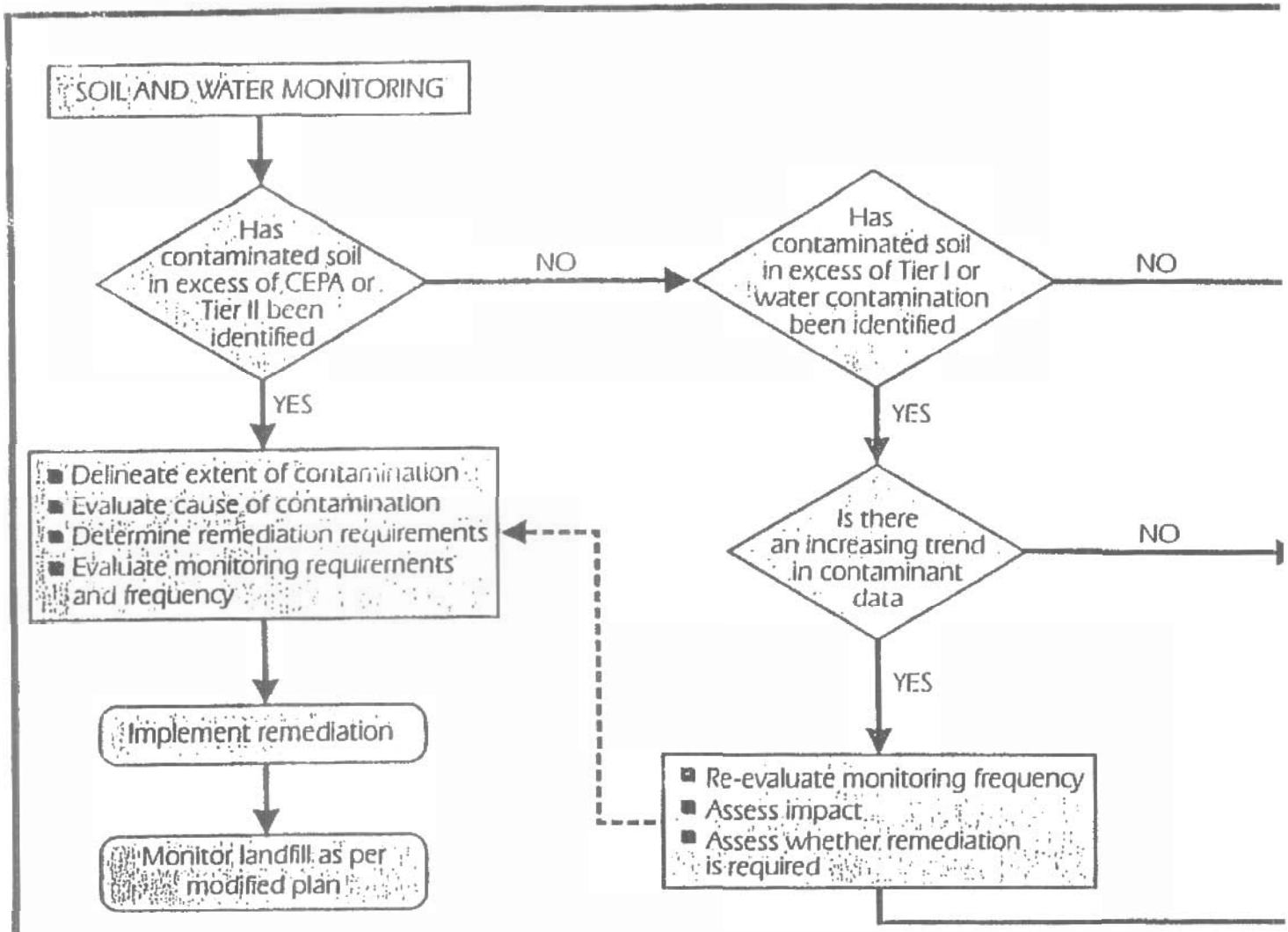

Note:

Water contamination to be evaluated relative to baseline and background concentrations.

