp (non-plastic preferred).
  - Prepare a report, as described in the previous section.

9.0 Spill Contingency Plan

The Spill Contingency Plan (SCP) was prepared for the FOX-2, Longstaff Bluff clean up team consisting of members from the clean up contractor (TBD), Defence Construction Canada, Environmental Sciences Group, UMA Engineering Ltd., and EBA Engineering Consultants Ltd. The SCP is effective as of June 1, 2008 (exact start date of clean up TBD in 2008), and will be available as a stand-alone document to all team members and will also be posted on-site in the camp.

The clean up is being conducted as part of the DEW Line Clean Up Project, as represented by the Department of National Defence and Defence Construction Canada. To request additional information, or additional copies of the SCP, please contact:

Douglas Craig, M.Sc.
Environmental Officer – DEW Line Clean Up Project
Defence Construction Canada
Constitution Square, Suite 1720
350 Albert Street
Ottawa, ON K1A 0K3

9.1 Introduction

The following contingency plan presents the prescribed course of action to be taken in the case of unanticipated spill events during the clean up of the FOX-2 site. The plans will enable persons in a particular situation to maximize the effectiveness of the environmental protection response and meet all regulatory requirements for reporting to the appropriate authorities.

9.1.1 Scope and Purpose

This plan applies to all activities and facilities pertaining to the construction activities at the FOX-2 site:

The purpose of the plan is to:

- Provide a clear statement of the procedures to be followed in response to all spills;
- Minimize the potential environmental impact of spills by establishing pre-determined action plans;
- Establish a state of preparedness for personnel through a Spill Response Training Program;
- Protect the health and ensure the safety of the personnel involved in the Spill Response activities;
- Provide a reporting network for spills;
- Ensure site restoration through appropriate remedial activities;
- Identify the roles and responsibilities of all parties involved in the Spill Response activities; and
- Identify sufficient personnel, materials and equipment needed to make an adequate response to a spill.

9.2 Site Information

It is estimated that the camp operation will require a combined total of approximately 350,000 litres of diesel and 20,000 litres of gasoline. Fuel is stored in double-walled tanks in a location situated a minimum of 100 metres from any water body or drainage course. Fuel is provided by the contractor.

Spill kits will be located at the fuel storage/handling area operated by the camp. It is anticipated that the camp, and all associated facilities including spill response equipment will be located at the camp area.

