DYE-M LANDFARM DESIGN AND MANAGEMENT PLAN

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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 When the revised document is issued, the previous issue is automatically superseded.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
1	17-Oct-2018	W. Wyman	All	New Document

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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 DYE-M, Cape Dyer. 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 DYE-M-M 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

The terrain is rugged and boulder strewn with very little soil, consisting of mostly silt. Vegetation on the upper site is sparse, consisting of grass, wildflowers, mosses, and lichen. Vegetation at the lower site is more abundant consisting of wildflowers, creeping willows, and sedges. Several small ice fields exist within five miles of the site.

2.1 Climate

The total mean annual rain and snowfall are 98.4 mm and 566.2 cm, respectively with a total average annual precipitation of 602 mm. Generally September to November receive the most precipitation. The mean annual temperature is -11°C, with the warmest month being July and the coldest months being January to March.

2.2 Geology

The mountainous terrain and the sheer cliffs, some over 610 m high, along the coastline are the most prominent features of the site.

The terrain at DYE-M varies from:

- a narrow coastal region along the southwest;
- to broad glacial U-shaped valleys and sub-rounded hills in the interior; and
- to boulder covered volcanic and metamorphic uplands.

2.3 Surficial Deposits

The drift is generally coarse textured consisting mostly of cobble, gravel, and sand with variable silt and clay content. Boulders are generally rare in the valley floor tills but become increasingly more common at higher elevations. Bedrock within the area is confined largely to the area of the main site facilities. It consists mostly of granite metasediments and volcanic rock.

3.0 LOCATION AND CONSTRUCTION OF FACILITIES

3.1 Location

The proposed location for the construction of a landfarm facility at DYE-M was based on the location of the previous landfarm facility which was constructed during the DEW Line Clean Up Project to remediate hydrocarbon (Type B) 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.

4.2 Health and Safety

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

a. Inhalation;
b. Ingestion;
c. Skin contact; and
d. Eye contact.

Since the facility is outside and concentrations of contaminants will be relatively low, inhalation exposure is not likely to be problematic. In special circumstances where contamination is heavy, respirators can be worn to scrub the air of volatile organics. Ingestion, under normal circumstances is very unlikely.

Skin contact will be prevented by issuing suitable personal protective equipment to employees working in the landfarm.

Eye contact is unlikely under normal circumstances. Where handwork is to be carried out in the landfarm with the risk of eye contact, protective goggles will be required.

4.3 Operation

The life cycle of the landfarm involves a survey the area, the removal of all organic materials and debris and preparation of the ground: the construction of roadways for access; construction of the landfarm facility; and placement of Type B hydrocarbon contaminated soils.

During the landfarm operation, granular nutrients are to be distributed evenly over the surface of the contaminated soil, at rates that will provide the minimum nitrogen loading. Moisture conditioning of the landfarm will be conducted as required by application of water spray to maintain optimum water content within the soil.

After application of nutrients, the full thickness of the soil is to be tilled every 10 days. During periods of prolonged warm, dry weather, the tilling frequency will be increased to every 5 days. During periods of precipitation, tilling of the soil will be delayed until the soil is considered damp to a depth of 100 mm.

4.4 Environmental Control

The high level of compaction of the granular material used to build the berm and the base of the facility will ensure that all leachate is captured within the facility. No water from the landfarm will flow directly to the surrounding environment; instead any water accumulating within the facility will be recycled back over the material contained in the facility.

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 analytically tested to ensure that contaminated soil is remediating.

Any repairs to the landfarm facility will be noted during weekly inspections, 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.

All contact water in the perimeter collection system is to be collected and tested to ensure it meets the wastewater discharge criteria (Annex D) prior to the facility decommissioning. If the contact water does not meet these guidelines, it will be treated so that it does meet the guidelines.

Equipment used in the landfarming operation will be cleaned off within the landfarm area prior to exiting to ensure that contaminated soil is not transferred away from the landfarm on the wheels and other parts of this equipment.

