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PROJECT DESCRIPTION

CLEAN UP OF THE BROUGHTON ISLAND (FOX-5) DEW LINE SITE

Prepared on behalf of the Director General Environment
Department of National Defence

Project Management Office DEW Line Clean Up
Defence Construction Canada

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BACKGROUND INFORMATION

Proponent Identification Information

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Lead Authorising 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.

List Of Approvals, Permits And Licences Required

The following is a list of permits required for the clean up of the FOX-5 Broughton Island site:

1. 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, will be required for the activities associated with the clean up the Broughton Island FOX-5 DEW Line site.
   contact: Department of Indian and Northern Affairs, Land Administration, Yellowknife NT, (867) 669-2671

2. Quarry Permit

   As per the *Territorial Land Use Act* and *Territorial Quarrying Regulations,* a Quarry Permit(s), issued by the Department of Indian and Northern Affairs, will be required for the extraction of granular material required for the clean up.
   contact: Department of Indian and Northern Affairs, Land Administration, Yellowknife, NT, (867) 669-2671

In addition, a number of permits or licences may be required by the successful contractor. These permits or licences pertain to the operation and maintenance of the contractors 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 nor the contractor to obtain the following permits or licences:

- Quarry permits for existing DND gravel sources located within the existing DND reserves;
- Water licences, as existing on-site or commercial sources will be used; and
- Research or archaeological permits, as scientific or archaeological research activities in support of the clean up requiring such permits has been completed.

List Of Previous Environmental Assessments

As a federal proponent, the Department of National Defence 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* (Environmental Screening Report for the Cleanup of 21 DEW Line Sites, November 1994). These assessments have been preceded by extensive on-site environmental and engineering investigations completed by the Environmental Sciences Group at Royal Military College and UMA Engineering Limited. 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 socio-economic aspects, in particular an archaeological survey of the sites, were completed during this time.

Subsequent changes to overall project planning have been assessed from time to 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 1998 further investigations were conducted to delineate contaminated areas and obtain environmental and engineering information required to finalized 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, 2000).

Environmental Assessment Process

The environmental assessment undertaken in support of this project, under EARPGO, and updated in accordance with the requirements of CEAA, has used a process in which potential environmental impacts have been assessed on Valued Ecosystem Components identified during an initial scoping exercise.

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

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 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 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 chart outline the scope of the project and of the assessment:

Scope of the Project: **Project:** Clean Up of the FOX-5 Broughton Island DEW Line Site **EA Trigger:** Funding from Department of National Defence **Scope of the project:** Principal Project: physical clean up of the FOX-5 Broughton Island DEW Line site, including demolition of surplus infrastructure. Accessory physical works: Transportation of waste (including hazardous) materials, debris disposal, mobilisation and demobilisation of contractors equipment and personnel Other undertakings in relation to the physical work: None.
Scope of the Assessment: **Project:** Clean Up of the FOX-5 Broughton Island DEW Line Site **EA Trigger:** Funding from Department of National Defence **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.

As a result of scoping, the following factors were identified for assessment:

- The need to evaluate 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, GNWT Natural Resources, GNWT Health, DIAND);
- 'Other' federal departments (DND, Defence Construction Canada, Parks Canada);
- Aboriginal organisations (Nunavut Tunngavik Incorporated, Nunavut Planning Commission); and
- The community leadership of the various eastern Arctic hamlets, including elders from Qitiktarjuaq, and the general public.

Refer to *Description of Public Consultation* section for details of the public consultation process.

Assessment of Environmental Effects

The initial step following the scoping exercise was to undertake a determination of 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, finally, 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 mobilisation, 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 demobilisation 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 all 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. In general, these interactions were shown using a matrix table which are shown in the environmental assessment reports that accompany this submission.

Also included in the assessment of environmental effects were possible impacts relating to socio-economic factors (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.

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, all potential adverse effects were addressed and not simply those deemed to be significantly adverse, the minimum required by assessment legislation. Mitigative actions now form part of the overall project design and planning documentation, which resulted in the Environmental Protection Plan (Annex A). 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.

PROJECT DESCRIPTION

Project Title

The clean up of the former FOX-5 Broughton Island DEW Line Site

Type of Activity

Construction activities in support of the environmental clean up of the former FOX-5 Broughton Island DND DEW Line Site.