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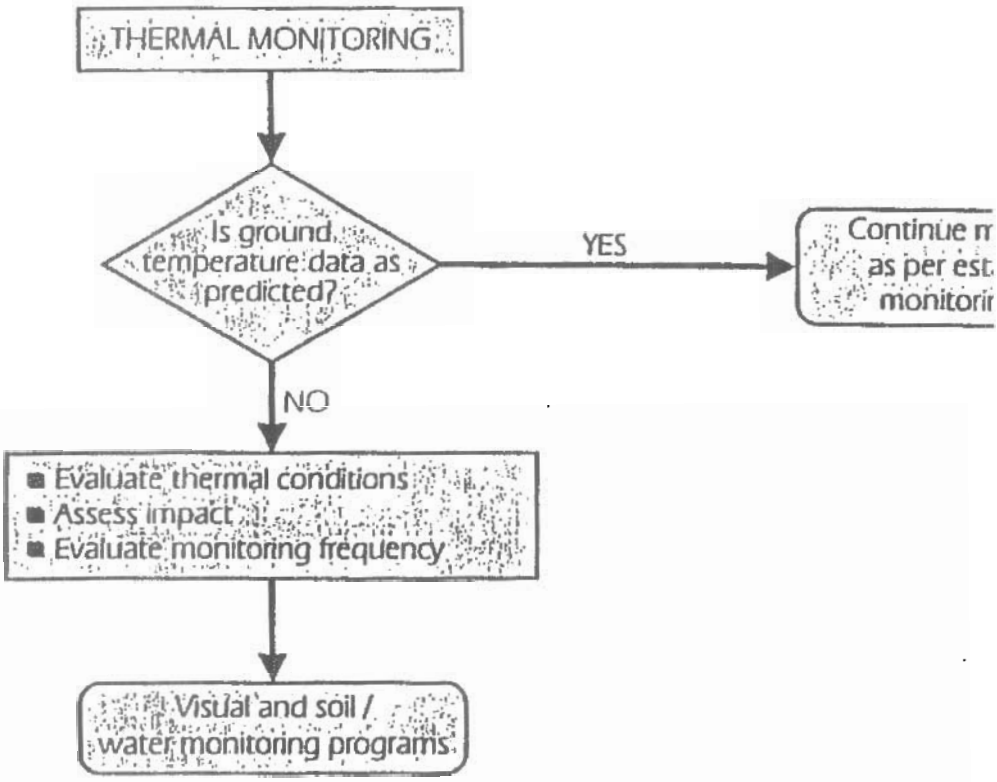

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6.0 Impact of Monitoring Results

The possible results and the associated potential mitigation requirements for the landfill monitoring components are described in the following subsections. For all instances, the mitigation requirements are dependent on the severity of the deficiency, and will be assessed by a professional geotechnical engineer with northern engineering design and construction experience. In addition, the assessment and implementation of resulting remediation requirements will be carried out in a staged approach to ensure that the proposed solutions address the specific requirements in a logical and cost effective manner.

6.1 Visual Inspection

If the results of the visual inspection program indicate evidence of significant settlement, ponding, or frost jacking, it may be necessary to implement one or more of the following mitigative measures:

- increase the frequency of the visual monitoring program
- place erosion protection material such as riprap, vegetation mats, etc.
- recompact existing debris material and existing granular material
- place additional granular fill
- regrade, as required, to promote positive drainage away from the deficient landfill area.

It should be noted that settlement of the landfill surface may not necessarily result in failure of the landfill. Settlement (typically differential settlement) that results in ponding and infiltration of surface water could lead to erosion and frost jacking problems.

If the visual monitoring program results indicate evidence of sloughing of landfill perimeter berms and thermal contraction cracks, it may be necessary to implement one or more of the following mitigative measures:

- flatten granular berm slopes
- compact existing granular slopes
- place and compact additional granular fill material

6.2 Soil and Groundwater Monitoring

The results of the soil and groundwater monitoring program will be compared against baseline data established prior to the initial landfill development or remediation program. Results of the analysis of soil and groundwater samples that show decreasing trends of contamination at the perimeter of landfills typically indicate that the implemented landfill remediation has been effective. Conversely, if the results indicate increasing levels of contamination, then it may be necessary to implement one or all of the following:

- Increase the frequency of the monitoring program.
- Carry out a review and evaluation of the nature and extent of the contamination, including the incorporation of the results of the visual monitoring program. The major objective of this evaluation will be to determine the cause of the contaminant migration problem, and in particular to determine if it is the result of ineffective design, material (e.g. liner) failure, improper compaction, selection and use of inadequate granular material, poor grading, etc. This evaluation may require intrusive investigation into and around the landfill.
- Depending on the results of the above, it may be necessary to remove and replace liner material, reconstruct containment berms, etc.
- Assess the requirement to excavate and dispose of the contaminated soil; this would include the delineation of the vertical and areal extent of the contamination.
- Excavate and dispose of contaminated soil and/or excavate all or part(s) of the landfill, as required.

The requirement for the specific scope and extent of remediation, as outlined above, will also incorporate an risk evaluation of the potential impacts of the contamination based on the principles defined in the Landfill Risk Evaluation Matrix. The need for the risk evaluation is predicated on the understanding that not all affected sites pose the same risk to the environment, and consequently remediation requirements will vary.

6.3 Thermal Monitoring

The results of the thermal monitoring program will be compared against the parameters for freezeback that were incorporated into the geothermal design of the landfills. It is important that the overall assessment of these results consider the results of both the visual and soil/groundwater monitoring programs. If the thermal monitoring results indicate ground temperatures that are significantly higher (greater than 2° C) than

APPENDIX C

Public Consultations

Cam-5 Community Meetings

April 12-14, 2005
Hall Beach
Kugaaruk

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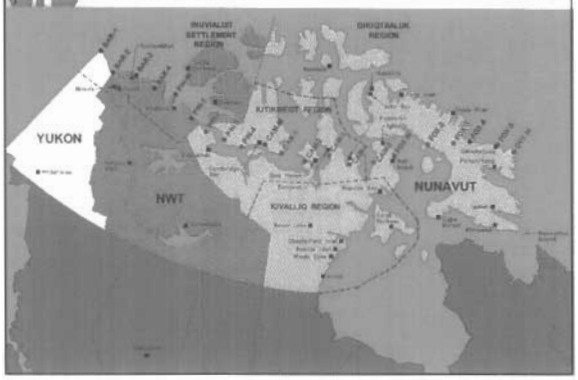
DEW LINE CLEAN UP (DLCU)

National Defence / Défense nationale

COMMUNITY MEETINGS FOR CAM-5 (Mackar Inlet), APRIL 2005

uma — Defence Construction Canada / Construction de Défense Canada

DLCU Sites



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Purpose of the meeting

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- To inform the residents about the status of the DEW Line Clean-Up project
- To provide information on the work to be done at CAM-5 Mackar Inlet.

