remnants of the beach ridge exist. By 1993, the entire pond had been infilled. Landfilling occurred sometime between 1964 and 1993 with some landfilling possibly occurring prior to 1964.

4.3.2 Remediation Plan

The East Beach Landfill covers an extensive area and, as such, the remediation of this landfill involves a number of components. Environmental investigations at the East Beach Landfill indicate that some portions of the landfill pose a high risk to the surrounding environment due to the potential leaching of contaminants and therefore, these portions are to be leachate contained. Any pockets of buried debris outside of the key trench areas of the leachate containment system are to be excavated. There are two areas of the landfill that are very low environmental risk and will be regraded.

The following provides a brief description of the construction of a leachate containment system. Further details are provided on Drawings 123-125 and 141 in Appendix III.

- Ground preparation, as required to facilitate treatment operations;
- Construction of exterior berms;
- Excavation of the key trench;
- Supply and installation of geotextiles and geomembranes as indicated on the Drawings;
- Placement of granular cover to promote freezeback;
- Final grading to promote drainage away from the site and to match the surrounding terrain.

Regrading requirements are described in Section 4.8 and excavation procedures are described in Section 4.4.1.

4.4 Site Debris

All site debris is to be disposed of in accordance with the DND/NTI Agreement. The 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. Materials painted with PCB amended paint 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.

4.4.1 Debris Excavation

The following describes the excavation procedures for debris areas:

- Excavation of contaminated soil and sorting of the debris into hazardous and non-hazardous components;
- On-site disposal of contaminated soil;
- Meltwater is to be collected at the low point of the excavation for settling of sediments and testing of water prior to discharge. The meltwater must meet the wastewater discharge criteria before discharge is allowed;
- Containerization of hazardous debris and hazardous contaminated soil as required; and
- Placement of clean granular material following landfill excavation to provide drainage away from the area.

4.5 Disposal of Contaminated Soils

All contaminated soil found at FOX-M 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 material.

Definitions of the types of contaminated soils potentially found at the FOX-M site are as follows:

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

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

Table 4.1: DCC Tier II Contaminated Soil Criteria

Parameter	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 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 Canadian Environmental Protection Act and the Federal Transportation of Dangerous Goods Act. 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 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 and 500 ppm and PCBs between 1 and <5 ppm. Type B and combinations of DCC Tier I and Type B contaminated soil shall be excavated and treated 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, analyzed, and determined to have contaminant concentrations below DCC Tier I contaminant levels, TPH less than 2500 ppm, and lead and PCBs at concentrations of less than 200 ppm and 1 ppm, respectively.

Table 4.2: Contaminated Soil Disposal Requirements

Designation Co-Designation	Tier I	Tier II	Type A	Type B	Hazardous
None (No Co-contaminants)	Non-Hazardous Landfill or Tier II Disposal Facility	Tier II Disposal Facility	Non-Hazardous Landfill or Tier II Disposal Facility	Hydrocarbon Contaminated Soil Treatment Area	Containerize for offsite transport and disposal by others.
Type A	Non-Hazardous Landfill or Tier II Disposal Facility	Tier II Disposal Facility			Containerize for off-site transport and disposal by others.
Type B	Hydrocarbon Contaminated Soil Treatment Area	Tier II Disposal Facility			Containerize for off-site transport and disposal by others with hydrocarbon resistant liners.

The locations of contaminated soil are shown on the design drawings 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 FOX-M 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 50 ppm.
- Removal of paint or segregation and containerization of facility components identified with leachable lead paint at concentration levels in excess of 5 ppm.
- Removal and disposal of asbestos material in accordance with the asbestos abatement program. Asbestos must be removed and disposed of in a method that eliminates the risk of

exposure to friable asbestos. Proper personal protective equipment and specialized equipment is required when removing asbestos. Asbestos materials are bagged in polyethylene prior to placement in 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.
- Removal and placement of hazardous waste material in containers in accordance with the Hazardous Waste Regulations. Hazardous waste is segregated and disposed of according to CEPA Guidelines.
- Removal, wrapping in plastic, and disposal of creosote treated timbers. Creosote treated timbers must be wrapped in polyethylene sheets before being placed in a NHW Landfill. Creosote coated power poles or foundations are to be cut off 300 mm below ground level.
- Removal and disposal of drainage culverts.
- Disconnecting and capping of services, as required.
- Non-hazardous materials require no special treatment and can be crushed and placed in the NHW Landfill.

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

4.7 Transportation of Hazardous Materials Offsite

Hazardous materials to be placed in environmental suitable containers at an approved containment facility on-site and removed by airlift or sealift in accordance with Transportation of Dangerous Goods Act.