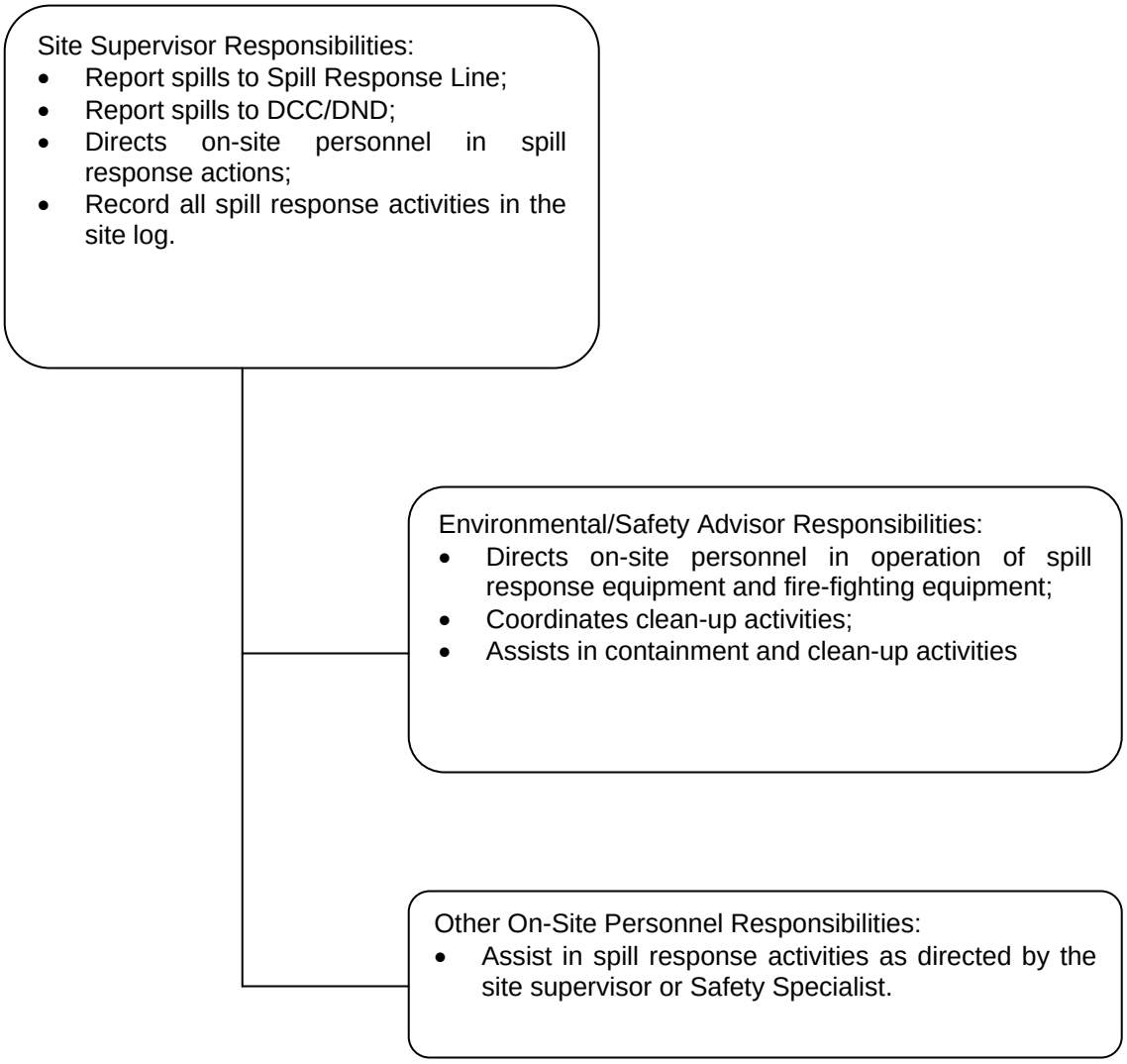
9.3 Response Organization

9.3.1 Roles and Responsibilities

The contractor and all sub-contractors will be involved in spill response actions in the event of a spill during the construction activities at FOX-2. Their roles and responsibilities are described as follows:

- Ensure the response crew members are appropriately trained.
- Practise spill prevention by performing regular maintenance on all fuel systems and by using proper methods for handling of fuel products.
- Provide personnel, materials, and equipment necessary for adequate response to fuel and hazardous material spills.
- Establish communications and verbally report all spills to the DCC Contract Coordinator as soon as practical.
- Isolate and eliminate all ignition sources.
- Ensure safety and security at the spill site.
- Stop or reduce discharge, if it is safe to do so.
- Make every effort to contain the spill by dyking with earth or other barriers on land and containment booms on water.
- Assess potential for fuel/chemical recovery.
- Deploy on-site crews to mobilize pumps, empty 200 litre barrels, hand tools and absorbents to the spill site.
- Hire additional assistance, if required, from northern residents, local communities, and commercial spill response firms.
- If required, request assistance from the DND (through the DCC Contract Coordinator) and the Canadian Coast Guard.
- Follow all guidelines and regulations for disposal of spilled materials, associated debris, contaminated soil and water as established by appropriate government agencies.
- Assess potential terrain and wildlife disturbance, erosion and archaeological site disturbance in any areas to be affected by clean up operations and contact relevant authorities.
- Document all events/actions.
- Report the spill to the Spill Report Line and follow up with a written spill report. This report shall summarize the initial report information; confirmation of spill volume; actions taken; future remediation/monitoring requirements; and a sketch map and/or photographs of the spill area.
- For spills on water, immediately mobilize additional containment and clean up equipment in consultation with the Coast Guard, Environment Canada, and Fisheries and Oceans Canada if on-site equipment is inadequate. Close isolation valves to stop fuel flow, if required. Deploy light-weight booms and oil absorbent materials to protect environmental resources along the coastline, as applicable. Track the progress of the spill, if of unknown origin.

Figure 1: Emergency Response Team Organization



Telephone, facsimile machines and e-mail are provided to on-site personnel to maintain communications with off-site parties. All on-site personnel are provided with two-way radios for all intra-site communications. Table 16 provides all other contact numbers. NOTE: The telephone and facsimile numbers and the e-mail addresses for the clean up contractor are not available at this time as the contract has yet to be awarded.