Defence Construction Canada / Construction de Défense Canada

Who We Are

DEW Line Clean Up Team

ᐅᖃᐅᓯᐅᓂᖓᓂᑦ ᐃᓄᓇᓕᖕᒪᓕᕐᓗᒍᓐᓇᖅ
Presentation Outline

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- ᐊᐃᖅᑯᑎᓂᖅ

DEW Line Clean up:

The Project Team and Background Agreements- Don Beattie

Site Investigation and Monitoring – Daniela Loock

Design and Construction – Barry Fedorak

Expected Timelines For Clean up – Phil Warren

Questions

Defence Construction Canada / Construction de Défense Canada

Project Management Office (PMO) and Project Team

PMO

- Responsible to DND for overall performance of the project, from start to finish
- Full time on-site Representation during the clean up construction

Environmental Sciences Group

- Scientific Advisor

UMA Engineering Limited

- Engineering Consultant/ Advisor

Water and Earth Sciences Associates

- Environmental Working Group

Defence Construction Canada / Construction de Défense Canada

Project Aim

At 21 DND DEW Line sites:

- Return sites to an environmentally safe condition
- Prevent migration of contamination from the sites into the food chain
- Demolish unused buildings
- Remediate existing landfills

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The Distant Early Warning (DEW) RADAR Line

- 42 sites constructed in Canada in the late 50's
- 21 sites were decommissioned in the early 1960's and are the responsibility of the Department of Indian Affairs and Northern Development (DIAND)
- 21 other sites were decommissioned between 1989 and 1993 and are the responsibility of the Department of National Defense (DND)
- Replaced by the more modern North Warning System; often these sites share locations with old DEW Line sites

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1998: Environmental agreement signed by DND and NTI in Cambridge Bay – Addresses environmental issues and how the clean-up will be carried out within Nunavut.

- Landfill containment
- Hazardous materials
- Asbestos
- Contaminated soils
- Testing to ensure the clean-up has been done properly
- Restoration of disturbed areas
- Monitoring landfills
- Schedule for the clean-up

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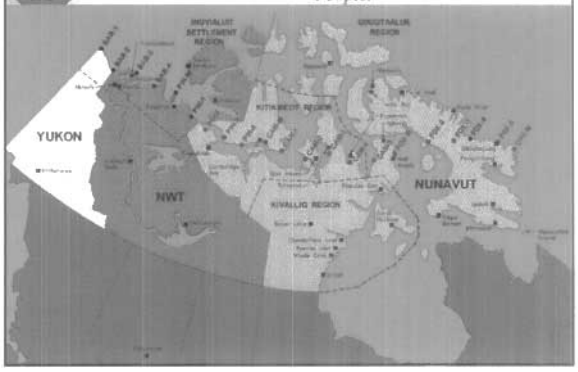
All the sites are located within Aboriginal land claim areas. It is a cooperative project with the Aboriginal People.



Economic Agreement between DND and NTI– signed in August 2001 in Iqaluit

- Economic benefits for NTI ensuring Inuit participation
- Training allocation ($750,000 for Nunavut sites) in support of an NTI training plan
- Increased opportunities for Inuit to receive training and experience to create, operate and manage Inuit owned businesses in Nunavut
- Competitive contracts that specify Inuit content and participation
- Establishment of a mechanism whereby contractors fulfill their agreements on levels of Inuit participation.

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Highlights of the DND-NTI Cooperation Agreement

- DND retains long term environmental responsibility.
- DND intends to finish the clean up of all 21 DEW Line sites in the next 9 years.
- Site cleanup followed by a 25 year monitoring program.

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Role of ESG

- To carry out an environmental investigation of the site
- To provide scientific advice for the cleanup
- To ensure appropriate removal of contaminated soils and materials during the cleanup

Final Result of the clean up

- Overall positive impact on wildlife, fish and marine mammals as contamination sources will be removed.
- Removal of safety hazards.
- Clean up of land at site.
- Economic, employment, and training opportunities for area residents.

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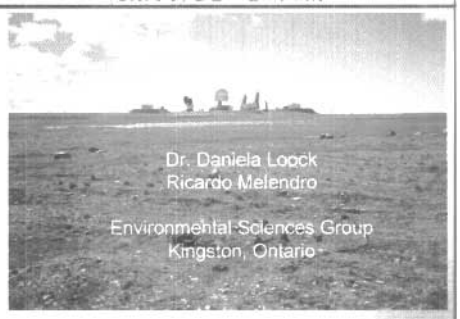
The DEW Line Clean Up Protocol

- *Includes the DEW Line Cleanup Criteria*
- To restore sites to an environmentally safe condition
- To prevent migration of contaminants into the arctic ecosystem

Environmental Cleanup at Mackar Inlet (CAM-5) DEW Line Site



The DEW Line Clean Up Criteria (DCC):