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 continent. This now inactive chain of radar stations, at approximately 70 degrees latitude, stretches several thousand kilometres across the breadth of the Arctic. The DEW Line originally consisted, in Canada, of 42 sites but was reduced to half this number in 1963. The 21 sites (6 in the Inuvialuit Settlement Region and 15 in the Nunavut Settlement Area), which were decommissioned in the 1960's, are now the responsibility of the Department of Indian Affairs and Northern Development (DIAND).

In March 1985, Canada and the United States agreed to modernise the North American Air Defence System by closing the remaining 21 DND DEW sites 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 stabilisation 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.

Preferred Options

Rationale for the project and primary goals

The process of biomagnification, which is defined as positively sloped variation in concentrations through increasingly higher tropic levels of the food chain, is a well-documented phenomenon. The process of biomagnification is a particularly important phenomenon 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 affects 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, 1991). 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 (principally copper, lead and zinc) and polychlorinated biphenyls (PCB's) pose the greatest threat to the biophysical environment. The clean up approach is general towards removing these contaminants from contact with the environment.

Evaluation of Alternatives to the Project

The DEW Line facilities at these locations no longer required by the Department of National Defence. 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, in general, and, specifically, the food chain.

As a project strictly dedicated to the clean up of these military establishments, the range of *alternatives to* this project are limited in nature. Two alternatives to the clean up of these sites that can be identified have been rejected or implemented in a limited fashion based on either military operational requirements and/or environmental reasons. These two alternatives were as follows:

Commercial or other Government use of the facilities. This alternative involves the sale of those facilities no longer required by the Department of National Defence to commercial interests. Two possibilities are present, namely on-site commercial development or sale of these

capital assets themselves and movement off-site. 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 realised 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.

Project Location

FOX-5 Broughton Island is one of the 21 DND DEW Line sites to be cleaned up under the DEW Line Clean Up Project. Refer to Table 1. Of the 21 DEW Line sites, 6 are located in the Inuvialuit Settlement Region (ISR) and 15 are located in the Nunavut Settlement Area (NSA). FOX-5 (67° 33' N, 63° 49' W) is located in the Baffin District of Nunavut. The site is near the eastern edge of Broughton Island, a small island off the east coast of the Cumberland Peninsula area of northeastern Baffin Island. Refer to Figure 1.

The upper site is situated on a high point overlooking Davis Strait and is connected by a 9 km road to the community of Qitiktarjuaq (formerly Broughton Island), which is on the western shore of the island. The lower site is located at a beaching area southwest of the community. Refer to enclosed drawing H-B233/1-9101-101 for a layout of the overall site.

The former DEW Line site is located on a DND reserve on federal Crown lands under the administrative control of Indian and Northern Affairs.

Enclosed with this submission are NTS Maps 16M & 16N and 26P, scale 1:250,000 and 16M/12 and 26P/9, scale 1:50,000.

Schedule

The clean up of the FOX-5 Broughton Island DEW Line site is scheduled from 2001 to 2003.

- The contractor will mobilize to the site by barge in 2001.
- Clean up activities will begin in 2001, once the contractor has mobilized to the site and set up camp. Clean up activities are expected to continue through to 2003, depending on the contractor's schedule.
- 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.

- Completion of the clean up and demobilization of the contractor's facilities and equipment is anticipated for September 2003.
- Long term monitoring of the landfills will begin in the year following completion of the clean up (2004) and will continue for a 25 year period. After 25 years, monitoring requirements will be evaluated.

Operations Plan

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 in general and the food chain in particular; and
- to develop practical environmental clean up strategies appropriate for the Arctic.

These investigations included:

i. An initial environmental clean up study of the DEW Line sites in Canada carried out by a Canadian consultant consortium, led by UMA Engineering Limited on behalf of the United States Air Force. The objectives for this study included identifying and investigating areas impacted by past waste disposal practices and spills; and determining and evaluating remediation alternatives for these waste disposal and spill areas; and for developing disposal options for debris arising from the demolition of facilities no longer required. This study provided information on the presence hazardous materials, the biophysical environment, the details of the facilities, and the landfills.

ii. An environmental study of ten 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 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.

iii. 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 its presence of debris on the ocean floor.

