APPENDIX I

Project Description and Environmental Screening Report

Project Description and Environmental Screening Report for the Clean Up of CAM-2, Gladman Point DEW Line Site

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on behalf of
Defence Construction Canada
(for the Department of National Defence)

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1. BACKGROUND INFORMATION

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1.2 Lead Authorizing Agencies

The lead agency for this project is the Department of National Defence (DND), 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.

1.3 List of Approvals, Permits and Licences Required

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

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

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

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

In addition, the successful contractor may require a number of other permits or licences. These permits or licences pertain to the operation and maintenance of the contractor's camp or owing 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.

There is no requirement anticipated for either the project management office or the contractor to obtain the following permits or licences:

- Quarry permits for existing DND gravel sources located within the existing DND reserves; and

- Research or archaeological permits, as scientific or archaeological research activities in support of the clean up requiring such permits has been completed.

1.4 Environmental Assessment Process

The environmental assessment undertaken under the Environmental Assessment and Review Process Guidelines Order (EARPGO), and updated in accordance with the requirements of Canadian Environmental Assessment Agency (CEAA), in support of this project has used a process in which potential environmental impacts are assessed on Valued Ecosystem Components (VECs) identified during the initial scoping exercise.

The following sections provide a summary of the activities that were undertaken in conducting this environmental assessment.

1.4.1 Scoping

As a self-directed environmental assessment, the initial step taken 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 VECs).

In scoping the project, clean up activities to be assessed were identified. Possible additional activities were examined using the CEAA's "Principal Project/Accessory" test, which is used to determine if other activities demonstrate an interdependence, 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 is an outline of the scope of the project and of the assessment:

Project: Clean Up of the CAM-2 Gladman Point DEW Line Site.

EA Trigger: Funding from Department of National Defence.

Scope of the Project: Principal Project: physical clean up of the CAM-2 Gladman Point DEW Line site.

Accessory Physical Works: Demolition of facilities, removal of waste materials (including hazardous), and contaminated soil, debris disposal, mobilization and demobilization of contractor's equipment and personnel.

Other undertakings in relation to the physical work: None.

Scope of the assessment: 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 (terrestrial, aquatic) and socio-economic assessment 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 offsite 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, GNWT Natural Resources, GNWT Health, INAC);
- 'Other' federal departments (DND, Defence Construction Canada, Parks Canada);
- Aboriginal organizations (Nunavut Tunngavik Incorporated, Nunavut Planning Commission) and the Regional Inuit Association; and
- Community leadership of the various eastern Arctic hamlets, including elders from Gjoa Haven, and the general public.

Section 9 of this Project Description provides a detailed outline of the Public Consultation process.

1.4.2 Assessment of Environmental Effects

The initial step following the scoping exercise was to determine the possible environmental effects of the project. This assessment involves 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 on each of the DEW Line sites. 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 of), operating procedures,

control procedures and demobilization plans. Detailed data concerning each of the activities (i.e. material volumes) was included with this description.

During the scientific studies described above, the site teams collected the relevant information concerning the existing environment components of the study area. 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 was focused on the location, sensitivity, seasonal presence and abundance of these components.

The assessment of environmental effects also included possible impacts relating to socio-economic factors (e.g. heritage, culture, archaeological, employment and business opportunities), land use and human health.

During the assessment stage, conclusions were made as to the type of impact (i.e. level of adversity) and its level of significance, based on scientific judgement and comments received during public consultation sessions.

1.4.3 Identification of Mitigation Options

The third stage of the assessment process was to undertake the identification of mitigation measures that would result in a reduction or elimination of likely environmental effects associated with the clean up of each of the sites. In the case of this project, the minimum requirement by assessment legislation is to address all potential adverse effects and not simply 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 Appendix II. The requirement for on-site personnel to adhere to these mitigative measures is contractual in nature as the Environmental Protection Plan forms part of the clean up contract.

1.5 List of Previous Environmental Assessments

As a federal proponent, the DND is required to conduct an environmental assessment for the clean up of each DEW Line site. As an early planning tool, these assessments were drafted in 1994 by the Department of National Defence under the auspices of the Environmental Review Process Guidelines Order (ESG, 1994). These assessments have been preceded by extensive on-site environmental and engineering investigations completed by the Environmental Sciences Group (ESG) at Royal Military College and UMA Engineering Limited (UMA). The initial investigations, which took place from 1989 to 1994, provided 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 socio-economic aspects, in particular a detailed archaeological survey of the sites, were completed during this time.