Table 16: Spill Contingency Plan - Contact List

Resource	Location	Phone No.
24 Hour Spill Line	NWT/Nunavut	867-920-8130
Environment Canada	Environmental Protection Branch	867-669-4700
Government of Nunavut – Environmental Protection	Iqaluit	867-975-5907
Indian and Northern Affairs Canada – Water Resources Inspector	Nunavut Regional Office	867-975-4550
Indian and Northern Affairs Canada – Land Administration Minister	Nunavut Regional Office	867-975-4280
Department of Fisheries and Oceans	Nunavut Regional Office	867-975-8000
Defence Construction Canada (representatives for the Department of National Defence)	Environmental Officer – Douglas Craig	613-998-7288
	Project Manager –LCol. David Eagles	613-998-9523

9.4 Reporting Procedures

When reporting a spill to the 24 Hour Spill Report Line and completing the GNWT Spill Report Form, the following information shall be included:

- Date and time of the spill;
- Location of the spill and direction the spill may be moving;
- Name and phone number of a contact person close to the location of the spill;
- Type of contaminant spilled and quantity spilled;
- Cause of the spill;
- Whether the spill is continuing or has stopped;
- Description of the existing containment;
- Action taken to contain, recover, clean up and dispose of spilled material;
- Name, address and phone number of the person reporting the spill; and
- Name of owner or person in charge, management or control of the contaminants at the time of the spill.

The spill report is to be submitted to the INAC Water Resources Officer no later than 30 days after initially reporting the spill to the spill report line. A copy of the NU Spill Report Form is attached. The contact list is provided in Table 16 in Section 9.3.1.

9.5 Action Plan

The following substances could potentially be spilled at the FOX-2 site:

- Diesel fuel
- Gasoline
- Lubricating oils;
- Solvents;
- Alcohols and glycols;
- PCB containing liquids; and
- Heavy metal containing liquids.

9.6 Initial Action

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

The individual discovering a spill shall:

- Warn the people in the immediate vicinity and evacuate if necessary.
- Isolate or remove any ignition sources.
- Identify the spilled material, if possible, and take all safety precautions before approaching it.
- Locate the source of the spill.
- Attempt to stop the leakage and contain the spill, if safe to do so.
- Assess the likely size, extent and condition of the spill.
- Report to the DCC Contract Coordinator the spill location, type of material, volume and extent, status of spill (direction of movement), and prevailing meteorological conditions.
- In the event of a shoreline spill, provide information about the beach location, contaminated area, beach characteristics, presence of wildlife and archaeological sites that may be threatened.

Once the DCC Contract Coordinator has been contacted and arrives at the spill site, the following actions are to be taken:

- Assess the severity of the spill via direct observation and/or information from communications.
- Deploy equipment and personnel to initiate containment and clean up.
- Prepare the Government of the Northwest Territories Spill Report Form.
- Notify all other pertinent parties, including the DND and other government agencies.

Figure 2 provides the initial response actions to be taken in the event of a spill, and Figures 3 and 4 provide the actions to be taken in the event of a fuel spill on land and on water, respectively.