During the final site investigations conducted in 1996 at Tuktoyaktuk and Cape Parry (two former DEW Line site in the Inuvialuit Settlement Region), 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 landfilled. Studies have indicated that PCB's do not leach out of the paint and that PCBs in paint are common throughout the world. DND therefore requested that Environment Canada review these scientific studies and consider revising the regulatory definition of a PCB solid in order to permit the landfilling of construction debris that contains PCB paint. Environment Canada is examining the issue with the Canadian Council of Ministers of Environment (CCME) and is expected to make a decision by February 2001. Pending a decision, this type of material from completed or on-going clean ups of DEW Line sites is being stored temporarily at the clean up sites in accordance with the *Storage of PCB Materials Regulations*.

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 the sensitive Arctic food chain;
- Stabilize existing landfills;
- Clean up surface debris; and
- Physically restore the unused portion of the site to as natural a state as possible.

In cooperation with several federal departments (Environment Canada, Fisheries and Oceans, Indian and Northern Affairs) 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 (Annex B). As there are no established standards for the Arctic, existing federal guidelines, such as the CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites (1991), have been modified to account for the unique northern environment. These adjustments to existing guidelines 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 secondary, barrel specific, protocol has been promulgated. The barrel protocol outlines the process for dealing with barrels and barrel contents found on the DEW Line sites.

The protocol outlined in the DND/NTI Agreement (Annex B) was developed from the conclusions and recommendations resulting from the biophysical, socio-economic, and engineering site assessments (mediated through the DND/NTI EWG). The end result of the protocol development process is the documenting of contaminant clean up criteria and specific physical actions that are to be undertaken, if required at a particular site. 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 (see Appendix E of Annex B). Soil substrates containing Tier I concentrations may be placed in appropriate on-site landfills

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 or destruction facility. A Barrel Protocol has also been established for the disposal of waste materials from barrels. On-site containment measures are discussed below.

Tier II Soil Disposal Facilities

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 (estimated at 30,000 m^3 total) 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 Cleanup Project team; of these, the most environmentally and economically viable was determined to be the development of engineered Tier II soil disposal facilities at specific sites. These facilities utilise a double containment system, using permafrost and synthetic liners to limit leachate generation and prevent contaminant migration.

The Tier II soil disposal facilities are designed to provide a contained facility for the disposal of Tier II contaminated soil. One of the major concerns with respect to the facilities is the possible leakage of contaminants from soils placed in the facility and the potential impact on the surrounding ecosystem and nearby communities. The double containment system developed for the Tier II soil disposal facilities is designed to prevent contents from leaking and migrating into the surrounding environment. The design has been based on the characterisation 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, has been used to determine the thickness of both the cover and base as well as the time required to provide adequate permafrost encapsulation. Synthetic liners provide secondary containment. A HDPE (high density polyethylene) liner will be placed at the base and side slopes of the facility; this liner is chemically compatible with the contaminated soils (i.e. not adversely affected by exposure to hydrocarbons), and will prevent the potential movement of moisture during the period required for permafrost aggradation. The second liner, a geocomposite clay liner (GCL), is to be installed in the cover of the facility, which will prevent drainage from percolating down through the cover fill which might otherwise impact the time required for permafrost freeze-back. The geocomposite clay liner provides the required flexibility for accommodating settlement or disturbance. The GCL consists of a sandwiched composite of geotextiles and bentonite clay.

Careful consideration has also been given to the characterization of waste soils being placed in the Tier II soil disposal facilities. 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 facilities. These

materials are to be removed from the site to a licensed disposal facility along with other hazardous wastes. 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 will be contained within the soil matrix and will not exist as free liquids which could potentially leach. Leachate testing has also been conducted on most of the more highly contaminated soil samples as set forth in *Ontario Regulation 347*. Waste determined to be "leachate toxic" under this test are not place in the Tier II disposal facility, but are instead removed from the site to a licensed disposal facility.

Another environmental concern during the development of these facilities is the possible requirement of explosives for use 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 authorised personnel in accordance with all required permits, licenses and applicable laws and regulations, and as dictated by regulatory authorities.

Selection of the areas for Tier II soil disposal facility development is based on a number of technical factors including:

- Topography, drainage and geology;
- Availability of construction materials (gravel borrow);
- Minimisation 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.

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 organisations. Specific tasks that have been assigned to the EWG included:

- 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.

