# CAM-3 LANDFARM PLAN (DRAFT)

**FOR THE**

NORTH WARNING SYSTEM

Contract # W8485-157352/001/NX
SOW Ref: 17.2.2

**Document Number**

PLN-EHS-15-DRAFT, Revision A, 31-Jan-2024

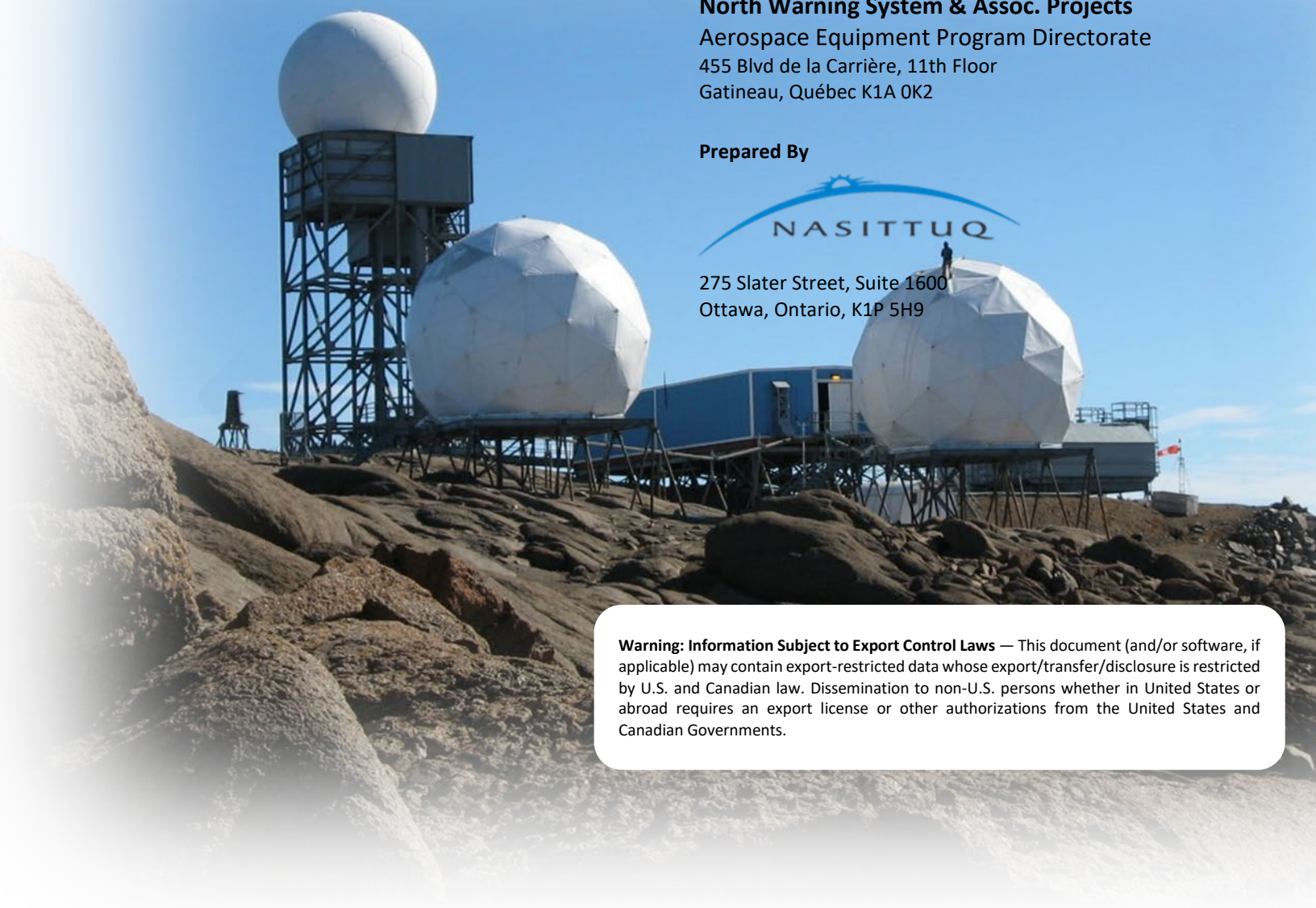
**Prepared for**

**North Warning System & Assoc. Projects**
Aerospace Equipment Program Directorate
455 Blvd de la Carrière, 11th Floor
Gatineau, Québec K1A 0K2