Figure 2: Initial Response Actions

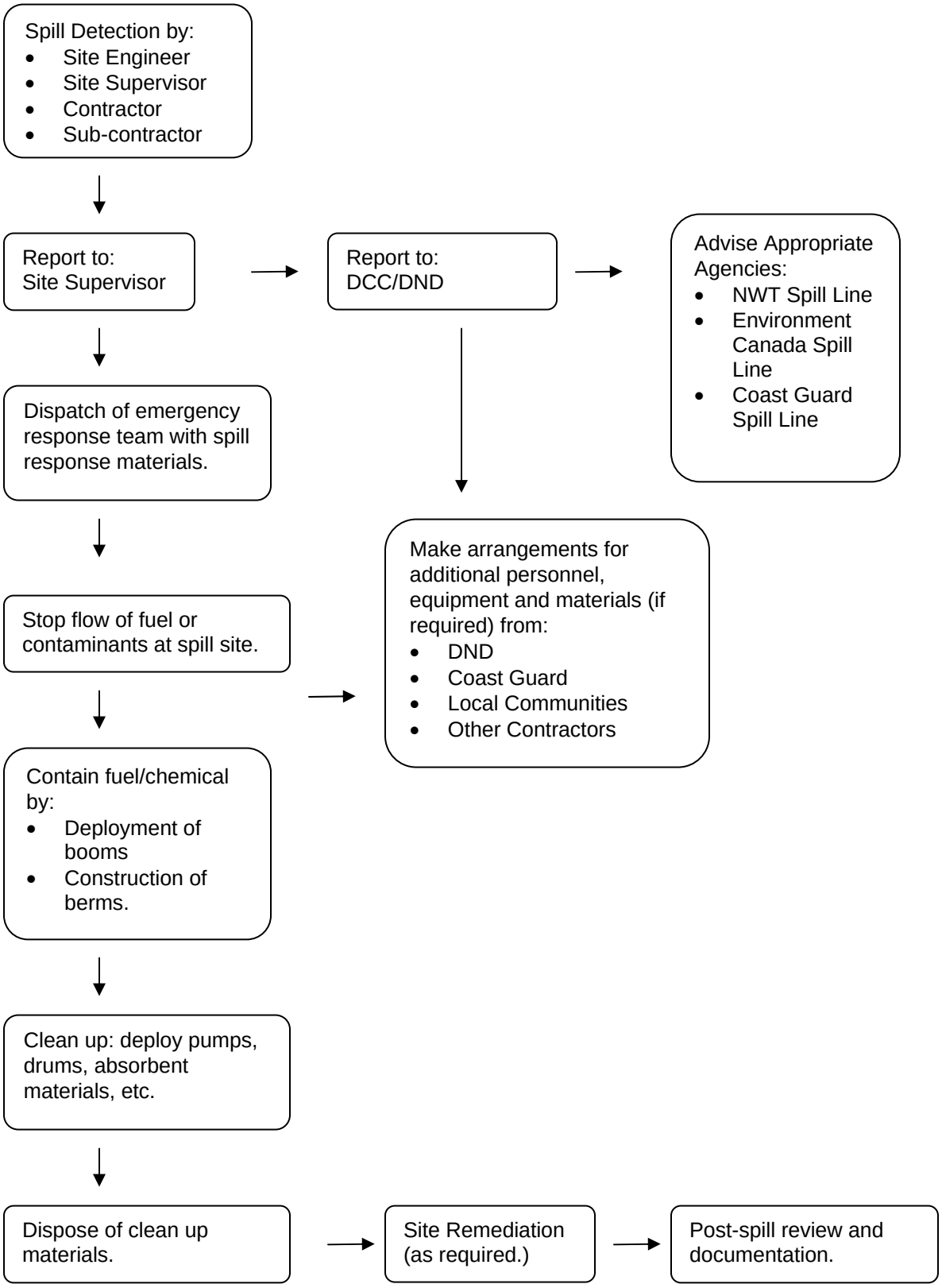


Figure 3: Procedures for