The EWG prepared a report (EWG, 2000) detailing their evaluation and recommendations of the landfills and hydrocarbon contaminated areas at FOX-5 (Annex C).

Investigation and Delineation Activities

Prior to the clean up of each site, the Department of National Defence undertakes a final site assessment. The aim of these site visits is several-fold, including:

- To fully delineate the extent of contaminated areas in order to prepare accurate construction drawings;
- To confirm the structural and environmental status for buildings and other facilities that are to be demolished;
- To re-confirm the baseline environment of the site prior to implementation; and
- To examine landfills, where required, to confirm details pertaining to the remediation of these areas.

The delineation investigations at Broughton Island (FOX-5) were conducted in July 1998 (ESG, 1999). A brief site re-visit was required in August 2000 to obtain additional information to confirm the extent of specific contaminated areas.

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 site specific planning. Traditional and local knowledge is being collected as part of the site-specific pre-construction phase (described immediately above) of the project. An Inuit representative who is familiar with both the DEW Line site and traditional use of the area will be chosen by the relevant Regional Inuit Association to be on-site during the pre-construction delineation phase of each clean up. The Inuit representative will work closely with the EWG to identify Inuit use of the area, wildlife patterns, related past activities and occurrences that may have impacted on landfills (i.e., dumping, hazardous waste storage, natural occurrences). This traditional and local knowledge is used to refine cleanup activities by including unknown issued or adjusting environmental protection plans.

Additionally, DND and the NTI will attempt to establish a community DEW Line Clean Up committee which will facilitate the flow of local knowledge to the EWG prior to and during each site visit. To effect this, the EWG will 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 HTA and other relevant community organizations.

Project Design – Engineering

Refer to enclosed drawings for details of the clean up.

Landfill Development

Non-hazardous Landfill – This landfill is to be located in the station area approximately off the northwest corner of the exting module train. Demolition debris and scattered debris from the Station Area will be placed in this landfill. Following placement and compacting of the debris, a minimum of 1 metre of fill material will be placed over the landfill. Groundwater monitoring wells will be installed around the landfill to facilitate monitoring.

New Tier II Disposal Facility – This facility is to be located adjacent to the access road approximately halfway between the airstrip and station areas. The facility will consist of saturated berms around the perimeter of the landfill, a synthetic liner incorporated along the base and side slopes, and sufficient granular fill material, as determined through geothermal analyses, to cover the facility to ensure permafrost aggradation of the contents. Monitoring of the thermal regime and the quality of the active layer water will be accomplished through the use of thermistors and monitoring wells, as specified in the DND/NTI Agreement.

Propose PCB Amended Painted Material Landfill – This landfill would be used for the disposal of demolition debris pained with PCB amended paint (PAP materials). It would be located at the Station Area, approximately 250m northwest of the existing module train. The landfill would involve excavation of the ground to a depth of 1m, construction of berms, a geomembrane cover and base and granular cover. Long term monitoring, designed to evaluate the performance of the landfill, includes visual monitoring, thermal monitoring and environmental sampling and analysis (soil and water). If a timely decision from CCME/Environment Canada regarding the disposal PAP materials is not received, these materials will be temporarily stored in accordance with the *Storage of PCB Regulations* under CEPA with the until a decision is reached as to their ultimate disposal.

Landfill Closure

Two landfills requiring closure were identified at FOX-5, Broughton Island.

Main Landfill:

- Located approximately one kilometre northwest of the Station Area, north of the access road from the Station to the airstrip, in a broad valley; encompasses an area of approximately five hectares; existing cover material - 0.6 metre depth of wet gravel and sand with some cobbles.
- Leachate has been detected in the area down gradient of the landfill; the cleanup protocol for this landfill specifies a leachate containment system; drainage will be diverted away from the landfill and erosion protection will be provided on the landfill surface; Tier I

contaminated soil would be excavated from the surface of this landfill and placed in new Non-hazardous landfill.
- Prior to closure, scattered debris from the surrounding area and some of the demolition debris will be placed and compacted in the landfill.
- Monitoring of the performance of the containment system for this landfill will be accomplished through the use of thermistors and monitoring wells, as specified in DND/NTI Agreement.