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 (Project Management Officer DEW Line Clean Up, 1998). This report was submitted with the Project Description of the Fifteen DEW Line Site in the Nunavut Settlement Area to the Nunavut Impact Review Board (NIRB) in June 1998 (Project Management Office DEW Line Clean Up, 1998b).

In 2001, further investigations were conducted to delineate contaminated areas and obtain environmental and engineering information required to finalize the clean up plans. This information has been reviewed and the environmental screening report updated to include relevant new information (Project Management Office DEW Line Clean Up, 2001).

2. PROJECT DESCRIPTION

The clean up of the former CAM-2 Gladman Point DEW Line Site.

2.1 Type of Activity

Construction activities in support of the environmental clean up of the CAM-2 site.

2.2 Summary of Operation

From 1955 to 1993, the Distant Early Warning System - the DEW Line - provided radar surveillance of the northern approaches to the North American air space. These inactive chain of radar stations, at approximately 70° N latitude, stretches several thousand kilometres across the Arctic. In Canada, the DEW Line originally consisted of 42 sites but was reduced to half of this number in 1963. The 21 sites decommissioned in the 1960's are now the responsibility of the Department of Indian and Northern Development Canada (INAC).

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 (6 in the Inuvialuit Settlement Region and 15 in the Nunavut Settlement Area), and building the North Warning System (NWS). The DEW Line Clean Up (DLCU) focuses on closing out the former DEW Line sites, including the remediation of chemically contaminated soils, the stabilization of landfill areas and the demolition/disposal of surplus infrastructure and debris. A monitoring program will be carried out after the clean up has been completed.

2.3 Preferred Options

2.3.1 Rationale for the Project and Primary Goals

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 organisms, where, as a result of their dependency on a high fat content in their diets, 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 significantly adverse effects on any one level of the Arctic food chain. Specifically:

- The limited availability of species at any given trophic level leaves little opportunity for another species to offset the effects of the 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.

The aim of the DEW Line Clean Up Project is to decommission those facilities used by the former DEW Line, which have been declared surplus to the requirements of the new North Warning System, and to restore the sites to an environmentally safe condition. Environmental restoration includes the setting of remediation objectives that are designed to preclude the continued 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, higher plants and detritus); and

- The remediation of landfills, which may serve as a source of water contamination and may enter the lower levels of the marine food chain (i.e. algae).

In anticipation of the close out of the existing DEW Line system, DND sponsored a five year environmental and engineering study of the 15 DND DEW Line sites in Nunavut (UMA, 1991 and ESG, 1993). The purpose of this study was to ascertain the baseline condition and to propose realistic clean up objectives and strategies. 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 (e.g. principally copper, lead and zinc) and polychlorinated biphenyls (PCB's) pose the greatest threat to the biophysical environment. The clean up approach is geared towards removing these contaminants from contact with the environment.

2.3.2 Evaluation of Alternatives to the Project

The DEW Line facilities at these locations are no longer required by the DND. Therefore, they pose both a safety hazard and a potential long-term source of contaminant input to the sensitive Arctic environment and, as such, must undergo a clean up process that will preclude further input into the environment and the food chain.

As a project strictly dedicated to the clean up of these military establishments, the range of alternatives to this project is limited in nature. Three alternatives to the clean up of these sites can be identified. The three alternatives 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 offsite. The federal government's continuing operational requirements of these sites (i.e. most sites remain part of the North Warning System) preclude the on-site option from being followed.

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.

DEW Line Clean Up: This alternative involves cleaning up the sites to the criteria in the DEW Line Clean Up Protocol as agreed to in the DND-NTI Cooperation Agreement, Environmental Provisions. The clean up includes removal of contaminated soil, remediation of landfills, removal of debris, demolition of surplus buildings and facilities and regrading of the site to as natural a state as practical. The clean up objectives in the agreement are considered to be protective of human health and the environment. As such, this is the chosen clean up alternative.