Land Spill Response

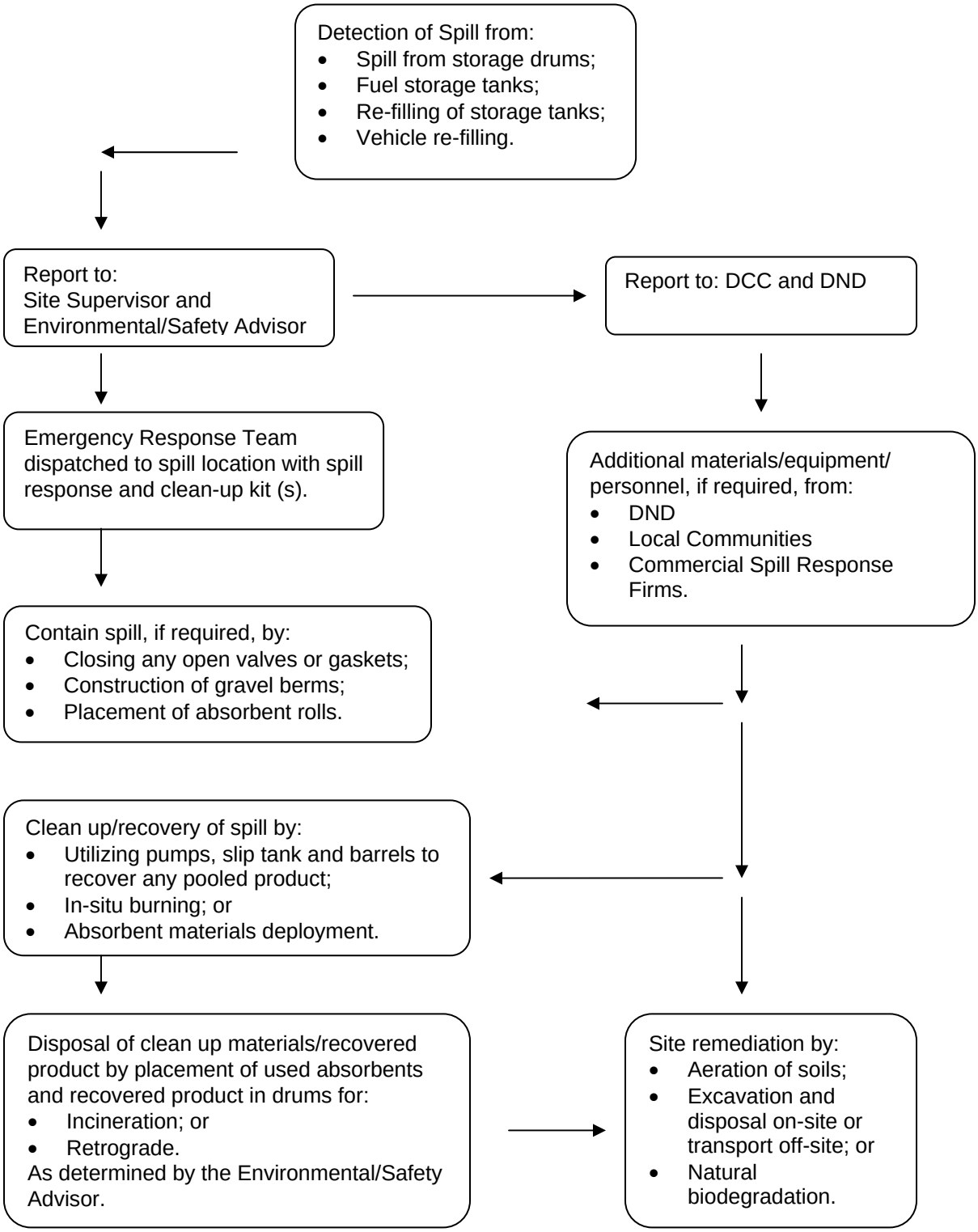
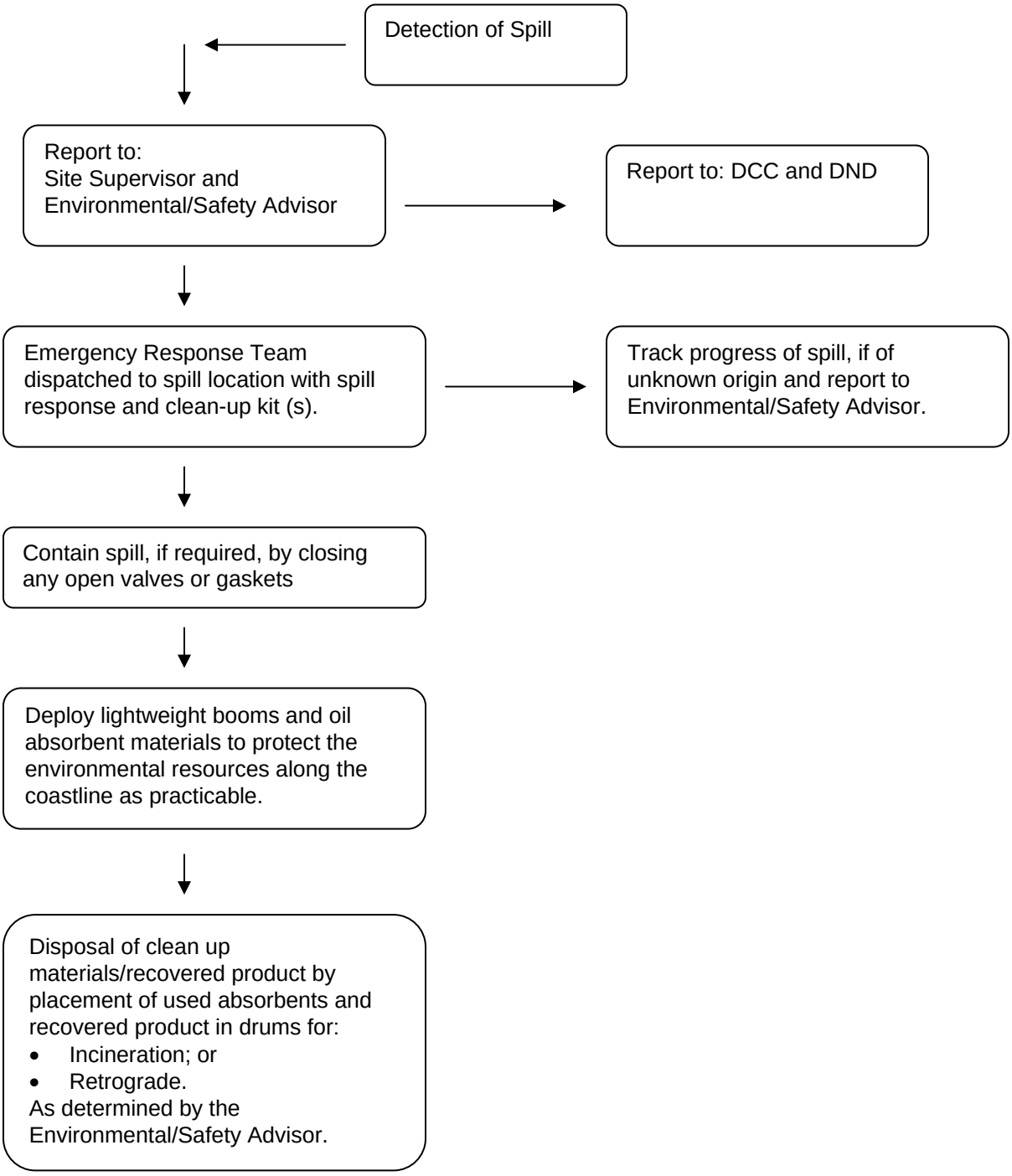