**Prepared By**

NASITTUQ

275 Slater Street, Suite 1600
Ottawa, Ontario, K1P 5H9



## APPROVAL PAGE

Prepared by: *A Leslie* Date: 31-Jan-2024

**Sr Environmental Technician**

Approved by: *TBD* Date: TBD

**Title**

Note: The electronic record of approval is located in the SharePoint Management System.

## CHANGE HISTORY

This sheet is a record of each issue of this document. When the revised document is issued, the previous issue is automatically superseded.

| Revision | Date | Author | Pages Changed | Reason for Change |
|---|---|---|---|---|
| A | 31-Jan-2024 | A Leslie | All | Draft initial release |
| | | | | |
| | | | | |
| | | | | |

# TABLE OF CONTENTS



# LIST OF TABLES

# 1.0 INTRODUCTION

## 1.1 Overview

The North Warning System Office (NWSO) occasionally has a requirement to remediate spills on-site. Given the effort involved, landfarming impacted soil will only be considered where it is the best option for remediating a spill (e.g. treating the soil from a large spill instead of shipping it off-site for treatment). This is a general plan for the construction and operation of a landfarm for hydrocarbon-impacted soil at CAM-3, Shepherd Bay. JET-A1 fuel is the main fuel used on the North Warning System (NWS) so it is the most common hydrocarbon contaminant in soil.

During any field season requiring an active landfarm at CAM-3, the NWSO, or the NWS operations and maintenance contractor, intends on having a contract in place to allow for the excavation of all contaminated soils; preparation of a engineered landfarm to receive and remediate contaminated soil; conduct confirmatory soil sampling to ensure all contamination is removed according to the CCME commercial standard for coarse-grained soil; back-fill and grade excavated areas; and, till contaminated soil until remediated to the CCME commercial standard for coarse-grained soil (Annex C). Confirmatory sampling will be conducted during tilling to ensure the remediation target is met or exceeded; and at which time the landfarm will be decommissioned.

# 2.0 GENERAL INFORMATION

## 2.1 Climate

CAM-3 is situated about 46 m above sea level on in a region that is characterized by a very flat and wide low lying plain, 50 m or less in elevation. The plain between the ridge and the sea contains a number of irregularly aligned gravel ridges and is covered with many small lakes, ponds, and swamp areas. The lakes and ponds are shallow, partly filled with vegetation, and surrounded by a spongy humus comprised of mosses. Well-sorted sands, gravels, and silts form a blanket of glacial drift over the region. Vegetation in the drier areas of Shepherd Bay may consist of Arctic willow, a variety of sedges, and flowering herbs.

The total mean annual rain and snowfall are 80 mm and 65 cm, respectively. Generally July to October, receive the most precipitation. The mean annual temperature is -20°C, with the warmest month being July and the coldest months being January to March.

## 2.2 Geology

The CAM-3 area is just west of the western extent of the Canadian Shield on the Boothia Peninsula. The site area is well covered with surficial veneer or blanket of glacial drift, subsequently reworked by marine waters. The site is located on a bedrock controlled U-shaped ridge that rises slightly above the surrounding topography.