4.8 Regrading

There were numerous small areas identified during the field investigations, in addition to the two areas identified at the East Beach Landfill, that require regrading. These areas generally consist of piles of buried or partially buried, non-hazardous debris that will be covered with additional granular material and shaped to blend in with the natural terrain and promote positive drainage.

4.9 Contractor Support Activities

- Use of existing beach landing area, airstrip and roads at site for equipment transport, movement and access to work areas.
- Set-up of cleanup camp and equipment storage.
- Sewage from the camp will be handled with, at minimum, primary treatment (settling tank and lagoon) and discharged to ground surface. Sewage treatment and disposal will be in accordance with the Land Use Permit and Water Use License.
- Domestic waste to be disposed (as is, or incinerated as specified by the Land Use Permit) in the new Non-Hazardous Waste Landfill.
- Demobilization of cleanup camp following end of project.
- Vehicle traffic to work areas is to be supported by the existing access roads that traverse the site.

- Labour and equipment requirements are anticipated to include 35 - 50 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 5 years.

4.10 Future Activities

The site is a North Warning System Logistics Support Site, and there are no current plans to change this land use. The site is also adjacent to the Hamlet of Hall Beach, and there exists the possibility the community may expand into some of the areas that are closed/remediated during the clean up. In addition, an ongoing landfill monitoring program was agreed to in the DND/NTI Agreement. The proposed landfill monitoring program is updated after the completion of the clean up program.

5. PROJECT IMPLEMENTATION

5.1 Site Access and Transportation Methods

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

- **Air transport** - most transportation by air is expected to utilize existing commercial and charter services in and out of the 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).

- **Sealift transport** - it is anticipated that contractors will utilize sealift to transport bulk materials and equipment (vehicles, heavy equipment, etc.) to/from FOX-M. This would potentially result in the increase in sealift traffic by one or two sailings per year (one early and one late summer). Otherwise, no additional vessel traffic is anticipated.

- **Land transport** – it is anticipated that overland transport will be required between the site and boat dock for mobilization/demobilization of materials and equipment.

5.2 Environmental Protection and Contingency Plans

5.2.1 Environmental Protection Plan

The main focus of the project environmental management program during the clean up is based upon site specific environmental protection plans. 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 harmful effects. Disposal methods for solid, liquid or gaseous wastes are shown in this plan. The Environmental Protection Plan for FOX-M is provided in Appendix II.

5.2.2 Contingency Plans

Contingency plans associated with the clean up of each site are 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 maximize 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, as per the Northwest Territories Water Board Contingency Planning Guidelines. A copy of the Contingency Plan is in Appendix VI.

5.3 Clean Up Contract

The following steps outline the contract award procedures:

- A tender package is produced which includes **ALL** of the work to be completed at the site. The tender package will include instructions for the contractor to attain Minimum Inuit Content (MIC) in his/her workforce, as well as a Minimum Inuit Employment Content (MIEC), as specified in the DND/NTI Economic Agreement.

- The tender award will go to the most competitive bidder, who fulfills all of the requirements as stated in the tender package.

- Once the contract is awarded, the successful contractor can begin plans to start the clean up work.

6. DESCRIPTION OF THE ENVIRONMENT

Environmental conditions at FOX-M were documented by UMA (1991) and UMA and ESG (2001). Those environmental components potentially impacted by or influencing cleanup operations are summarized below.

6.1 General Geology

The FOX-M site is located on the east coast of Melville Peninsula, within the Arctic Platform, and lies on top of a knoll approximately 5 metres above sea level. The area is covered by gravel and appears to be an emerging sea bottom. The underlying bedrock consists of limestones and dolomitic limestones, Ordovician and Silurian in age.

The landscape is characterized by a surficial cover of marine reworked glacial drift consisting mostly of sand, gravel, and cobble sized bedrock rubble. These materials are distributed throughout the landscape and are typically overlain by an organic-rich lacustrine black or brown mud and silt veneer in low lying or depressional terrains, particularly in areas which are water saturated.

The landscape is typically undulating to nearly flat-lying with raised beach ridges and nearshore marine features superimposed on the landscape. The raised beach configuration broadly reflects the morphology of the present day shoreline. The elevation rarely exceeds more than 5 metres above sea level and numerous water-filled depressions occur throughout the landscape.

No bedrock exposures occur within the study area; however, Trettin (1975) mapped the region as part of a succession of variable dolomitic limestone that appears in isolated outcrops at Igloolik and Ouilliam Bay, consisting of finely crystalline, yellowish grey to buff dolostone. The succession is complete in the Rowley Island Aquataine well and consists of approximately 200 m of dolomite that carries an Arctic Ordovician fauna that may be at least partly correlative with Ordovician limestones and dolostones along the Arctic Platform.