Figure 4: Procedures for Freshwater and Marine Spill Response



9.6.1 General Procedures

The environmental protection measures outlined in the following sections are to be taken by all workers on-site to reduce the chance of environmental impairment due to a spill, release or other incident. The following general clean up procedures shall apply for all spill areas:

- Wear protective clothing as required for handling spills.
- Contain spills on soil or rock by construction of earthen dykes using available material. If soil is not available, place sorbent material or a boom in the path of the spill. As the sorbent barrier becomes saturated, continually replace it. Fuel or other liquids lying in pools, trenches or in specially constructed troughs are to be removed with pumps, buckets or skimmers.
- If the ground is snow-covered, create snow dykes and line with a chemically compatible liner for containment and recovery of liquid.
- For fuels on water, deploy containment booms and recover as much fuel as possible with a work boat and skimmer if the area has less than 1/10 ice cover. If the area is ice infested, burn any fuel spills using igniters.
- Apply sorbents if necessary.
- Assess potential for disturbance of wildlife, fish and archaeological sites by spill or clean up operations and notify the relevant authorities.
- Notify environmental authorities to discuss disposal and clean up options.
- Conduct required clean up operations.
- Assess and appropriately treat any areas disturbed by clean up activities.
- Ensure the site has been completely restored and leave the site only when all work is finalized.

9.6.2 Fuel Storage Areas

In order to prevent spill or accidents at fuel storage areas, the following procedures apply:

- Avoid sites that slope towards waterways or other environmentally sensitive areas, exhibit ponding or flooding, have high groundwater tables, and/or excessive seepage or ice-rich (thaw sensitive) soils.
- Avoid archaeological resources.
- Conduct fuelling and equipment lubrication in a manner that avoids spillage of fuels, oils, greases and coolants. When refuelling equipment, operators are to use leak-free containers, reinforced rip and puncture proof hoses and nozzles, and drip trays. Operators are to be in attendance for the duration of the refuelling operation and are to ensure that all storage container outlets are properly sealed after use.
- Store fuel in self-dyking containers, or position over an impervious liner and surround by an impervious dyke of sufficient height to contain not less than 110% of the capacity of the tank(s).
- Smoking is prohibited within 7.5 metres of the fuel storage facility. Provide appropriate signage.
- Inspect fuel storage facilities at least once each week for the duration of the project. Fire-fighting equipment will be made available for immediate access at each and every fuel storage facility.
- Store all barrels containing fuel and/or other hazardous materials in an elevated position either on their side with the bungs facing the 9 and 3 o'clock position or on pallets, upright, banded and encased in overpack containers.
- All barrels shall be individually identified. The label is to be to industry standards and should provide all information necessary for health and safety, and environmental purposes. Material Safety Data Sheets for all materials maintained in the construction camp will be available for all personnel.
- Treat all waste petroleum products, including used oil filters, as hazardous material and handle and dispose as per the requirements specified in the appropriate regulations.
- Conduct regular inspections of all machinery hydraulic, fuel and cooling systems. Repair leaks immediately.