## 2.3 Surficial Deposits

Surface materials consist mostly of sand, gravel, and cobble sized rubble with variable silt and clay content. The surface materials are derived largely from the underlying bedrock, which consists mostly of dolostone. The surface materials are often veneered by organic-rich muds or silts, particularly in areas of standing water or water saturated surface materials. The coastal area and specifically the active beach region is comprised of well sorted gravel and cobble sized fragments with variable sand and silt content

## 3.0 LOCATION AND CONSTRUCTION OF FACILITIES

### 3.1 Location

The proposed location for the construction of a landfarm facility at CAM-3 was based on the location of the previous landfarm facility, which was constructed during the DEW Line Clean Up Project to remediate hydrocarbon-contaminated soil. Annex A contains a site map identifying the location of the landfarm. Originally the selection of this site was chosen for the level area which was present; also the design of a landfarm took into account several other factors, including geotechnical suitability which considers topography, soil conditions, natural drainage in the area, depth to bedrock or permafrost, groundwater, and adverse soil conditions that may affect permafrost and potential containment. Environmental considerations weighed heavily in the consideration for the location of the landfarm, these include the footprint of area required; the distance from ecologically sensitive areas, including marine and freshwater systems; the distance from water supplies; contaminated soil areas; geotechnical suitability; and the accessibility of the landfarm location during the remediation work.

### 3.2 Construction

During the construction of the landfarm facility berms will be created around the area that will contain the contaminated soil. The berms and the base of the facility will be heavily compacted to a level of 95% compaction; this will reduce the permeability of the granular fill. Once the facility has been prepared, the excavated hydrocarbon contaminated soil will be added and spread in a thin layer of 0.4 m thickness and treated to facilitate a reduction in hydrocarbon concentrations through biodegradation and volatilization.

Remediation of contaminated soil by landfarming typically involves the addition of nutrients and water to the soil, followed by tilling to aerate the soil and stimulate microbial activity.

## 4.0 LANDFARM MANAGEMENT

### 4.1 General

The focus of management of the landfarm will be safety and environmental responsibility.

Employees working in the landfarm will be trained prior to commencement of work so that they are aware of the health and safety risks associated with the type of contaminants inside the landfarm.

Landfarming typically involves the following:

1. Preparation of an engineered landfarm to receive and remediate contaminated soil;
2. Excavation of all contaminated soils;
3. Soil sampling of excavated material to characterize contaminants of concern;
4. Soil sampling of the base and side walls of the excavation to ensure all contamination is removed;
5. Back-fill and grade excavated areas;
6. Till contaminated soil within the landfarm until remediated to the appropriate CCME soil guideline (see Annex B for details);
7. Soil sampling will be conducted to ensure the remediation target is met; and,
8. Decommissioning of the landfarm.

### 4.2 Health and Safety

There are four primary exposure pathways to chemicals within the landfarm:

1. Inhalation;

2. Ingestion;
3. Skin contact; and
4. Eye contact.

Because the landfarm is outside in open air, inhalation exposure can be mitigated. Ambient air concentrations of volatile organic compounds (VOCs) will be monitored periodically using a photoionizing detector (PID). In the case that PID readings are elevated, respirators with combination filters will be worn.

Incidental ingestion, as well as skin and eye contact, will be prevented through appropriate worker training and personal protective equipment (PPE).

### 4.3 Operation

Prior to placing new material in the landfarm it will be characterized to ensure any contaminants of concern are appropriate for landfarming. Soil will then be placed into the landfarm cells in an even layer, ideally 30 to 75 cm thick.

After placing contaminated soil granular nutrients may be distributed over the surface. Moisture conditioning may be conducted, as required, by application of water spray to maintain optimum water content within the soil.

After application of nutrients, the full thickness of the soil may be tilled every five to ten days. During periods of heavy precipitation, tilling of the soil will be delayed until the soil is considered damp to a depth of 100 mm.

### 4.4 Environmental Control

Water runoff will be captured within the landfarm due to the impervious liner and berms. In the event that water discharge is necessary water will be sampled and analyzed, prior to discharge, to ensure it meets the wastewater discharge criteria (see Annex C).

The landfarm will be monitored weekly during summer months by the contractor to ensure proper operating conditions of soil moisture and aeration (i.e., moisture content around 5%, uncompacted soil). Soil samples will be routinely collected and analyzed at a CALA-accredited laboratory to ensure that concentrations of hydrocarbons are decreasing. Headspace vapour readings using a PID may aid in determining frequency of laboratory analysis.