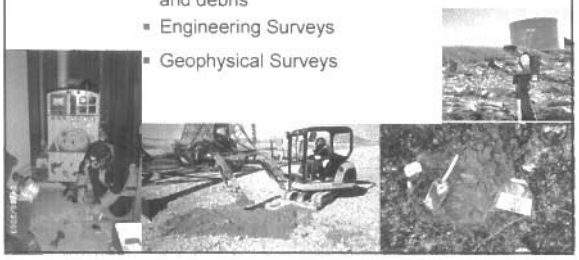
Contaminant	DCC Tier I (ppm) low	DCC Tier II (ppm) moderate
Arsenic		30
Cadmium		5.0
Chromium		250
Cobalt		50
Copper		100
Lead	200	500
Mercury		2.0
Nickel		100
Zinc		500
Polychlorinated Biphenyls (PCBs)	1.0	5.0

Other Federal Regulations

- PCBs in excess of 50 ppm are regulated by the Canadian Environmental Protection Act
- Materials which can release certain contaminants into water are regulated by the Fisheries Act

Investigation Phase

- Determine the extent of contamination
- Assess landfills
- Inventory and test building materials, facilities and debris
- Engineering Surveys
- Geophysical Surveys



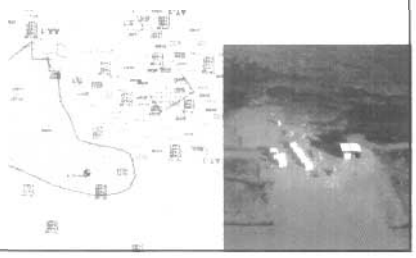
Activity Phases of the DLCU

Sampling Phases

Assessment | Investigation | Construction | Monitoring

CAM-5: 1990,1992 2000, 2002 2007-2009 **2009-2034**

Site Investigation

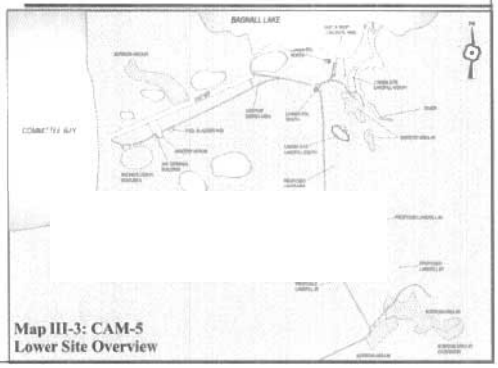


Assessment

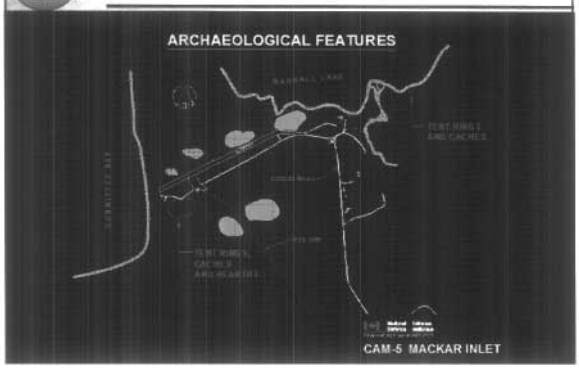
Site Investigation

Map III-2: CAM-5
Upper Site Overview

Site Investigation



Map III-3: CAM-5
Lower Site Overview



Site Investigation Results

- Fuel storage facilities (Fuel and lube oil, lead, zinc)
- PCBs in areas where power-generating equipment was used and from building materials
- Fuel and lube stains, PCBs, copper, lead, and zinc in landfills, sewage outfalls, and debris areas
- Contamination is consistent with patterns at other DEW Line sites

Construction

Landfill Risk Evaluation Process

- Landfills are evaluated in a consistent manner
  - Where contaminants come from (Source)
  - How do contaminants move (Pathway)
  - Are there any people, animals or plants that can be affected? (Receptors)
- Traditional knowledge about site is also considered in these evaluations.
- Landfills are classified as high, moderate or low environmental risk.
- Recommendations are reviewed by DND and NTI representatives.

Barrel Sampling

- test contents
  →incinerate contents or ship South
- crush or shred *empty* barrels

Confirmatory Sampling

- Collect Soil Samples
- Test for contaminants
- Establish area meets criteria or continue excavation

How often will the landfills be monitored?

- *Phase I: First 5 Years*
  Confirmation that landfill is performing as expected.
- *Phase II: Years 6-25*
  Confirmation of stable conditions

Soil Stockpile Classification

Summary

- A detailed environmental investigation of the CAM-5 (Mackar Inlet) DEW Line site was conducted by ESG.
- A detailed engineering design for the cleanup of the site was prepared based on the results of this investigation by UMA.