6.2 General Hydrology

Site drainage and topography of FOX-M and the surrounding area is governed by shallow relief. The FOX-M site is located on the eastern shore of Melville Peninsula and is situated on top of what appears to be a gravel covered, emerging sea bottom. The area is a flat-lying coastal plain with an approximate elevation of 5 metres, which gently increases in elevation inland to the west.

Overall surface drainage generally flows east towards Foxe Basin. There are several isolated lakes and shallow catchments west of the site which are typical of the coastal area of Melville Peninsula. There are four large lakes immediately upgradient of the site which feed the site water supply reservoir.

There are several catchments and man-made depressions in the immediate vicinity of the site buildings and facilities due to extensive gravel extraction over the years at this site. Surface drainage from many of the buildings, POL, and drum storage areas will collect in these catchments and depressions. Other surface drainage will continue through shallow ditches or along the ground surface toward Foxe Basin.

The water supply reservoir is located west of the main module train area. The reservoir was part of a lake which completely occupied a natural depression. The reservoir was constructed using man-made dykes on all sides and by the installation of a dam in the southwest corner. It is recharged from another large lake located immediately upgradient and west of the reservoir. The lake was at one time isolated from the reservoir, but was joined through the excavation of a channel between them.

Drainage is towards the shore. Drainage in the vicinity of the airstrip and associate buildings is dictated by local topography and generally flows to the east. Drainage from the facilities along the western edge of the airstrip including the dry storage flows to a lake located immediately southwest.

6.3 Flora

The FOX-M site is located on a relatively flat, raised beach adjacent to Foxe Basin. There is very little vegetation on the disturbed portions of the site. Wet meadows which surround ponds and lakes, common in and around the station, are underlain by a thin, organic mat, and are dominated by a near complete cover of grass and sedge species.

The following types of vegetation may be found at the site: groundsel (*Senicio congestus*); cotton grass (*Arctagrostis latifolia*), polar grass (*Poa spp.*), bluegrass (*Elymus arenarius*), wild rye (*Festuca spp.*), fescue (*Festuca spp.*), arctic poppy (*Papaver radicatum*), mountain avens (*Pryas spp.*), mosses and lichens.

6.4 Fauna

6.4.1 Terrestrial Mammals

The following is a summary of the terrestrial fauna identified and observed at the FOX-M site:

- Barren ground caribou (*Rangifer tarandus pearyi*) - Hall Beach is located approximately 100 km north of the Northeastern Keewatin Caribou Grounds which include an extensive area (11,000 km^2) of special interest to the Government of Nunavut. However, no caribou were observed during the period of the site investigations in 1997, 2000 or 2001.

- Polar Bears (*Ursus maritimus*) - Polar bears in this area are within Management Zone C, which may support one of the largest polar bear populations in the Canadian Arctic. Prince Charles and Air Force Islands and immediately south of Hall Beach are important summer retreats for the bears of Foxe Basin, which is largely ice-free during that season. During winter, bears in this region are found on land-fast ice along the southern half of Melville Peninsula. Polar bear sightings were reported during the summer of 2002 during the due diligence clean up program.

- Arctic Wolf (*Canis lupus arctos*) – Known to occur on Melville Peninsula; however, none were observed during the site visits.
- Arctic Fox (*Alopex lagopus*) - Dens are typical for coastal areas. These animals were likely initially attracted to the artificial food sources (landfill and litter), as foraging is common. None were observed during the site visits.
- Arctic Hare (*Lepus arcticus*) – Known to occur in the area.
- Brown lemming (*Lemus sibericus*) – Known to occur in the area.
- Collared lemming (*Dicrostonyx torquatus*) – Known to occur in the area.

6.4.2 Marine Mammals

Foxe Basin is one of the least known areas of the Canadian Arctic in terms of marine mammal surveys. Pack ice does not completely clear until September or October, making surveys for marine mammals difficult. No sightings of marine mammals were recorded during the site visit, but archaeological surveys at the time located bones of walrus (*Odobenus rosemarus*), ringed seal (*Pusa nispida*), harp seal (*Phoca groenlandica*) and bearded seal (*Erignathus barbatus*) that may have been hunted in the area. Skulls of bowhead whales (*Balaena mysticetus*) were also found in the areas. Walrus and seals are hunted along the coast during fall by residents of Hall Beach and Igloolik, 50 km to the north.

Beluga whales (*Delphinapterus leucas*), narwhal whales (*Monodon monoceros*) and bowhead whales may pass through Hudson Strait and summer in Foxe Basin as the ice melts. Walrus may also pass through Hudson Strait and summer in Foxe Basin or may remain in Foxe Basin throughout the year. Large areas of Foxe Basin stay open throughout the winter, where walrus are often found. Bearded seals, ringed seals and harp seals may migrate into Foxe Basin via Hudson Strait.