Airstrip Landfill:
- The existing Airstrip Landfill is located adjacent to the shoreline approximately 100 metres southwest of the south end of the airstrip, and covers an area of less than half a hectare.
- Loose debris to be removed.
- This landfill will be excavated; testing of soil and waste materials will be required to determine disposal requirements; excavation will be in an appropriate sequence to allow classification testing to be carried out; the surface area will be regraded/reshaped as required.
- Confirmatory testing will be carried out to confirm all contaminated materials have been removed.
- No monitoring is required.

Disposal of Site Debris

- All site debris to be disposed of in accordance with the DND/NTI Agreement.
- All materials to be sorted into hazardous and non-hazardous debris - hazardous materials to be removed from the site; non-hazardous materials to be placed in new Non-hazardous Station Area Landfill or Lower Site Landfill. Site debris containing PCB amended painted materials will be segragated and disposed of as per PCB painted material.
- Debris areas have been identified at the Station Area, along road to Water Supply Lake, Main Landfill, Airstrip Area and Beach Area. Debris consists of barrels, metal, wood, cable, cement bags, rebar, culverts, tin cans , etc.
- Total volume of loose debris has been estimated at 200 m^3.

Disposal of Contaminated Soils

Delineation investigation conducted in 1998 identified contaminated soil in following locations:
- Module Train
- Dormitory Train
- Sewage Outfall
- Station POL area
- Garage
- MOGAS Area
- Main Landfill
- Beach POL
- Heated Vehicle Storage Area

- Airstrip Landfill

Disposal of contaminated soil is as follows:

• Tier I	665 m^3	to be landfilled on site
• Tier II	1850 m^3	to be placed in Tier II facility
• Type A Hydrocarbons	235 m^3	to be landfilled on site
• Type B Hydrocarbons	1800 m^3 (minimum)	on-site treatment (landfarm)
• Tier I/Type A	1900 m^3	to be landfilled on site
• Tier II/Type A	205 m^3	to be placed in Tier II facility
• Tier II/Type B	800 m^3	to be placed in Tier II facility

The locations of contaminated soil are shown on enclosed drawings (H-B233/1-9101-103 to H-B233/1-9101-106). The fuel oil contamination at the Beach POL appears to be extensive (Type B). It is appears the fuel oil is in contact with the ocean.

Removal of Hazardous Materials

All hazardous materials, as designated under territorial or federal legislation, are to be shipped off-site to a licensed hazardous material facility for disposal. The exceptions to this are asbestos and creosote treated wood. Asbestos will be double-bagged and disposed in the new Non-hazardous Landfill. The location of the asbestos within the landfill will be marked on "as-built" drawings. Creosote-treated wood wrapped in plastic and placed in the Non-hazardous 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. The disposal requirements for this material is to be confirmed. The option include:

- Containerize and transport off-site for disposal; or
- Landfilled in the PAP Materials Landfill

Any temporary storage on-site will be in accordance with the *Storage of PCB Material Regulations* under CEPA.

Demolition of Facilities

All DEW facilities not required for NWS SRR operations will be demolished to top of concrete foundations, sorted into non-hazardous and hazardous components and treated as described above, and that portion of the site restored.

Hazardous materials that may be encountered during demolition include:

- asbestos in insulated buildings;
- creosote-treated timbers;
- sludge from cleaning of fuel tanks;
- painted building materials containing lead and PCBs; and
- other small amounts from various electronic equipment.

Station Area:

- Seven buildings, including module train, dormitory buildings, warehouse, garage;
- Antenna; five air ground antenna, one TV antenna and five additional unidentified antennae;
- Two communication dishes;
- Two communication billboards;
- Radome, antenna, waveguides and support structures;
- POL line; from the beach to the upper site;
- Power cable; from the airstrip to the upper site and distribution lines are upper site;
- Sewer line;
- Two 65,000 gallon diesel tanks, two 6,000 gallon mogas tanks, one unidentified capacity diesel tank, fuel pumphouse and distribution lines; and
- Four water tanks, 14,600 gallon capacity.

Airstrip and Beaching Area:

- Heated vehicle storage building at the airstrip (to be confirmed) and storage shed at the beaching area.
- Two 65,000 gallon diesel tanks, two 6,000 gallon mogas tanks and two 18,300 gallon diesel tanks at the beaching area; and one 18,300 gallon diesel tank at the airstrip.