2.4 Project Location

CAM-2 is one of the 21 DND DEW Line sites to be cleaned up under the DLCU Project. Figure 1 in Appendix III is an NTS Map segment showing the location of the CAM-2 site. CAM-2 (68° 40' N, 97° 48' W) is located northwest of a sand and gravel spit which separates Simpson Strait

from M'Clintock Bay on the south coast of King William Island in the Kitikmeot Region of the Territory of Nunavut.

The CAM-2 site is located on a DND reserve on federal Crown lands under the administrative control of Indian and Northern Affairs Canada.

2.6. Schedule

CAM-2 underwent a detailed site investigation in 2001, and is scheduled for clean up beginning in 2003 as part of the DLCU Project. The anticipated schedule includes, but not be limited to:

- The contractor will mobilize to the site in July 2003, by barge or sealift and set up a temporary construction camp.
- Clean up activities are expected to continue through to 2006, depending on the contractor's approach and weather conditions.
- The expected duration of annual clean up activities on-site will be from July to October. During the winter months, work will cease and equipment and facilities on-site will be winterized. It is expected that the contractor's workforce and accessory personnel will mobilize to and from the site via chartered aircraft from Gjoa Haven, Cambridge Bay and other nearby northern communities.
- Completion of the clean up and demobilization of the contractor's facilities and equipment is anticipated for October 2006.
- Long term monitoring of the landfills will begin upon completion of clean up (2007) and will continue for a 25 year period. After 25 years, the monitoring requirements will be re-evaluated.

3. PROJECT PLANNING

3.1 Initial Investigations and Planning

During the radar upgrade program in the early 1990's, prior to the start of the DEW Line Clean up, a number of environmental and engineering investigations were conducted at the DEW Line sites. The objectives of these studies were as follows:

- To identify the nature and extent of chemical contamination at the sites;
- To determine the possible impact of these contaminants on the Arctic ecosystem, particularly to the food chain; and
- To develop practical environmental clean up strategies appropriate for the Arctic.

The 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 investigating areas impacted by past waste disposal practices and spills; determining and evaluating remediation alternatives for the waste disposal and spill area 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 carried out in 1989/90 by the Environmental Sciences Group (ESG) at Royal Roads Military College for the Canadian Department of National Defence: This study provided a detailed physical and chemical inventory of the stations and considered the impact of chemical contaminants on the Arctic ecosystem. This study also

provided information on the debris found on-site, contents of landfills, fuel spills and patterns of contaminant dispersal and impact from use of 45 gallon drums.

Two studies designed to assess the impact of the historically common practice of disposing debris into the ocean through the 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.

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. Materials containing such concentrations of PCBs are regulated under the Canadian Environmental Protection Act. Currently, this material cannot be placed in a landfill, and the PCB painted demolition materials are being packaged and transported to a southern disposal facility for destruction. Prior to transport, PCB painted demolition waste is being stored temporarily at the clean up sites in accordance with the Storage of PCB Materials Regulations.

3.2 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;
- Remove contaminated soils from contact with the Arctic food chain;
- Stabilize existing landfills;
- Clean up surface debris; and
- Physically restore the site to as natural a state as practical.

3.2.1 Protocol Development

In cooperation with several federal departments (Environment Canada, Fisheries and Oceans, Indian and Northern Affairs Canada) and the Government of the Northwest Territories (Renewable Resources and Health departments), DND initially drafted the General Protocol for 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 these sites (Appendix VI). 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 has been prepared that outlines the process for dealing with barrels and barrel contents found on the DEW Line sites.

3.2.2 Criteria

The protocol outlined in the DND/NTI Agreement was developed from the results of the biophysical, socio-economic, and engineering site assessments, mediated through the DND/NTI Environmental Working Group – EWG. The DEW Line Clean Up Protocol documents contaminant clean up criteria and specific physical actions that are to be undertaken, specific to the DEW Line sites. These criteria have been developed based on existing federal and provincial criteria in conjunction with studies that show the functional relationships and/or pathways for biological uptake 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 offsite at a licensed disposal or destruction facility. On-site containment measures are discussed in the following subsections.

3.2.3 Environmental Working Group

In 1997, the Department of National Defence and Nunavut Tunngavik Incorporated (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 DEW Line Clean Up 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, and recommendations for, a post-construction/remediation landfill monitoring program;
- Identification of hydrocarbon clean up requirements;
- Establishment of confirmatory testing protocols; and
- Preparation of a list of items suitable for landfilling at the DEW Line sites.