Landfill Monitoring

- Visual Assessment
- Temperature of ground
- Soil and Water

DEW Line Clean-up Project

Role of UMA:

- Provide Engineering and Design, including:
  - Collection of Engineering Information during the Site Investigation
  - Provision of Engineering Design and Drawings
  - Construction Quality Assurance for Materials
  - Construction Assistance
  - Administration Support

uma

Design and Construction

Mobilization to CAM-5

- No marine access to CAM-5 via Committee Bay.
- Mobilization alternatives considered include a winter overland route from Hall Beach or utilization of a Hercules Aircraft.

uma

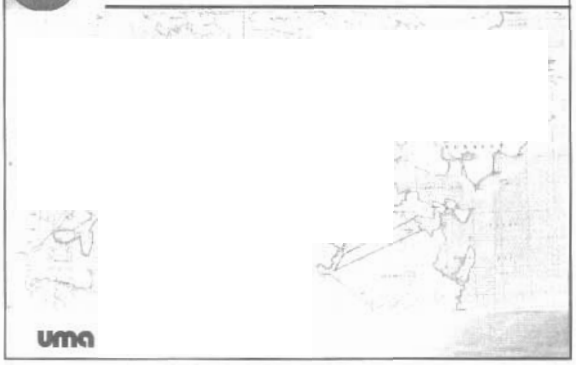
Design and Construction

Clean Up Activities at CAM-5

- Contractor Mobilization Challenges
- Remediation of Existing Landfills
- Demolition of Surplus Structures
- Debris Collection
- Contaminated Soils Excavation
- Construction of New Landfills and Landfarms

uma

Overall Area – Melville Peninsula



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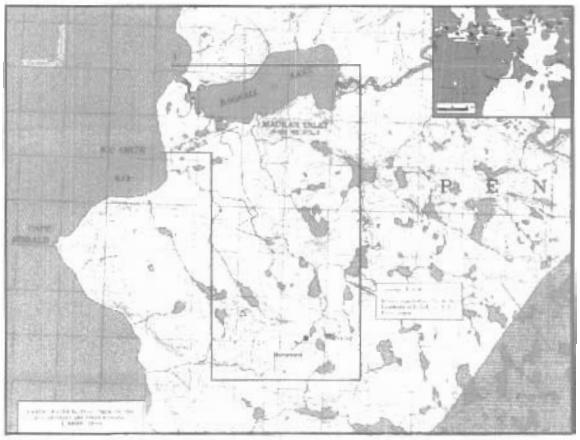
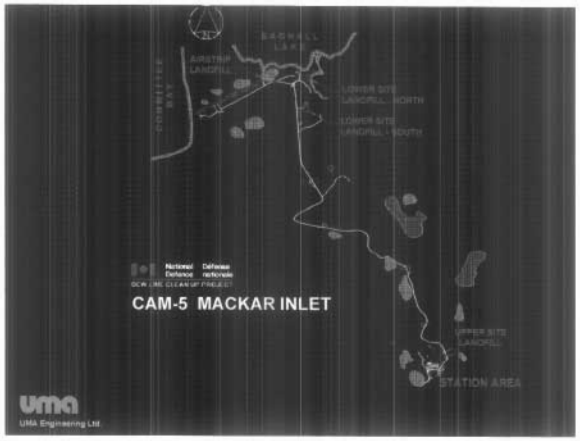
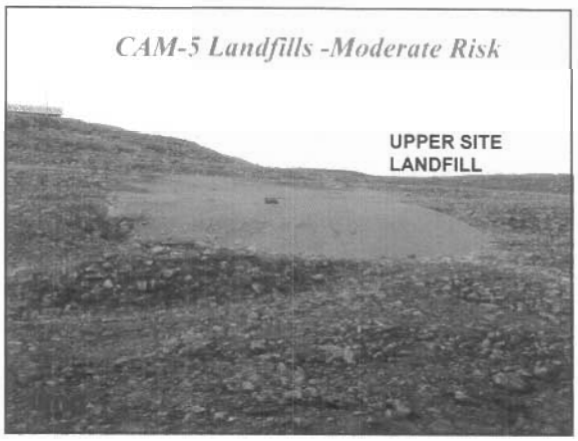


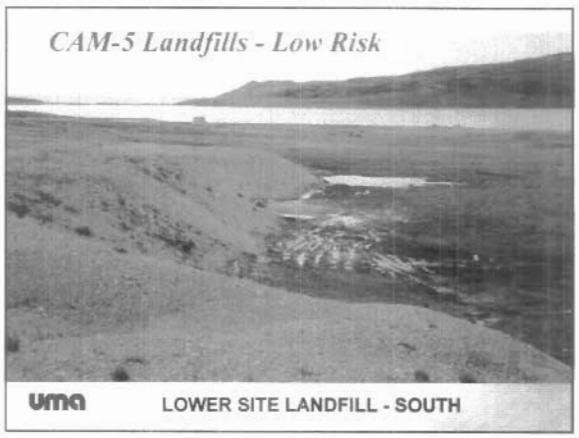
Existing Landfills

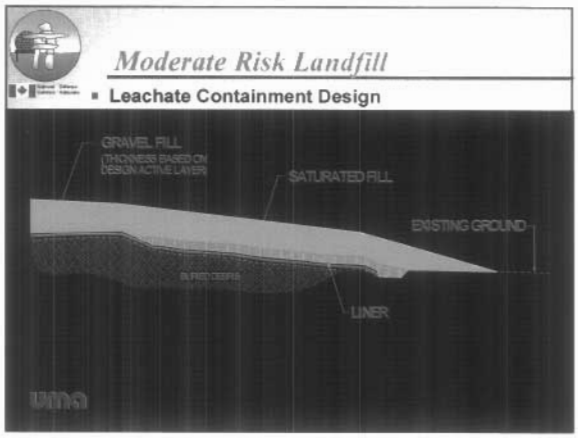
- **There are 4 Existing Landfills at CAM-5 to be Remediated, including:**
  - 1 Low Risk Landfill to be Covered with Gravel
  - 1 Medium Risk Landfill to be Leachate Contained
  - 2 High Risk Landfills to be Completely Excavated