General Site Grading

Areas include:

- Two existing landfills to be closed.
- Two new landfills to be developed and properly closed.
- Tier II Disposal Facility.
- Locations in Station, Beach and Landfill Areas disturbed during demolition.
- Debris and contaminated soil excavation areas.
- Borrow areas for granular materials.
- Locations disturbed by contractor during establishment and operation of cleanup camp and equipment storage facilities.
- Hydrocarbon treatment areas ie. landfarm (these requirements for these areas are to be confirmed).

Development of Borrow Sources

Approximately 170,000 m^3 of granular material is required for the clean up. A contingency of 40% was used for the DIAND Quarry permit.

Granular fill is required for closure of landfills, upgrading of the access road to the main site from the airstrip, backfill contaminated soil areas and general site grading purposes. Additional granular fill is required for the development of the new Non-hazardous Landfill, Tier II Disposal Facility and the PAP Landfill. Amount to be quantified upon the completion of the final design.

Five borrow areas have been identified at the site:

- #1 – located near the water supply lake
- #2 – located along access road (northwest of Station Area)
- #3 – located along access road (closest to and northwest of Station Area)
- #4 – located southwest from the abandoned construction camp area.
- #5 – located along the access road between #3 and #2

Contractor Support Activities

- A potential Beach Landing Area, located at the POL Sealift Receiving Area on the shoreline approximately one kilometre south of the south end of the airstrip, is available to the Contractor. This area was used for beach landing support when the site was in operation, and is accessible from the Station.
- Potential equipment storage areas include: the area adjacent to the Beach Landing Area described above; a granular area in the vehicle storage area; and, a granular pad east of the module train at the Station Area.
- Potential cleanup camp areas are located in the granular areas at the Vehicle Storage Area and Station Area.
- Sewage from the camp will be handled with, at minimum, primary treatment (settling tank) and discharged to ground surface. Sewage treatment and disposal will be in accordance with the Land Use Permit.
- Domestic waste to be disposed (as is, or incinerated as specified by the Land Use Permit) in a landfill on-site.
- Vehicle traffic to work areas is to be supported by the existing access roads that traverse the site. Access to the Upper site is via the access road from the Airstrip to the Station area.
- Labour and equipment requirements are anticipated to include 35- 45 personnel, 20 pieces of heavy construction equipment and 6 support vehicles.
- Duration of work is anticipated to be approximately 4 months, not including winter shutdown period, over a period of two years.
- Site decommissioning activities will involve the demobilisation of all contractor equipment, camp infrastructure (if used) and materials no longer required at the site. The requirement for the contractor to undertake these decommissioning activities will be a contractual obligation written into the project specifications.

Future activities

As an environmental clean up project, there are no future uses/activities associated with this project, outside of the ongoing environmental monitoring program agreed to in the DND/NTI Agreement (Appendix H and I of Annex B).

Site Access and Transportation Methods

Off site activities in support of this project will be in the form of transportation (sea and air) associated with the transport of materials, equipment and personnel to the site. These two activities are described below:

- Air transport - most transportation by air is expected to utilise existing commercial and charter services in and out of each site . Depending on the contractor's schedule, minimal use of chartered aircraft will occur at remote sites (i.e., one flight per week using Twin Otter). No rotary wing flying activity directly to the site by the clean up contractor is anticipated.

- Sealift transport - it is anticipated that contractors will utilise sea lift support to transport bulk materials and equipment (vehicles, heavy equipment, etc) to the sealift beach. This would potentially result in the increase in sealift traffic by one or two sailings per year (one early and one late summer), only if a specific, dedicated trip is made for DEW Line Clean Up purposes. Otherwise, no additional vessel traffic is anticipated.

Hazardous materials are to be placed in environmental containers at an approved storage facility on-site and removed by air or sealift, in accordance with the *Transportation of Dangerous Goods Act.*

Environmental Protection and Contingency Plans

Environmental Protection Plan

The main focus of the project environmental management program during the clean up is based upon-site specific Environmental Protection Plans and the associated North Warning System spill response plan (Annex D). The requirements outlined in these plans are the end result of the EARPGO/CEAA environmental assessment process, and include those mitigative measures designed to reduce or eliminate potential effects. Disposal methods for solid, liquid or gaseous wastes are shown in this plan.