Corrective maintenance to the landfarm facility will be noted during weekly inspections, and any repairs will be carried out promptly. The nature of the repairs required and when repairs were completed will be recorded in the weekly report.

Prior to exiting the landfarm, equipment will be cleaned off to ensure that contaminated soil is not spread outside the landfarm.

### 4.5 Closure

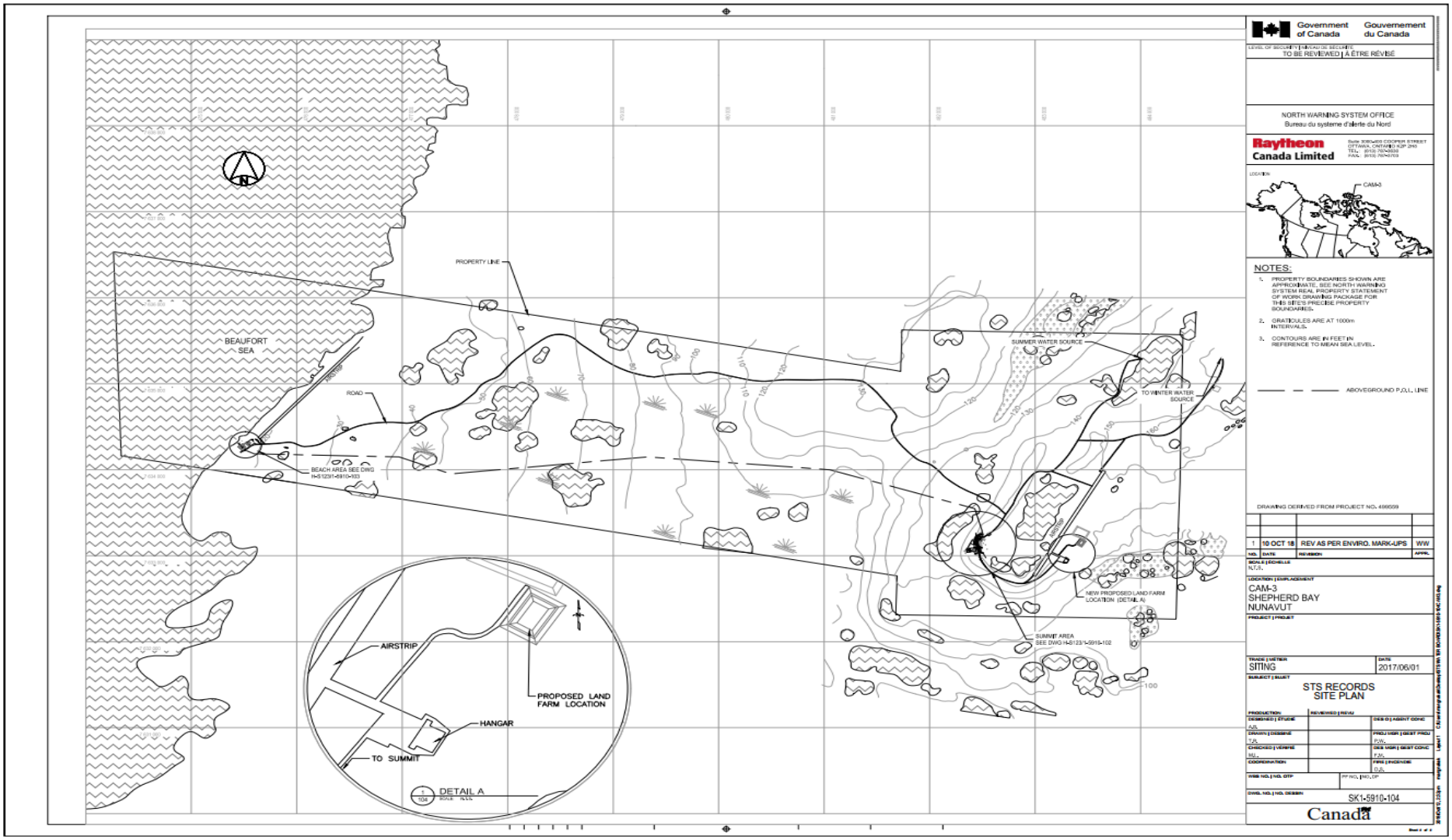
Once the soil in the landfarm facility has been remediated to the CCME Canadian Soil Quality Standards for commercial coarse-grained soil; and confirmatory testing of the soils verifies that the remediation objectives have been reached the landfarm will be decommissioned.