- Pre-assemble and maintain emergency spill response equipment including at least two fuel pumps, empty 200 litre barrels and absorbent material sufficient to clean up a 1000 litre spill at all permanent fuel storage sites.
- Remove all barrels, redundant fuel storage sites and associated materials and equipment from the site at the conclusion of the work.

9.6.3 Hazardous Material Storage Areas

Hazardous waste materials are wastes or materials that are designated as "hazardous" under Nunavut or Federal legislation; or as "dangerous goods" under the *Transportation of Dangerous Goods Act* (TDGA). The *Canadian Environmental Protection Act* (CEPA) regulates material containing PCBs at greater than 50 ppm. The hazardous material storage areas will be managed as outlined below:

- Hazardous waste materials may be encountered during sorting of site and demolition debris and during the excavation of the landfills. Collect and sort hazardous materials using equipment suitable for the task.
- Locate the hazardous material processing area a minimum of 100 metres from the nearest archaeological site or water body, on ice poor, well drained soil, and as close to the location of work as possible.
- Control movement of vehicles and equipment between the hazardous materials processing area and work site to prevent the spread of potentially hazardous material along roadways.
- Store hazardous materials so that each storage area is separated from the nearest water body by a 30 metre buffer zone.
- The TDGA and the *International Air Transport Association* (IATA) *Dangerous Goods Regulations* govern the packaging and shipment of hazardous goods within Canada. If shipping out of Canada, Canadian regulations and the regulations of the destination country both apply. Requirements of the IMDGC must be addressed in international waters (i.e., near Greenland).
- Any material classified as hazardous by the TDGA must be accompanied by the appropriate TDGA shipping documents. The documents are to state the shipper, the receiver and all carriers involved in the transport of the shipment. Non-hazardous materials are also to be accompanied by a document indicating ownership and responsibility of the receiver.
- Package all hazardous material in accordance with the TDGA regulations.

NOTE: MSDS and other information on hazardous materials are to be provided by the contractor once the clean up activities begin.

9.7 Potential Safety Hazards

The most significant potential safety hazard related to a fuel spill at the FOX-2 site is the possible soil and water contamination from the spill. The fuel storage area is located away from waterbodies and watercourses to avoid this hazard. Although soil contamination is a real potential hazard, the likelihood is small, spill volumes are small, and finally, any soils contaminated by a potential fuel spill can be cleaned up as part of the construction/clean up of the site.

9.8 Environmental Mapping

The drawings in Appendix A show the overall site plan and the project layout, which identify the locations of site facilities and the work areas. Once the camp is established, the locations of all spill response equipment can be noted and provided to on-site personnel.

Work areas, waterbodies, topography, etc., are also shown on the drawings.

9.9 Resource Inventory

The following equipment is typically found on-site during a clean up program. The exact type of equipment found at the FOX-2 site may vary slightly.

- Pick-up trucks
- Fuel truck
- Excavators
- Bulldozers
- Loaders
- Rock trucks and haul units
- Compaction equipment
- Large spill kits
- Small spill kits
- Generators
- Screening plant
- Crushing plant

All equipment is generally stored at the construction camp/storage area where the camp personnel are stationed. Some equipment may be stored in the area in which the equipment is being used. All vehicles are to be equipped with absorbent materials, drip trays, shovels and disposal bags.

9.10 Training and Exercises

The spill response training program will provide instruction in all aspects of spill response stated in the plan for all on-site personnel. Spill response training will include the following subjects:

- Spill awareness and prevention;
- Methods of detection;
- Storage and distribution systems;
- Storage of products on-site;
- Types of spills and seasonal considerations;
- Reporting procedures and initial responses;
- Spill response kit familiarization;
- Clean up and site remediation methods;
- Occupational health and safety; and
- Post spill review process and documentation.

NOTE: Spill response training is provided by the contractor.