Contingency Plans

Contingency plans associated with the clean up of each site are to be outlined in site- specific Environmental Protection Plans. One section of these plans outline generic contingency plans for the prescribed course of action to be followed in the event of fuel or chemical spills, potentially dangerous wildlife encounter and the discovery of heritage resources. These plans will enable persons that encounter a particular contingency situation to maximise the effectiveness of the environmental protection response and meet regulatory requirements for reporting to the appropriate agencies. Associated with this document is the detailed spill response plan for the North Warning System, which has operational control of the site. This spill response plan also forms part of the contractual obligations of the successful contractor.

DESCRIPTION OF THE ENVIRONMENT

Environmental conditions at FOX-5 were documented by UMA (1991) and RRMC (1991). Those environmental components potentially impacted by or influencing cleanup operations are described below.

Area Ecology

The 15 DEW Line sites in the Nunavut Settlement Area, including Broughton Island (FOX-5) are located within the Arctic Archipelago ecozone. This ecozone, which covers the northern mainland coast of Nunavut (including Boothia Peninsula) as well as the islands to the north of the mainland (i.e., Victoria Island, Jenny Lind Island, King William Island). Biologically, this ecozone is further subdivided into two ecoprovinces, five ecoregions and 21 ecodistricts.

General Geography and Geology

Refer to Figure 2 for details of the geology of the site.

The landscape at Broughton Island is consists of:

- raised marine sediments which form bench-like terrain that slopes gently toward the sea along the east and west coasts;
- glacial U-shaped valleys and broad, gently sub-rounded hills in the interior; and
- boulder covered uplands bound, partly, by sheer cliff walls along the southeast coast.

Some of the more prominent periglacial and frost features include extensive patterned ground, evident particularly within the valley; till sheets; and frost shattered bedrock common at high elevation. Surface materials include till, bedrock, fluvial deposits, colluvial deposits and raised marine deposits.

The station area is within an area of bedrock, characterized by numerous boulders. Station facilities are built on granular pads. Drainage is generally radial and surface materials are pervious and standing water and saturated soils are rare, with the exception of the area near the sewage outfall.

The airstrip and beach areas are located in an area of raised marine deposits. The terrain in this area is generally level and slopes very gently towards the sea. Surface materials are generally pervious, but wet or saturated areas are common throughout.

The area between the lower and upper sites consists of U-shaped valleys. Surface materials include mainly sands and gravels with variable amounts of fine materials and are highly to moderately pervious, although wet or saturated areas are found in the valley bottoms.

Steep terrain can be found around the station area and down the road towards the beach area. Surface materials are typically pervious and drainage channels range from poorly to well developed.

Flora

Vegetation is more sparse than that normally found in the region. Disturbed areas are almost entirely devoid of vegetation and the surrounding terrain consist of up to 5% vegetation cover. Species present include saxifrage (*Saxifraga* sp.), mountain avens (*Dryas* sp.), willow (*Salix* sp.), kobresia (*Kobresia* sp.), sedges (*Carex* spp.) and Arctic poppy (*Papaver radicatum*).

Vegetation is slightly more abundant at the Beaching Area, with up to 15% vegetation cover. Dominant species include sedges (*Carex* spp.) and cotton grass (*Eriophorum* sp.).

Fauna

Terrestrial Mammals

Terrestrial wildlife biodiversity is considered low to moderate. The proximity of the lower site to a commercial airstrip and corresponding disturbance limits use of area by wildlife. Wildlife is more likely at upper site.

Potentially Barren-ground caribou (*Rangifer tarandus greonlandicus*), although none observed or reported during site visits. Information from EWG indicate that Caribou may occur it the area.

Broughton Island is found within known or suspected polar bear (*Ursus maritimus*) denning and wintering areas. An important summering area is located approximately 150 km to the north and a major denning area is located 120 km to the southeast. Polar bears have been observed at the municipal dump

Other terrestrial animals that are likely present include Arctic fox and lemming.