3.3 Investigation and Delineation

Prior to the clean up of each site, the DND undertakes a final site assessment. The aim of the site visits 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 for buildings and other facilities that are to be demolished;
- To re-confirm the baseline environmental conditions at the site prior to implementation;

- To examine existing landfills and identify new landfills to confirm details pertaining the required remediation strategy; and
- To identify areas suitable for the construction of a Non-Hazardous Waste (NHW) Landfill and a Tier II soil disposal facility.

The initial site investigation at CAM-2 was carried out in 1992. The final environmental and engineering investigations were completed in 2001.

3.4 Inclusion of Traditional Knowledge

One of the guiding principles of the DEW Line Clean Up 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 relevant 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 and related past activities, and occurrences that may have had an impact on landfills (i.e. dumping, hazardous waste storage, 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/or Mayor, the local Hunters and Trappers Association and other relevant community organizations.

3.5 Disposal Requirements

3.5.1 Tier I Contaminated Soil

Soils exceeding Tier I contamination criteria but not classified as Tier II contaminated soil are not considered to pose a leachate risk and may be disposed of in an on-site, non-hazardous waste (NHW) landfill. NHW landfills are also used to dispose of non-hazardous site debris and demolition materials. 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.

3.5.2 Tier II Contaminated Soil

Based on 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 DEW Line Clean Up Project Team. Of the options, the most environmentally and economically viable 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.

The design of the landfill is based on the characterization of the contaminants in the soils and the geothermal properties of the permafrost. Permafrost will provide the primary containment barrier in which the frozen substrate will advance (freeze-back) and encapsulate the contents in the facility. Extensive geothermal analysis on the time required for freeze-back, thermal regime in the ground surrounding the facilities and the depth of the active layer in the cover material have been used to determine the thickness of both the cover and the base. A high density polyethylene (HDPE) liner will be 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 moisture during the period required for permafrost aggradation. A second liner, a geocomposite clay liner (GCL), is to be installed in the cover of the facility and will prevent drainage from percolating down through the cover fill which might otherwise impact the time required for permafrost freeze-back. The GCL consists of bentonite clay sandwiched between geotextiles.

3.5.3 CEPA Contaminated Soil

Contaminated soils, which contain levels of contaminants exceeding criteria in the Canadian Environmental Protection Act (CEPA) and associated regulations, are considered hazardous material and will not be placed in the Tier II soil disposal facilities. 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 contamination 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 disposal facility, but are instead removed from the site to a licensed disposal facility.

3.5.4 Hydrocarbon Contaminated Soil

In 1998, the DEW Line Clean Up 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 contamination 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 leachablilty 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 unlined landfills. 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 options are placement in a secure, Tier II style landfill; passive land-treatment (landfarming); and containerization and transport offsite to a disposal facility in the south.

Selection of the areas for contaminated soil disposal facilities development is based on a number of technical factors including:

- Topography, drainage and geology;
- Availability of construction materials (gravel);
- Minimization of disturbance to natural drainage patterns;
- Appropriate distances from marine and freshwater systems and communities, as well as other biologically-sensitive areas;
- Ensure drainage away from ocean and domestic water supplies, distances from beaching areas and locations of contaminated soil, and
- Accessibility.

Another environmental concern during the development of these facilities is the possible requirement for use of explosives in some excavation activities. In addition to the obvious danger to human health, other possible impacts could include damage to surrounding areas (including waterbodies, 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, where 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.

4. PROJECT DESIGN - ENGINEERING

4.1. 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 will be disposed of offsite.

The new facilities are sited following the completion of the detailed engineering investigation. Currently, the Non-Hazardous Waste Landfill does not have road access. The contractor may be required to make special provisions to protect tundra vegetation. It is assumed that the contractor will have to provide adequate drainage for all excavations.

4.1.1 Non-Hazardous Waste (NHW) Landfill

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

The following materials are proposed for disposal in a NHW Landfill at CAM-2:

- 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 timbers wrapped in polyethylene sheeting; and
- Double-bagged asbestos.