10.0 Abandonment and Decommissioning Plan

The contractor is required to complete the clean up and remediate all of the areas in which their activities took place, as described in this Project Description. Following completion of the clean up activities, all vehicles and equipment, remaining fuel, supplies and construction camp are to be removed from the site by the contractor, which typically coincides with the annual sea-lift.

The following sections provide a summary of the closure activities that will occur at the completion of the clean up at the FOX-2 site.

Contractor Demobilization: Contractor demobilization includes the dismantling and removal from the site of all vehicles and equipment, remaining fuel, supplies and construction camp, clean up of the site, and transportation of labour from the site. Upon removal of the construction camp, the contractor is to grade the area to match the surrounding terrain and to ensure positive drainage. Grading is also done at the sewage lagoon and borrow areas. Existing roads are left as-is.

Demolition: Upon the completion of the demolition work, the contractor is to remove any remaining debris and leave the work site clean. Building sites and all areas affected by demolition work are graded. The areas surrounding remaining concrete and timber foundations are reshaped so that the top of the gravel is flush with the top of the foundation. Any voids or holes in the surface of the foundation are filled with gravel.

Contaminated Soil Excavation: In areas of contaminated soil excavation, the excavations are filled with granular material, compacted and graded to match the existing ground surface.

Landfarm Closure: At the conclusion of landfarm operations, additional granular material is placed to provide a compacted cover. The surface area is graded to a minimum slope of 2-4% to promote surface water run-off. Groundwater wells installed around the perimeter of the landfarm are decommissioned, including backfill with grout.

Non-Hazardous Waste Landfill: A final lift of granular material will be placed, compacted and the surface graded to avoid water ponding and minimize infiltration at the completion of landfill operations. Following completion of the landfill closure, groundwater monitoring wells are installed to facilitate monitoring of the landfill performance.

Tier II Soil Disposal Facility: Placement and compaction of the final cover of the landfill also includes grading to promote drainage away from the landfill. Following closure of the Tier II Soil Disposal Facility, groundwater monitoring wells and thermistor strings are installed to facilitate monitoring of the facility's performance.

11.0 Information Sources

ACIA, *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge University Press, 2004.

Canadian Environmental Assessment Agency, *Addressing Cumulative Environmental Effects*. Minister of Supply and Services, 1994.

Canadian Environmental Assessment Agency, *Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects*. Minister of Supply and Services, 1994.

Canadian Environmental Assessment Agency, *Responsible Authorities Guide*. Minister of Supply and Services, 1992

Canadian Environmental Assessment Agency. *Incorporating Climate Change Considerations in Environmental Assessment.* Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment, 2003.

Defence Construction Canada - DEW Line Clean Up Project, *Project Description for the Nunavut Impact Review Board Clean Up of Fifteen DEW Line Site in the Nunavut Settlement Area*. Defence Construction Canada Project Management Office, 1998.

EBA Engineering Consultants Ltd. *Dew Line Clean Up Project, FOX-2 (Longstaff Bluff) Dew Line Site – 2005 Geotechnical Investigation*. 2006.

Environment Canada. *Canadian Climate Normals 1961-1990 Longstaff Bluff Northwest Territories/Nunavut*. 2007.

Environmental Sciences Group. *FOX-2, Longstaff Bluff, Nunavut Site Investigation*. 2005

Environmental Sciences Group. *Naturally Elevated Concentrations of Trace Metals (Cu, Ni, Co, As) at the FOX-2 Longstaff Bluff DEW Line Site, Longstaff Bluff, Nunavut*. 2006.

Nunavut Land Claims Agreement, *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, 1993.

Nunavut Water Board (NWB 2004). *Guidelines for Spill Contingency Planning*, Draft, November 2005.

UMA Engineering Ltd., *Environmental Clean Up Study of 21 DEW Line Sites in Canada. Volume 19 FOX-2, Longstaff Bluff, NWT*. UMA Engineering Ltd., in association with Hardy BBT Limited and Jacques Whitford Group, 1991.

UMA Engineering Ltd., *Preliminary Design Report, FOX-2, Longstaff Bluff*.

UMA Engineering Ltd., *Specifications for the Clean Up of the FOX-2, Longstaff Bluff DEW Line Site – Draft*. UMA Engineering Ltd., in association with Hatch, 2007.

Appendix A
Drawings

Appendix B
DND/NTI Cooperation Agreements

Appendix C
NTI Technical Representative Report

Appendix D
Site Photographs

Appendix E
Historic Ocean Disposal Summary