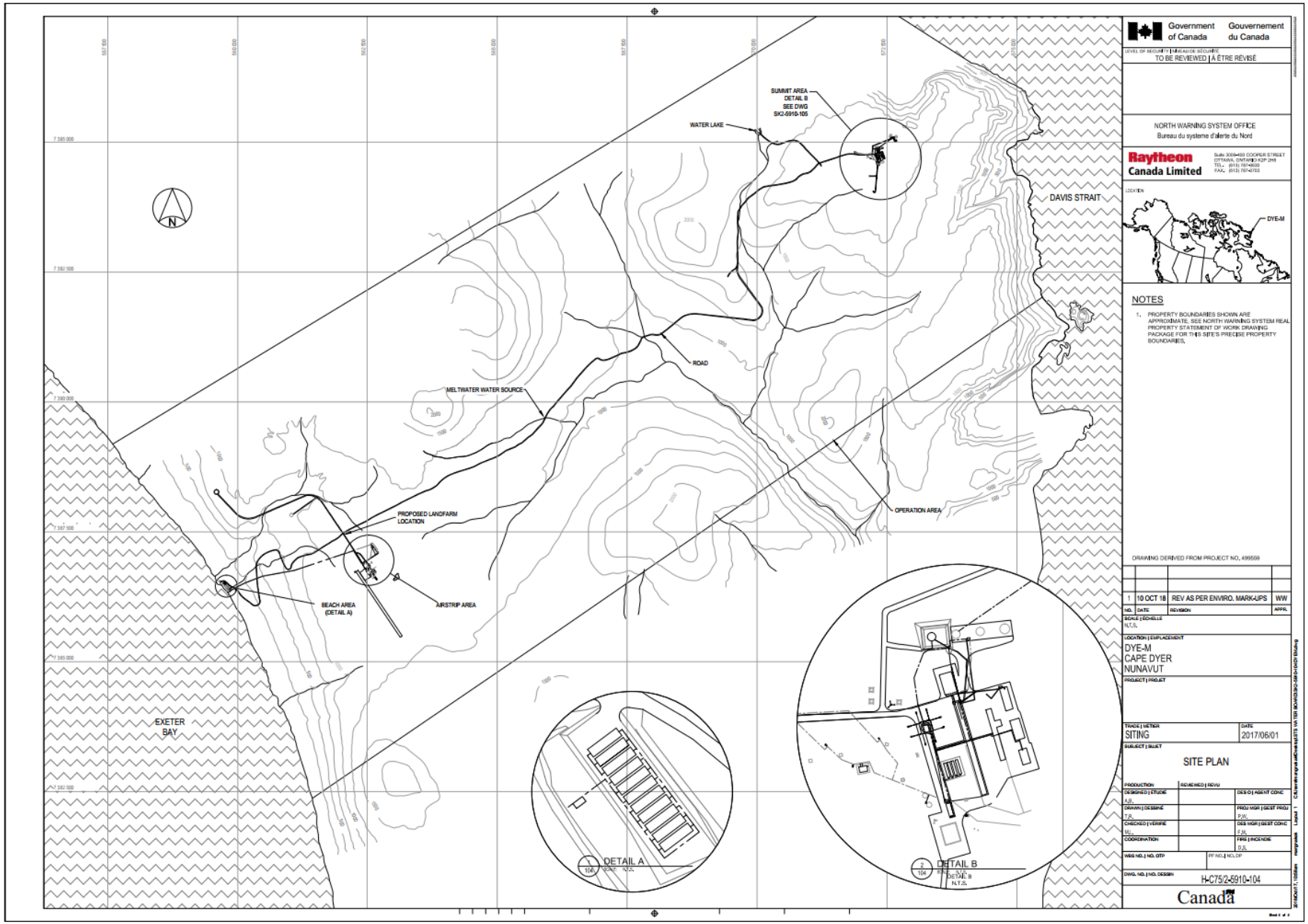
4.5 Closure

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 A: DYE-M SITE PLAN AND PROPOSED LANDFARM LOCATION



ANNEX B: DYE-M LANDFARM DESIGN DRAWING

Engineered design drawings will be provided to the NWB in advance of a landfarm being established at DYE-M.

ANNEX C: CCME CRITERIA

Table 1: CCME - Canadian Soil Quality Guidelines

Parameter	Commercial/ Industrial
Arsenic (inorganic)	12
Cadmium	22
Chromium (total)	87
Copper	91
Cobalt	300
Lead	600
Mercury (inorganic)	50
Nickel	50
Zinc	360
PCBs	33
PHCs F1 (C6 to C10)	230/230
PHCs F2 (C>10 to C16)	150/150
PHCs F3 (C>16 to C34)	1700/3500
PHCs F4 (C>34 to C50+)	3300/10000

ANNEX D: WASTEWATER DISCHARGE CRITERIA

Table 2: Wastewater Discharge Criteria

Parameter	Sample (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