The NHW Landfill at CAM-2 will consist of a perimeter containment berm and granular cover to minimize erosion and provide long term stability. The NHW is to be established on native ground (stripped of any organic matter). No base liner is required for this landfill. Development and closure of the NHW Landfill includes the following work:

- Construction of exterior berms;
- Placement and compaction of non-hazardous waste in the landfill;
- 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; and
- Supply and installation of groundwater monitoring wells in and around the landfill as indicated on the drawings.

For further design details of this landfill, please refer to Drawings 103 and 110 in Appendix III.

4.1.2 Tier II Soil Disposal Facility

A Tier II Soil Disposal Facility is designed to contain contaminated soil exceeding Tier II Criteria only. The development and closure of a Tier II Disposal Facility at the CAM-2 site will include the following work:

- Excavation of a perimeter trench around the landfill and backfill with saturated granular fill;
- Construction of perimeter berms;
- Supply and installation of geomembranes and geotextiles, as shown on the design drawings;

- Placement and compaction of Tier II contaminated soil in the disposal facility;
- Placement and compaction of intermediate granular fill within and over the disposal facility; grading to promote drainage away from the landfill; and
- Supply and installation of groundwater monitoring wells and thermistor strings in and around the landfill, as shown on the design drawings.

Further details on the design of the Tier II Soil Disposal Facility are on Drawings 103, 111, and 112 in Appendix III.

4.1.3 Landfarm

The hydrocarbon contaminated soil treatment facility at CAM-2 consists of a landfarm. Development, operation and closure of a landfarm at the CAM-2 site will involve the following work:

- Ground preparation, as required to facilitate treatment operations;
- Construction and maintenance of roadways required to support treatment operations;
- Construction of perimeter berms and runoff collection ditch;
- Installation, operation and maintenance of monitoring installations required to support treatment operations;
- Placement, stockpiling, processing and treatment of Type B hydrocarbon contaminated soil at the treatment area;
- Management of surface water runoff; and

- Closure and removal of all equipment and materials following confirmation that treatment has remediated contaminated soil.

The landfarm will be located at least 100 metres away from any water body, and in an area free of ponded water; to provided for the convenient access of equipment; at least 500 metres from the construction camp, offices and laboratory; and in an area that is relatively free of boulders and that is generally level.

Soil excavations are to remain free of water during soil removal, confirmatory sampling and backfilling activities. Dewatering of ponded water areas may be required. If dewatering is required, the water is to be tested and must comply with the wastewater discharge criteria.

Excavating is not permitted within 2 metres of any watercourse or within 2 metres of the high water mark of the intertidal zone.

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 a water content of approximately 15% within the soil.

After application of nutrients, the full thickness of the soil is to be tilled. The contaminated soil will 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 as required and prior to the end of each operational season. The water will be tested to meet the wastewater discharge guidelines. If the contact water does not meet these guidelines, it will be treated as hazardous material, and disposed of offsite.

At the conclusion of the third treatment season, the soils will be tested to ensure they meet the hydrocarbon criteria. The following tasks are to be completed to close the landfarm:

- Consolidate the treated contaminated soil within one area of the landfarm to a maximum depth of 1 metre;
- Excavate granular material from the treatment area perimeter berms and place this material over the consolidated treated soil area;
- Place and compact granular material from the perimeter berms to provide a cover over the contaminated soil area. Additional cover material is to be placed to provide a 300 mm minimum depth of compacted granular fill as cover over the contaminated 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; and
- Decommission the groundwater monitoring wells, including backfill 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.

Additional details on the landfarm can be found on Drawings 103 and 109 in Appendix III.

4.2 Development of Borrow Sources

Approximately of 102,000 cubic metres of granular material is required for the clean up.

Granular fill is required for closure of landfills, upgrading of the access roads during construction, backfill 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 Disposal Facility. Amount to be quantified upon the completion of the final design. Table 4.1 summarizes the estimated quantities of the granular borrow source at CAM-2 site.