6.4.3 Avifauna

Arctic terns (*Sterna paradisaea*) are very common along the coast of the FOX-M site. The tundra swan (*Cygnus columbianus*) and common eider (*Somateria mollissima*) were also observed at the site. Large snow goose (*Chen caerulescens*) colonies have been known to occur immediately north and south of the site. Although no sightings of the snowy owl (*Nyctea scandiaca*), peregrine falcon (*Falco peregrinus*), gyrfalcon (*Falco rusticolus*) or rough-legged hawk (*Buteo lagopus*) were reported, these raptors have been known to occur in the region.

6.4.4 Fish

There are no commercial fisheries in the Hall Beach area; however, Hall Lake contains a population of Arctic char (*Salvelinus alpinus*).

6.5 Heritage Resources

Two previously recorded sites occur in the vicinity of FOX-M. The recorded locations of both of these sites placed them well off the station facilities. Evidence suggests that at least one of these sites, a Thule village, is located inside the southern edge of the radar property. It consists of 12 house foundations with interior features. The western edge of the site has been destroyed by road construction and the northern edge by gravel extraction activities. In addition, disturbance by souvenir collectors was obvious. The location of the second previously recorded site was not verified.

Two newly identified prehistoric sites were recorded. One site is located southwest of the Hamlet of Hall Beach. The single artifact recovered suggests that the site has a Dorset Palaeo-Eskimo component, although other evidence suggests that the major part of the site dates to the Thule and subsequent Inuit period. This location has been disturbed by pipeline construction in the past and exhibited more recent disturbance, possibly by souvenir collectors. The other site, south of the

station, consists of 7 features including inuksuit and meat caches. Examination of fragments of a soapstone vessel found near the features suggests that at least part of the site contents may be Thule in age. Approximately 500 metres to the south is a single large cache with associated walrus crania. The depth of the vegetation and lichen on this site suggests some antiquity. The site is currently undisturbed.

The Hall Beach area is of high archaeological potential. Disturbance of relevant sites has already occurred.

6.6 Socio-Economic Setting

It is expected that for the short term (i.e., 5 years), a significant number of person-years of employment will be generated as a result of this project. Additionally, further enhancement of the areas' economy is expected resulting from increased local purchases and use of local businesses.

6.7 Native Land Use

It is recognized 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.

No special conservation land status has been designated at this site.

6.8 Government Land Use

The FOX-M site was a main station within the original DEW Line system. The DEW Line radar/communication facilities at this site were decommissioned and replaced by a Long Range Radar (LRR) in the early 1990s. The FOX-M site operates as a manned Logistics Support Site throughout the year.

6.9 Valued Ecosystem Components

Valued Ecosystem Components (VEC's) are detailed in the environmental screening report included with this submission and include:

6.9.1 Physical

- Protection of permafrost soils; and,
- Surface water, particularly related to the drinking water supply.

6.9.2 Biological

Tundra habitat including:

- Feeding and nesting areas for birds;
- Feeding areas for herbivores;
- Feeding and calving areas for local wildlife; and,
- Local vegetation.

6.9.3 Socio-economic

- Regional employment opportunities;
- Regional business opportunities;
- Regional training opportunities; and,
- Hunting and fishing in local area.

6.9.4 Archaeological, Historical and Cultural

- Archaeological sites identified around the station.

7. IDENTIFICATION OF ENVIRONMENTAL EFFECTS

An environmental assessment of the clean up of FOX-M was completed. As part of this assessment, potential interactions between the project components and the environment were identified. The focus of the assessment was on the location, sensitivity, seasonal presence and abundance of these components (i.e. bird nesting areas). Through this assessment Valued Ecosystem Components (VECs) were identified, which can include physical, biological, socio-economic, historical or cultural components.

7.1 Environmental Effects

7.1.1 Value Ecosystem Components vs Project Components

The following summarizes the interaction and potential impacts between VECs and the various activities associated with the clean up.

VEC	Activity	Description of Impact
Air Quality	Hazardous Materials Removal	The removal of the contaminated soil from the environment will reduce the risk of impacting air quality.
	Site Grading / Borrow Source Development	The extractions of granular materials and grading activities have the potential to create dust and impact air quality.
Soil Quality	Landfill Development/ Landfill Closure	The migration of contaminants from the new landfills has the potential to degrade soil quality if not constructed properly. The closure of the existing landfill will reduce the risk of impacting soil quality.
	Contaminated Soil Disposal/Hazardous Materials Removal	The removal of the contaminated soil and hazardous materials from contact with the environment will improve soil quality.