Any wastewater in the perimeter collection system will be tested and treated accordingly to ensure that prior to discharge all wastewater conforms to Wastewater Discharge Criteria.

The perimeter berms will be regraded to prevent ponding within the landfarm and the final grading will promote drainage away from the site and will match the surrounding terrain.

ANNEX C: CAM-3 LANDFARM LOCATION

Note: Engineered design drawings will be provided to the NWB in advance of a landfarm being established at CAM-3



# Annex B: Soil Guidelines

**Table B-1: CCME guidelines for coarse-grained soil (Canadian Soil Quality Guidelines (CCME, 1999 r. 2018) and Canada-Wide Standards for PHC in Soil (CCME, 2001 r. 2008))**

| Grouping | Parameter | Land Use: Commercial | Land Use: Industrial |
|---|---|---|---|
| Metals and Inorganics | Arsenic | *12* | *12* |
| | Barium | *2000* | *2000* |
| | Cadmium | *22* | *22* |
| | Chromium (total) | *87* | *87* |
| | Copper | *91* | *91* |
| | Cobalt | *300* | *300* |
| | Lead | 260 | 600 |
| | Mercury | 24 | 50 |
| | Nickel | *89* | *89* |
| | Zinc | *410* | *410* |
| PHCs | PHCs F1 (C6 to C10) | 320 | 320 |
| | PHCs F2 (C>10 to C16) | 260 | 260 |
| | PHCs F3 (C>16 to C34) | 1700 | 2500 |
| | PHCs F4 (C>34 to C50+) | 3300 | 6600 |
| VOCs | Benzene | *0.03* | *0.03* |
| | Toluene | *0.37* | *0.37* |
| | Ethylbenzene | *0.082* | *0.082* |
| | Xylene | *11* | *11* |
| Other | Phenol | *3.8* | *3.8* |
| | PCBs | *33* | *33* |

*Grey Italic* – Indicates the industrial and commercial guidelines are the same

Units: mg/kg

Notes:

1. Guideline values for PHCs are in reference to the Canada-Wide Standards for PHC in Soil (CCME, 2001 r. 2008). The other values are in reference to the Canadian Soil Quality Guidelines (CCME, 1999 r. 2018).
2. Guideline values for PHCs refer to surface soils (between 0 and 3 mbgs) (CCME, 2008).
3. Parameter groups recommended by FCSAP (2013) for spills of unleaded gasoline, leaded gasoline and/or aviation gasoline include: metals and inorganics, PHCs and VOCs. These parameters may be used for the initial screening to establish contaminants of concern. Additional parameters, such as the ones listed as “Other”, may be used if other contaminants are suspected. If containments of concern are established confirmatory sample analysis may only include specific parameters.

## ANNEX C: WASTEWATER DISCHARGE CRITERIA

**Table C-1: Landfarm wastewater discharge criteria as listed in Nunavut Water Board licence No. 8BC-SHE1929, Part D.**

| Parameter | Wastewater Discharge Criteria (µg/L) |
|---|---|
| pH | 6 to 9 (units) |
| Oil and Grease | 5000 |
| Arsenic (total) | 100 |
| Cadmium (dissolved) | 10 |
| Chromium (dissolved) | 100 |
| Cobalt (dissolved) | 50 |
| Copper (dissolved) | 200 |
| Lead (dissolved) | 50 |
| Mercury (total) | 0.6 |
| Nickel (dissolved) | 200 |
| PCB (total) | 1000 |
| Phenols | 20 |
| Zinc (total) | 500 |
| Benzene | 370 |
| Toluene | 2 |
| Ethylbenzene | 90 |