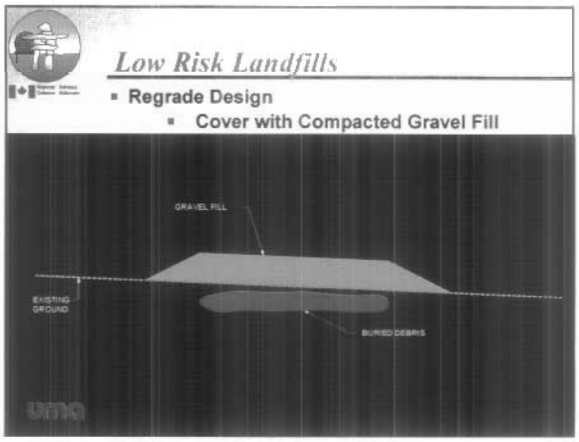
uma

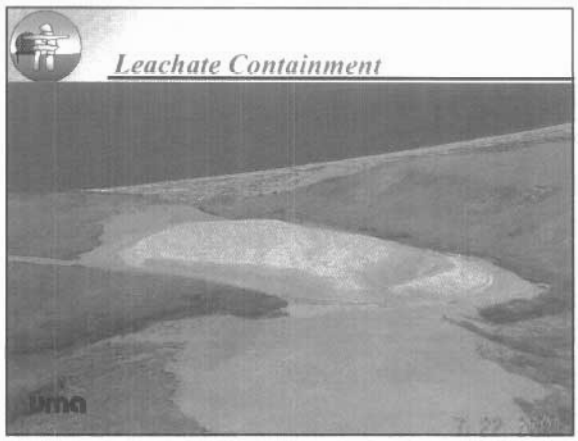

CAM-5 MACKAR INLET
UMA Engineering Ltd


CAM-5 Landfills -Moderate Risk
UPPER SITE
LANDFILL


CAM-5 Landfills - Low Risk
LOWER SITE LANDFILL - SOUTH


Moderate Risk Landfill
Leachate Containment Design
GRAVEL FILL
SATURATED FILL
EXISTING GROUND
LINER


Low Risk Landfills
Regrade Design
Cover with Compacted Gravel Fill
GRAVEL FILL
EXISTING GROUND
BURIED DEBRIS


Leachate Containment

High Risk Landfills

- Complete Excavation

uma

Design and Construction

Demolition and Debris Removal includes:

- Demolition of Buildings, Tanks and Structures
- Collection of Scattered Site Debris
- Separation and classification
- Disposal in Non Hazardous Waste Landfill, or
- Hazardous Materials placed in Secure Containers for Disposal Off-site

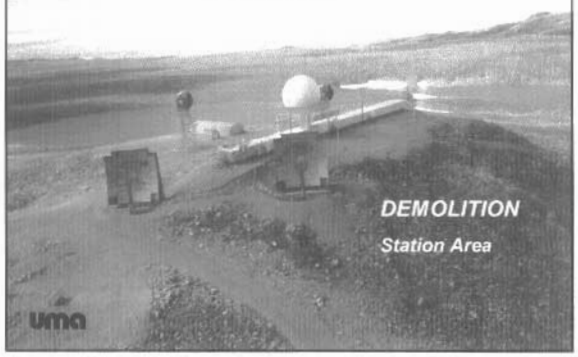
uma

CAM-5 Landfills - High Risk

LOWER SITE LANDFILL - NORTH

uma

Demolition



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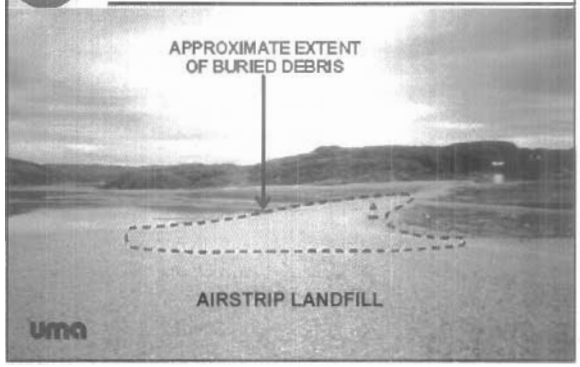
CAM-5 Landfills - High Risk



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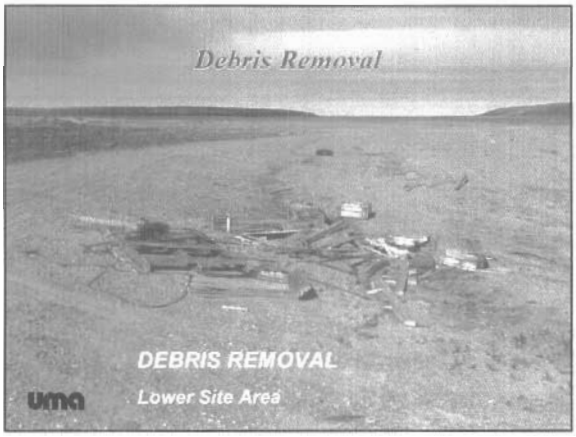
Debris Removal