VEC	Activity	Description of Impact
	Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil and/or fuels could impact soil quality.
	Contractor Support	The operation of the construction camp will include treatment and disposal of waste, and could negatively impact soil quality.
Water Quality	Landfill Development/ Landfill Closure	The migration of leachate from the new landfills and siltation of waterways during construction/closure has the potential to degrade water quality, both surface and active layer water, if not constructed according to the specifications. Remediation/closure of the existing East Beach Landfill will reduce the risk of negative impact on water quality. The development and closure of the landfills has the potential to disrupt drainage at the site.
	Contaminated Soil Disposal / Hazardous Materials Removal	The removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of surface and active layer water.
	Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil, and/or fuels. An accidental release could impact water quality.
	Site Grading/Borrow Source Development	Erosion and sedimentation of waterbodies during grading and gravel extraction activities has the potential to negatively impact water quality. Drainage to be improved as a result of grading disturbed areas. The extraction of granular material will alter the terrain of the borrow area and has the potential to disturb drainage.

VEC	Activity	Description of Impact
	Contractor Support	The operation of the construction camp will include treatment and disposal of waste. The potential exists for waste to impact water quality.
Terrain	Landfill Development/Landfill Closure	Excavation required for the development and subsequent closure of the new landfills and closure of existing landfills has the potential to degrade permafrost.
	Site Debris Disposal	The removal of site debris has the potential to further disturb the existing terrain.
	Site Regrading	Terrain and drainage will be improved as a result of grading disturbed areas. Previously disturbed areas will blend into the natural environment.
	Borrow Source Development	The extraction of granular material will alter the terrain of the borrow area.
	Contractor Support	Movement of contractor's equipment and personnel around the site has the potential to disturb the tundra.
	Contaminated Soil Excavation	The excavation and removal of contaminated soil has the potential to degrade permafrost.
Terrestrial Animals and Habitat	General Clean Up Activities	The use of heavy equipment during the clean up has the potential to disturb wildlife.
	Contaminated Soil Disposal/Hazardous Materials Removal	The removal of hazardous materials and contaminated soil from the environment reduces the risk of exposure to terrestrial animals.
	Landfill Development	Loss of habitat may occur as a result of the development of the new landfills in previously undisturbed areas.
	Facility Demolition	The existing facilities may be used by wildlife as habitat (i.e. nests in structures). The demolition of these facilities has the potential to impact availability of habitat.
	Borrow Source Development	The extraction of granular material will require the disturbance of the ground and has the potential to impact terrestrial habitat.

VEC	Activity	Description of Impact
Aquatic Habitat and Animals	Landfill Closure	The proximity of the East Beach Landfill to the marine environment has the potential to impact aquatic habitat, thereby affecting aquatic animals, due to sediment or hazardous materials entering the water. The remediation of the East Beach Landfill will reduce the potential for impact.
	Site Regrading/ Borrow Source Development	The extraction of granular material and grading adjacent to waterbodies (both fresh and marine) has the potential to impact aquatic habitat, and thereby affecting aquatic animals, due to sediment entering the water.
	Contaminated Soil Disposal/Hazardous Materials Removal	The removal of contaminated soil and other hazardous materials from areas close to waterbodies, reduces the risk of exposure to aquatic animals.
	Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil and/or fuels. An accidental release could impact aquatic habitat.
	Contractor Support	The transportation to/from the site has the potential to disturb aquatic animals.
Health and Safety	General Clean Up Activities	The excavation of potential hazardous materials from the landfills, the collection and disposal of potential hazardous debris, the removal of hazardous materials from the facilities and the general handling of hazardous materials has the potential to impact health and safety of workers.
	Contaminated Soil Disposal/Hazardous Materials Removal	The removal of contaminated soil and other hazardous materials from the environment reduces the risk of exposure to people.
Archaeological	General Clean Up Activities	The presence and movement of people around the site has the potential to disturb the archaeological resources identified around the site.
Land Use	General Clean Up Activities	Clean up activities may disturb traditional land use, i.e. hunting and fishing activities that would occur during the summer months.

VEC	Activity	Description of Impact
Aesthetics	General Clean Up Activities	Generally, the clean up will improve the aesthetics of the site by removing unsightly debris and restoring the site to a more natural state.
Economy	Contractor Support	The contractor will be required to have a minimum Inuit content in the workforce for the clean up. This will provide employment benefits and related economic benefits.

7.1.2 Impact of the Environment on Project

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

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

Typically, labour required for the clean up includes heavy equipment operators and general labourers, as well as environmental and engineering specialists. Other opportunities include cleaning and cooking staff and transportation. Effects from the clean up will be felt primarily by the community of Hall Beach. During the clean up there will likely be increased employment and

business opportunities for members of the community. As the contract for the clean up of FOX-M has not been awarded, the requirements of the community are not confirmed. It is likely that a temporary self-sufficient construction camp will be established at the site to accommodate the contractor and other personnel.