Table 4.1 - Summary of the Granular Borrow Sources at the CAM-2 Site

Borrow Area	Location	Estimated Quantity (m^3)
Borrow Area 1	Approximately 300 metres southeast of the module train and is connected to Borrow Area 10 to the north	11,000
Borrow Area 2	Approximately 700 metres south of the module train	2,500
Borrow Area 3	Approximately 500 metres south of the module train, between Borrow Areas 2 and 4	1,000
Borrow Area 4	Approximately 600 metres south of the module train, west of Borrow Area 3	4,000
Borrow Area 7	Approximately 1.8 km north of the module train, adjacent to the north end of the Abandoned Airstrip	22,000
Borrow Area 8	Located north of the Short Range Radar (SRR) facility	7,000
Borrow Area 9	Approximately 2.5 km southwest of Station Area	40,000
Borrow Area 10	Approximately 200 metres east of the module train, adjacent to Borrow Area 1	3,500
Borrow Area 11	Located at the Beach Area, approximately 4.2 km south of the Station Area	11,000

4.3 Landfill Closure

Four landfill areas require closure/remediation at the CAM-2 site. A description of each landfill is provided in the following sections.

4.3.1 Airstrip Landfill

The Airstrip Landfill is located 450 metres west of the hangar along the shore of Simpson Strait. This landfill is approximately 130 metres long and 60 metres wide, based on the results of the geophysical survey. Environmental investigation at the landfill indicated that it poses a high risk to the surrounding environment due to the potential contaminants in the landfill and its proximity to the ocean. Therefore, the Airstrip Landfill is to be completely excavated. The following describes the excavation process:

- All surface snow/ice is to be removed and surface runoff is to be directed around the landfill;
- All debris is to be removed during excavation and separated into non-hazardous and hazardous debris. Once the debris is removed from the excavation walls and base, the soil can be sampled.
- Any leachate generated within the landfill is to be collected, sampled and tested. The water must meet the wastewater criteria in order to be discharged.
- A volatile organic compound (VOC) measurement instrument is to be used continuously during the excavation to measure concentrations of VOCs during landfill excavation operations, and prior to the removal of barrels from the landfill. If the concentrations of VOCs exceed 20% LEL, work shall be temporarily halted until ventilation (natural or induced) reduces the concentration to a safe working level.
- All asbestos containing material potentially encountered during the excavation is to be kept thoroughly wet or frozen during excavation. Once removed, the asbestos material is to be transported to the designated on-site landfill for disposal.
- Soils from within the excavation will be characterized and disposed of accordingly, either on-site on one of the landfills, or if it is hazardous, it will be packaged for offsite transport.
- If the results of the sampling from the walls and base of the excavation meet the DLCU criteria, no further excavation is required. If the results show that contaminated soils are still present, further excavation will occur.
- Once the excavation is complete and the results of the soil samples show the DLCU criteria have been met, clean granular material will be placed within the excavation and graded to provide drainage away from the area.

In order to protect the nearby marine environment during excavation, a berm is to be constructed to prevent silt and potential contaminants from entering the marine system. In addition, a floating silt fence is to be placed outside of the berm. Additional details are provided on Drawings 106 and 113 in Appendix III.

4.3.2 West Landfill

The West Landfill can be divided as two distinct landfill areas, the West Landfill-South and the West Landfill-North. The West Landfill-South is located next to the Short Range Radar facility and is comprised of a number of pockets of buried debris. This area extends for approximately 700 metres along the east side of a drumlin, and is bound by Borrow Area 8 to the west (upslope of the landfill) and by a broad, low-lying valley to the east (downslope of the landfill).

The West Landfill-North is located approximately 350 metres north of the SRR facility. This area is approximately 320 metres long and 100 wide and also encompasses a number of distinct buried debris areas. This area is bound by Borrow Area 7 to the west (upslope of the landfill), and a broad, low-lying valley to the east (downslope of the landfill).

Based on the results of the engineering and environmental investigations, there are small areas of contaminated soil to be excavated from the West Landfill. After this soil has been removed, the landfill will be covered with granular material and regraded.

4.3.3 Station Landfill

The Station Landfill is located approximately 300 metres north of the module train along the east side of a drumlin. There were two distinct areas of buried debris identified in the landfill by the geophysical survey. The results of the environmental investigation found that there is a low risk to the surrounding environment from this landfill. Therefore, the remediation option for this landfill is

to cover it with granular material and regrade it to promote surface runoff, minimize erosion, and stabilize the slope.

4.3.4 USAF Closure Landfill

The United States Air Force (USAF) Closure Landfill is located approximately 1.5 km northwest of the Station Area and 200 metres from the shore of Simpson Strait. The landfill is marked with four corner posts and a sign, INAC Permit No. 92X751. This landfill was constructed during closure of the site.