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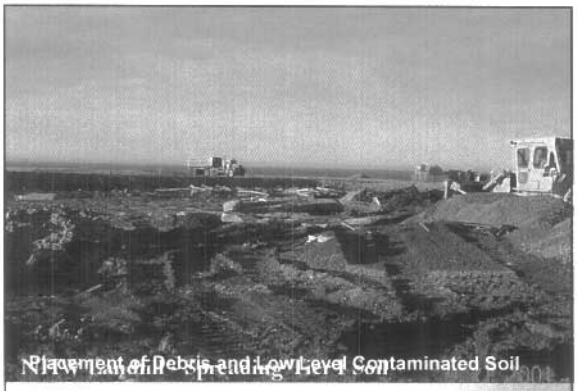
New Landfills – CAM-5

Non-Hazardous Waste Landfill

- Non Hazardous Demolition Materials
- Non Hazardous Debris
- Low Level Contaminated Soils

uma



Placement of Debris and Low Level Contaminated Soil

uma Non-Hazardous Waste Landfill

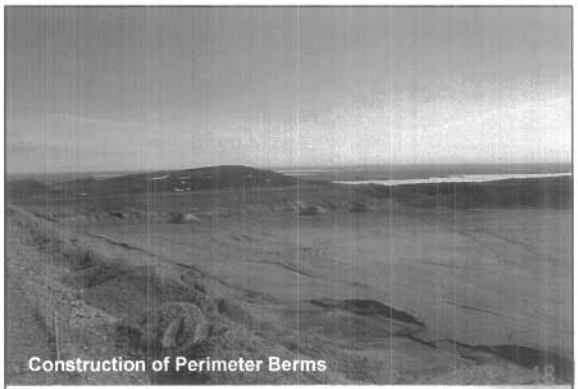
New Landfills – CAM-5

NON-HAZARDOUS WASTE LANDFILL

uma

Completing Placement of Fill on Top of Landfill

uma Non-Hazardous Waste Landfill



Construction of Perimeter Berms

uma Non-Hazardous Waste Landfill

Contaminated Soils

- **EXCAVATION and DISPOSAL**

Low Level Contamination		Moderate Contamination
↓	↓	↓
NORTHERN DISPOSAL FACILITY	NON-HAZARDOUS WASTE LANDFILL	NORTHERN DISPOSAL FACILITY

uma

New Landfills – CAM-5

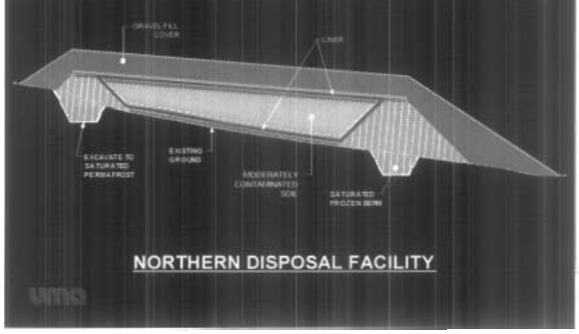
- **Northern Disposal Facility**
  - **For Disposal of Moderately Contaminated Soils**
  - **Designed for freeze-back of the contaminated soil**
  - **Frozen, icy berms**
  - **Incorporates an HDPE Liner System**

uma

Placement of Granular Fill along Base

uma Northern Disposal Facility

New Landfills – CAM-5



NORTHERN DISPOSAL FACILITY

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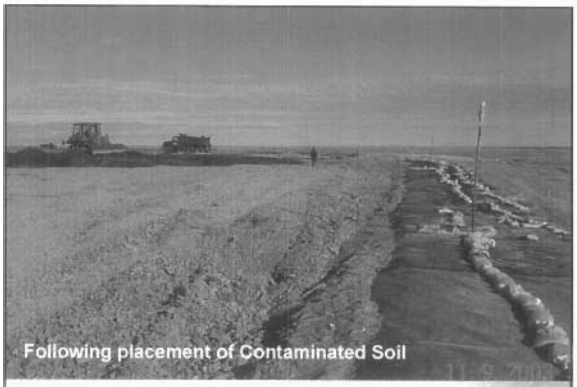

Following placement of Contaminated Soil

uma Northern Disposal Facility

Placement of Textile and Geomembrane along Base

uma Northern Disposal Facility

Contaminated Soils

Hydrocarbon Contaminated Soils

- **Soils Contaminated with Fuel or Lube Oil**
- **Removed from Areas at Risk (Areas near Water Bodies)**