8. IDENTIFICATION OF CUMULATIVE ENVIRONMENTAL EFFECTS

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

- Physical or chemical transport mechanisms;
- "Nibbling loss" (i.e., gradual disturbance);
- Spatial or temporal crowding;
- Growth induction initiated by the project.

8.1 Analysis of Cumulative Environmental Effects

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

8.1.1 Scoping

Scoping includes the identification of issues of potential concern, VECs that could be affected and boundary setting. The activities considered included the operation of the FOX-M North Warning System Long Range Radar and Logistics Support site and the day-to-day operations of the Hamlet of Hall Beach.

The spatial boundaries included impacts over a larger (regional) area including the crossing of jurisdictional boundaries. As the landfills will remain on-site, temporal boundaries extended beyond the time frame required to complete the clean up work.

8.1.2 Analysis of Effects

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

8.1.3 Mitigation Measures

Mitigation measures were identified for project-environment interactions. Mitigation measures are outlined in Table 8.1.

8.1.4 Significance

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

8.2 Identification of Mitigation Measures and Residual Impacts

Mitigation measures were identified that would result in a reduction or elimination of likely environmental impacts associated with the clean up. Mitigation measures are outlined in the Environmental Protection Plan (EPP) for FOX-M (Appendix II). The EPP forms part of the contract documents and requires all on-site personnel to adhere to the mitigation measures outlined.

The following summarizes the mitigation measures identified for the potential adverse environmental impacts detailed in Section 7. Taking into account the mitigation measures, the significance or anticipated residual impacts were identified for all potential impacts.

Impact	Mitigation Measure	Significance
The extraction of granular materials and grading activities have the potential to create dust and impact air quality.	Implement dust control measures. Only water will be used for dust suppression.	Not significant.
The potential for migration of leachate from the existing and new landfills could degrade soil and water quality.	New facilities do not include hazardous materials. The Tier II facility will incorporate leachate containment, which includes synthetic liner and freezeback of permafrost. Existing landfills are being remediated to eliminate the risk of leachate production and migration. Grade landfill cover to promote surface run-off. Site facilities away from natural drainages.	Not significant due to design criteria for landfill development and closure.

Impact	Mitigation Measure	Significance
The potential exists for accidental release of hazardous materials and contaminated soil. An accidental release would impact the local environment, including soil and water quality.	Implement proper handling, storage and transportation procedures for hazardous materials. All workers to be trained in proper handling procedures for all hazardous materials on-site. Do not store hazardous materials, including fuel, in the beach area. Follow the spill contingency plans. Ensure all materials and equipment to implement contingency plans are available on-site. Handle all fuel in accordance with Contingency Plan.	Significant impacts are not likely provided mitigation measures are implemented.
The operation of the construction camp will include treatment and disposal of waste. The potential exists for waste to impact the environment.	Do not dispose of hazardous materials in camp waste system. Disposal of all sewage to be in accordance with applicable regulations and guidelines.	Not significant.
Erosion and sedimentation of waterbodies during grading and gravel extraction activities has the potential to impact water quality.	Maintain a 30 m setback from the water bodies during gravel extraction activities. Use silt curtains during grading of portions of the East Beach Landfill near the shoreline.	Not significant.

Impact	Mitigation Measure	Significance
Excavation required for the development or closure of the landfills and contaminated soil excavation has the potential to degrade permafrost.	Minimize time permafrost is exposed. Minimize surface area of exposed permafrost or active zone.	Not significant.
Disturbance of the terrain and drainage may occur due to extraction of granular material, the development and closure of the landfills, movement of contractor's equipment and personnel around the site and removal of site debris.	Regrade and reshape disturbed areas to match existing terrain and drainage paths. Use existing roads for movement around the site.	Not significant provided mitigation measures are implemented.
The use of heavy equipment in various aspects of the clean up including landfill development and closure, demolition, grading and transportation will increase noise levels, which has the potential to disturb wildlife. Marine transportation to and from the site has the potential to disturb marine mammals.	Avoid known wildlife colonies or bird nesting areas, if possible. Employ minimum distance/ height restrictions for transportation activities.	Not significant provided mitigation measures are properly implemented.
Loss of habitat as a result of the development of the new landfills and the extraction of granular material in previously undisturbed areas.	Regrade and reshape the disturbed areas to match existing terrain to facilitate recovery of ecosystem components.	Not significant.
The existing facilities may be used by wildlife as habitat (i.e. nests in structures). The demolition of these facilities has the potential to impact availability of habitat.	Inspect facilities prior to demolition for use by wildlife. Do not demolish while birds are nesting. Contact appropriate wildlife officer for additional guidance to ensure disturbance of wildlife is minimized.	Not significant.