Because the environmental investigation found this landfill to pose a low environmental risk to the surrounding area, the landfill is to be covered and regarded to promote surface runoff.

4.4 Disposal of Site Debris

All site debris is to be disposed of in accordance with the DND/NTI Agreement. All debris will be sorted and classified as hazardous and non-hazardous debris. Hazardous materials will be shipped offsite for disposal; non-hazardous materials will be placed in the NHW landfill.

Creosote treated timbers will be wrapped in plastic and asbestos double-bagged and disposed of in the NHW landfill. PCB painted material will be segregated and disposed of offsite at a disposal facility.

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.

4.5 Disposal of Contaminated Soils

All contaminated soil found at CAM-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 3 square metres, are regraded whereas more extensive contaminated soils are excavated. Excavations left by soil removal are backfilled with granular fill.

Definitions of the types of contaminated soils potentially found at the CAM-2 site are as follows:

DCC Tier I Contaminated Soil: soils containing concentrations of any or all contaminants listed as follows: Lead – 200 ppm to 500 ppm; PCBs - 1 ppm to <5 ppm.

DCC Tier II Contaminated Soils: Soils containing concentrations equal to or in excess of any or all of the contaminants as listed in Table 4.2.

Table 4.2 – DCC Tier II Contaminant Criteria

Parameters	Criteria
Arsenic	30 ppm
Cadmium	5 ppm
Chromium	250 ppm
Cobalt	50 ppm
Copper	100 ppm
Lead	500 ppm
Mercury	2 ppm
Nickel	100 ppm
Zinc	500 ppm
PCBs	>5 ppm to <50 ppm

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

CEPA Contaminated Soil: Soil containing concentrations of PCBs equal to or in excess of 50 parts per million (ppm). 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 CEPA and the Federal Transportation of Dangerous Goods Act (TDGA). All applicable regulations must be adhered to.

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. All applicable regulations must be adhered to.

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

Hydrocarbon Contaminated Soil: Soil containing concentration of Total Petroleum Hydrocarbons (TPH) in excess of 2,500 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 product 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 ppm and 500 ppm and PCBs between 1 ppm and <5 ppm. Type B and combinations of DCC Tier I and Type B contaminated soil shall be excavated and treated on-site in a landfarm.

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, analysed, and determined to have contaminant concentrations below DCC Tier I contaminant levels, TPH less than 2,500 ppm, and lead and PCBs at concentrations of less than 200 ppm and 1 ppm, respectively. Table 4.3 presents a summary of contaminated soil disposal requirements.

Table 4.3 – Contaminated Soil Disposal

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	Hydrocarbon Contaminated Soil Treatment Area	Containerize for offsite transport and disposal by others.
Type A	Non-Hazardous Landfill	Tier II Disposal Facility			Containerize for offsite transport and disposal by others.
Type B	Hydrocarbon Contaminated Soil Treatment Area	Tier II Disposal Facility			Containerize for offsite transport and disposal by others with hydrocarbon resistant liners.

The locations of contaminated soil are shown on Drawings 102-107 and 116-120 in Appendix III.

4.5.1 Removal of Hazardous Materials

All hazardous materials are to be shipped offsite to a licensed hazardous material disposal facility. The exceptions to this are asbestos and creosote treated wood. Asbestos will be double-bagged and placed in the NHW Landfill, and the location of the asbestos within the landfill will be marked on "as-built" drawings. Creosote-treated wood will be wrapped in plastic and placed in the NHW Landfill.

The paint on many of the building materials contains PCBs in access of 50 ppm. These construction materials will be collected using suitable equipment for the task, containerized and transported

offsite for disposal. Temporary storage of these materials on-site will be in accordance with the Storage of PCB Waste Regulations under CEPA.

4.6 Demolition of Facilities

The work to be conducted at the CAM-2 site includes the demolition, removal and disposal or containerization of all structures and utilities as shown on the demolition drawings 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 concentration levels in excess of Tier II concentrations.
- Removal of paint or segregation and containerization of facility components identified with leachable lead paint at concentration levels in excess of Tier II concentrations.
- Removal and disposal of asbestos material in accordance with the asbestos abatement program (included in the contract documents). 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 a 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.