Marine Mammals

Marine mammals that may be found off the coast of Baffin Island include:

- Beluga whales (*Delphinapterus leucas*) – One of the populations occurs in Cumberland Sound region and belugas frequent coastal areas during the summer period of July to late August.
- Narwhal (*Monodon monoceros*) – During the fall they migrate along the east coast of Baffin Island to overwintering grounds in Davis Strait and west Greenland.
- Bowhead whale (*Balaena mysticetus*) – They migrate south along the east coast of Baffin Island to Cumberland Sound region. A major summering area is located approximately 200 km north of the station.
- Killer whale (*Orcinus orca*) – May be found in Davis Strait in late summer.

- Harp seal (*Phoca groenlandica*) – Migrate along the east coast of Baffin Island, north in the summer and south in September/October.
- Harbour seal (*Phoca vitulina*) – They occur in small numbers in the summer along the east coast of Baffin Island.
- Bearded seal (*Cystophora cristata*) – Are year round residents of the eastern Arctic.
- Ringed seal (*Phoca hispida*) – Are abundant throughout the arctic and are resident year round.
- Hooded seals *(Cystophora cristata)* - Davis Strait is an important breeding and migration area.

The local community has indicated that seals, narwhal and walrus populations occur year round in Davis Strait and Broughton Channel. The receiving waters of Davis Strait are a known harvest area supporting diverse marine life.

Birds

Potentially Snowy Owl (*Nyctea scandiaca*); Peregrine Falcon (*Falco peregrinus*), Gyrfalcon (*Falco rusticolus*), and Rough-legged Hawk (*Buteo lagopus*) are known to occur in the region, although none have been observed on site.

The largest population of Fulmar (*Fulmarus glacialis*) is located 50 km south of the station at Cape Searle. Other colonies include Exeter Sound and Scott Inlet.

Unidentified gulls (*Larus hyperboreus or L. argentatus or L. thayeri or Xema sabini*) have been observed at site.

Fish

Anadromous Arctic char (*Salvelinus alpinus*) are known to occur throughout southeastern Baffin Island. Large populations of both land-locked and sea-run Arctic char constitute a significant food source for domestic and commercial use. Fishing for Arctic Char occurs off the coast. Limited numbers of Atlantic salmon (*Salmo salar*) occur in late summer.

Heritage Resources

Several historical sites have previously been recorded on Broughton Channel. None of these sites occur within the station area.

One new site was recorded on the west side of Broughton Island southeast of the summit station in 1990. It is a small Inuit site, possibly late Thule in affiliation. The site includes two areas. One area includes a grave marker, three tent rings, two caches, one shelter and two set of possible kayak rests. The other area includes two shelters, a hearth and a cache. The archaeological site is well removed from the station and is not expected to be impacted by cleanup activities.

Socio-Economic Setting

The Hamlet of Qitiktarjuaq (formerly Broughton Island) is located adjacent to the site. The Broughton Island airstrip provides regular scheduled air links to the south, west and north, with Iqaluit being the main hub of the area. A wide range of other commercial and public services are available in the village.

It is expected that, for the short term, a significant number of person-years of employment will be generated in the local community as a result of this project. Additionally, further enhancement of the area's economy is expected resulting from increased local purchases and use of local businesses.

Optimization of Inuit involvement in the clean up is the subject on on-going negotiations between NTI and DND, and will include minimum levels in the contract for Inuit labour and business participation. This agreement, which will meet the requirements under the Nunavut Land Claims Agreement, is expected to be completed in the fall of 2000.

Native Land Use

It is recognised that hunting and the relationship to the land are of profound cultural and spiritual importance to the Inuit. Hunting itself provides a means for linking modern day lifestyles and culture with the past. Hunting is valued by the Inuit as it contributes to both independence and community well-being. Renewable resources provide Inuit with food and other needs such as clothing. The main terrestrial mammals used for food and other applications are polar bears, caribou and muskoxen. People from Qitiktarjuak hunt and fish throughout the general area. The many fiords, inlets and bays from Broughton Island, south to Cape Dyer are used by the residents of the community for hunting marine mammals. Across Broughton Channel, on Baffin Island, residents of Qitiktarjuaq will hunt for caribou.

Residents are known to visit the upper site, but the duration of the stay is limited.

Government Land Use

The Broughton Island (FOX-5) site is used exclusively for the purposes of operating a military radar station, which includes on-site operation and maintenance of infrastructure and off-site transportation by air and sealift. Currently an unmanned North Warning System Short Range Radar is located at the site.

Arctic Airports operates an airport adjacent to the Lower Site.