Impact	Mitigation Measure	Significance
Impact on aquatic habitat due to sediment and/or hazardous materials entering an aquatic environment from activities such as the extraction of granular materials, grading and handling of contaminated soil and other hazardous materials	Implement mitigation measures to prevent deleterious substances from entering the aquatic environment.	Significant effects not likely provided mitigation measures are implemented.
The transportation to/from the site has the potential to disturb aquatic animals.	Follow designated routes and times for shipping activities.	Significant effects not likely provided mitigation measures are implemented.
The excavation of hazardous materials from the landfills, the collection and disposal of hazardous debris, the removal of hazardous materials from the facilities, and general handling of hazardous materials has the potential to impact health and safety of workers.	Transportation of any hazardous materials to be in accordance with Transportation of Dangerous Goods Regulations. Develop and implement a comprehensive health and safety plan. Workers are to wear and use appropriate personal protective equipment. Workers to be trained in use of personal protective equipment and proper handling procedure for hazardous materials. Proper procedures for working around heavy equipment to be implemented.	Significant effects not likely provided mitigation measures are implemented.

Impact	Mitigation Measure	Significance
The presence and movement of people around the site has the potential to disturb archaeological resources in the area.	Clearly mark archaeological resources. Avoid resources. Contact authorities in the event a new resource is discovered or a known resource is disturbed.	Not significant.
Clean up activities may disturb traditional land use, hunting and fishing activities that would occur during the summer months	Contact local hunters and trapper organizations to coordinate clean up activities and traditional land use.	Not significant.

9. PUBLIC CONSULTATION PROCESS

As part of the DEW Line Clean Up Project, public consultations were carried out in communities across the north since August 1992. In 1992 and 1993, teams from the Department of National Defence and other federal departments conducted a broad range of public consultation sessions to consult the local residents about the project and to obtain input regarding specific concerns about the work.

9.1 Initial Public Consultation

DND has sought to integrate the views of all interested stakeholders, including individuals or groups, into the decision making process for the DLCU Project. The approach to public involvement in environmental assessments for this project includes two major elements:

- Adequate public notification; and
- Appropriate public consultation.

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

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

Public consultation meetings were held in those communities in the vicinity of DEW Line sites. Briefings to government officials were also held in Iqaluit, Cambridge Bay and Yellowknife.

Advertisements and information packages were provided in English as well as Inuktitut. Minutes were recorded at each of the meetings and action items passed on to the responsible agencies.

9.1.1 1992 Program

Nine communities were visited in 1992 including: Broughton Island; Clyde River; Igloolik; Hall Beach; Taloyoak (formerly Spence Bay); Kugaruuk (formerly Pelly Bay); Gjoa Haven; Kugluktuk (formerly Coppermine); and Cambridge Bay.

The primary objectives of the initial meetings were to:

- Provide general information to the community regarding the status and schedule for the project;
- Provide information regarding the process for closure and cleanup of the DEW Line;
- Present environmental information regarding the DEW Line Clean Up (DLCU) Protocol adopted for the project;
- Provide general information regarding the demolition/disposal of facilities;
- Obtain information regarding public concerns through discussions at the meetings and through questionnaires; and
- Obtain information regarding local labour and contracting capabilities to assist in developing implementation strategies.

A report prepared by the project management team outlined the information provided to the public and summarized questions/concerns that arose during the meetings.

There were a variety of questions and concerns raised regarding all aspects of the project; however, almost half of the questions and concerns dealt with employment opportunities and environmental impact and protection. There is a serious desire among the people in the communities to obtain training and to be involved in the clean up of the sites. The issue of environmental impact and protection was expressed as a concern about the short and long-term impact on the food chain. Perhaps the most serious concerns expressed centred on previous disposal practices, particularly ocean dumping.

The appearance of the sites, particularly those adjacent to communities, was also a concern raised during the meeting. The proposed cleanup protocol was generally accepted to be the most practical.

In general, the meetings were well attended, the project team was well received and discussions were wide ranging and lively. People seemed to appreciate the initiative taken by DND to inform the communities regarding the DLCU project and the public provided valuable insights. In some cases the community expressed unrealistic expectations regarding the economic impact of a one-time project and it was important to correct these.