Lube Oil Contamination		Fuel Oil Contamination
↓	↓	↓
NORTHERN DISPOSAL FACILITY	NON-HAZARDOUS WASTE LANDFILL	LANDFARM

uma

Landfarm – CAM-5

- **Treatment of Fuel Contaminated Soils in a Landfarm**
  - One Landfarm located at the Lower Site
  - Spread Fuel Contaminated Soil thinly over the Landfarm Area for Treatment
  - Mix soil and add nutrients regularly until tests are below criteria

uma

Engineering and Design

Hazardous Soil / Debris

- Placed in Government Approved Containers
- Shipped South for Disposal

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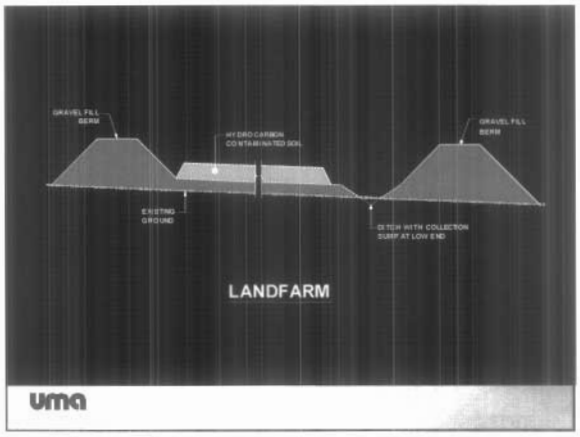

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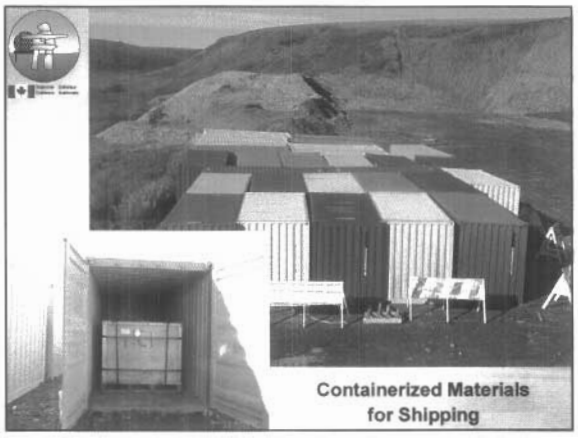


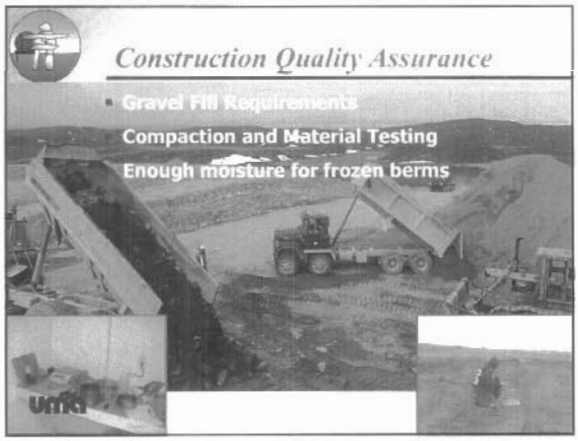
Containerized Materials for Shipping

Placement of Hydrocarbon Contaminated Soil

uma Landfarm

Construction Quality Assurance

- Gravel Fill Requirements
- Compaction and Material Testing
- Enough moisture for frozen berms



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Design and Construction

Construction Issues

- **Environmental Protection**
- **Erosion and Sediment Control**
- **Maintenance of Access Roads**
- **Protection of Archaeological Features**

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Project Schedule for CAM-5

Clean up Schedule

- Mobilization to the site in the early Spring of 2007.
- Clean up activities to occur over 3 years ending in 2009 with demobilization in the Spring of 2010.
- Long-term monitoring to be undertaken after clean up for 25 year period.

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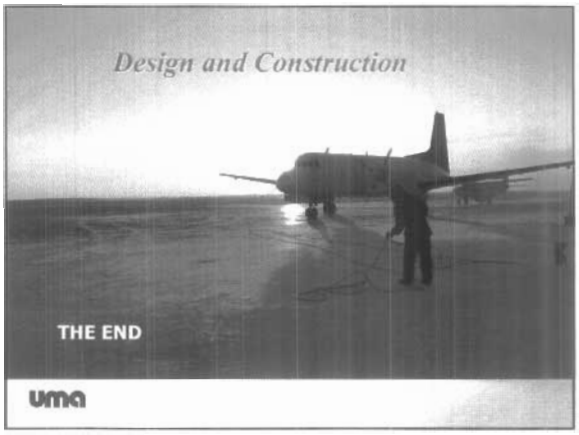

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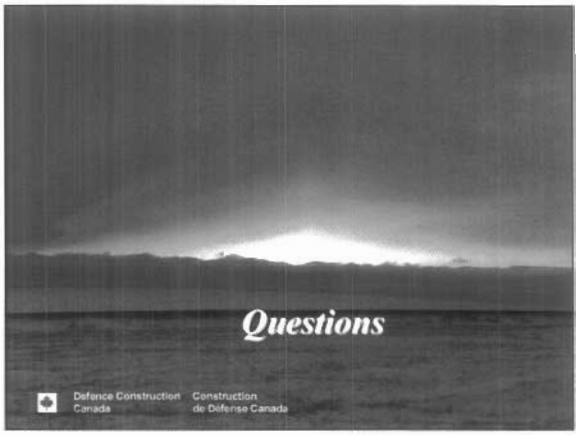

Project Schedule for CAM-5

Tendering Period

- Solicitation of Interest anticipated to commence in early summer 2005 (6 weeks).
- Tender period expected to begin in late summer of 2005.
- Letter of Intent issued to successful contractor to finalize participation plans.
- Contract awarded early in 2006.

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