9.1.2 1993 Program

The same nine communities in the Nunavut Settlement Area visited in 1992 were revisited in May and June 1993. The objectives for this second round of meetings were as follows:

- Update the communities on the current status of the project;
- Present information on the site investigations and the 80% Design Submission for 10 DND DEW Line sites studied in 1992;
- Provide clean up protocol information on the remaining 11 DND DEW Line sites surveyed in 1993;

- Present information on the plans for the 21 DEW Line sites; and
- Request suggestions and ideas regarding community concerns with the cleanup plans.

The questions and concerns raised by the public were similar in nature to those expressed during the 1992 meetings. Community members were predominantly concerned about employment, business and training opportunities, as well as environmental protection and impact to the food chain.

Generally, public concern on the aforementioned issues was alleviated through these consultation sessions.

9.1.3 1994 Program

In 1994, public consultation focused on the involvement of both the territorial government and the recently formed Inuit organizations. Two meetings were held in late 1994 with Nunavut officials in Cambridge Bay (Kitikmeot Inuit Association/Nunavut Tunngavik Incorporated joint meeting and Nunavut Planning Commission).

9.1.4 1996 Program

In 1996, the DLCU project resumed its public consultation program by holding public meetings at those communities closest to the sites undergoing clean up in 1996. Within the Nunavut Settlement Area, the communities of Broughton Island and Clyde River were invited to participate in a public meeting discussing upcoming DEW Line Clean Up activities at the FOX-4 Cape Hooper DEW Line site (approximately 160 km west of Broughton Island).

9.1.5 1997 Program

The DLCU project office followed up on the 1996 community visits in cases where there was local interest to do so. Both Clyde River and Broughton Island hosted a public information session.

These meetings focused on providing planning details as to the upcoming work at the FOX-4 site. Community interest continued to be high, especially in the area of employment opportunities, environmental protection and salvage opportunities.

9.1.6 Pre-Construction Public Consultation

In the summer of 1997, during the delineation investigations for FOX-M, further consultation was conducted to ensure local knowledge was collected and incorporated into the final delineation investigations. Local knowledge is important for uncovering location(s) of contamination that had not been previously assessed, as well as information required for completing the Landfill Risk Evaluation Matrix for each landfill site. Involvement of the local community and Inuit representation (Nunavut Tunngavik Incorporated (NTI) technical representative) included:

- Discussions with long time residents and community officials, including Hamlet Assistant Senior Administrative Officer and Chairman of Hunters and Trappers Association; and
- Site visit by NTI technical representative with a local community representative.

The local community was able to provide much information on past disposal practices. Concerns and comments were gathered and incorporated into the delineation investigation plans and the clean up plans.

The NTI technical representative and the local representative were on-site during portions of the delineation work. During this time, the NTI technical representative was able to observe the site and note any technical concerns that may have been overlooked by the DND investigation team.

Another meeting in the nearest local community is typically planned for 2-3 months prior to the start of the construction work to review the program with the local people.

9.2 DND/NTI Project Review Committee

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

10. ABANDONMENT AND DECOMMISSIONING PLAN

The contract documents for the DLCU Project will require the contractor to clean up and remediate the area in which their activities took place. Following the completion of clean up activities, all vehicles and equipment, remaining fuel, supplies, and construction camp are to be removed from the site by the contractor. The construction specifications provide for a percentage of the payment for mobilization/demobilization to be withheld pending a satisfactory withdrawal from the site.

The contractor will be required to arrange for demobilization, which usually coincides with the annual sealift. All provisions of the EPP will be strictly adhered to until the demobilization is complete.

11. MONITORING AND MAINTENANCE PLANS

11.1 Monitoring in Relation to the Environmental Assessment

This monitoring involves a continual on-site review of impact predictions made during the environmental assessment process. The purpose of this monitoring is two fold:

- To confirm the accuracy of impact predictions made if, and when, they occur on-site and to ensure that mitigative action taken is appropriate; and
- To be able to identify impacts that occur on-site that may not have been identified during the assessment process but, none the less, require an appropriate mitigative response.

The results of on-site this assessment of will be reviewed on an annual basis as part of the project quality assurance program. Assessment areas and impact predictions requiring adjustment or re-evaluation are identified at this point and an action plan prepared.

11.2 Monitoring in Relation to Environmental Objectives

As part of the overall DLCU program, DND will undertake an extensive multiple year post clean up monitoring program at each site. This monitoring program is contained in the DND/NTI Agreement. The purpose of this program will be to ensure that environmental objectives, particularly those related to landfill remediation, continue to be met. The specific tasks related to the monitoring of each landfill are based on the associated risk. A site specific monitoring plan will be developed upon completion of the clean up.

The Environmental Working Group will review the results of each monitoring event and provide recommendation to the Steering Committee. In those cases where the remediation standards are not being maintained, an engineering and/or other solution will be implemented to rectify the situation.

12. INFORMATION SOURCES

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