Landfarm Design and Management Plan

North Warning Site: FOX-3, DEWAR LAKES, Nunavut

Prepared for: The Department of National Defence,
North Warning System Office

Prepared By: Defence Construction Canada
November 2017

Contents

EXECUTIVE SUMMARY

The Landfarm Design and Management Plan provides pre-construction information on hydro carbon contaminated soil handling in a safe and environmentally sound manner at the Department of National Defence's (DND) North Warning System (NWS) site FOX-3, Dewar Lakes in Nunavut. This plan was developed in support of NWS's application for a renewal/amendment to the existing water licence from the Nunavut Water Board (NWB).

FOX-3 site is located in the central area of Baffin Island (landlocked site); in the Qikitani Region of Nunavut. The station area (which still in use by DND) is approximately 6 km northwest of Dewar Lakes, near which the airstrip was built. There is no direct sea access from this site. The nearest community is Hall Beach, approximately 400 km west of the site.

The NWS has a requirement to remediate the JET-A1 fuel contaminated soil originating from two separate spills. The Indigenous and Northern Affairs Canada (INAC), Water Resource Inspector has indicated that this remediation is a priority for this site; as per the FOX-3 Water Licence Inspection undertaken July 20, 2016.

The selection of location for and the design of a landfarm take into account several factors, including topography, drainage and geology; the footprint of area required; the distance from ecologically sensitive areas, including marine and freshwater systems; the distance from water supplies; contaminated soil areas; and the accessibility of the landfarm location. The location of the new landfarm will be in the same place as the former landfarm used during the DEW Line Clean Up Project; previously approved by NIRB and the NWB.

The landfarm dimensions will be 54.2 m by 78.6 m which approximately 600m^3 of Type-B hydrocarbon contaminated soil will be 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 will also involve the addition of nutrients and water to the soil, followed by tilling to aerate the soil and stimulate microbial activity. Confirmatory sampling will be conducted to ensure that the levels of hydro carbon contamination in the treated soil is below the CCME Canadian Soil Quality Standards for commercial coarse-grained soil, at which time the berms of the facility will be contoured and the whole area will be regarded to promote positive drainage and the facility will be considered decommissioned.

1. Introduction

1.1. Overview

The North Warning System Office (NWSO) has a requirement to remediate two outstanding spills at FOX-3, Dewar Lakes, Nunavut. The details of the two spills are as follows: JET-A1 fuel spill of unknown quantity was discovered on 08 July 2009 this spill originated from a 3 mm crack in the apron-to-summit pipeline; and, JET A1 fuel spill of approximately 917 litres resulting from a helicopter crash which occurred on 13 May 2013.

As a due diligence measure, NWSO contracted with the Environmental Sciences Group (ESG) in summer 2016 to delineate both spills and prepare an assessment report. The report confirms that up to 600 m3 of hydrocarbon impacted soil still remains to be excavated and treated.

During the 2018 field season the NWSO 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. General Information

2.1. Climate

The Dewar Lakes site is situated near a chain of lakes in central Baffin Island, approximately 525 m above sea level. The total mean annual rain and snowfall are 115.7 mm and 166.4 cm, respectively. The majority of the precipitation falls from May to October. The mean annual temperature is 13.3 C, with the warmest month being July and the coldest months being January to March. Generally temperatures at this site are less extreme than in the coastal areas of Baffin Island.

2.2. Geology

The bedrock-controlled topography of the area has been enhanced by glaciers that selectively eroded weaker rock layers and sculpted stronger ones. The entire area was covered by the Laurentide Ice Sheet during the late Wisconsinan and Holocene periods. Glacial ice flowed westward from the central plateau of Baffin Island towards Foxe Basin.

2.3. Surficial Deposits

The project area is located well above the original marine washing limit, therefore, glacial till is the prevalent deposit type, with glaciofluvial, alluvial, glaciolacustrine and colluvial deposits present in portions of the site. Till is bouldery with a predominantly silty sand matrix, well graded and unsorted.

3. Location and Construction of Facilities

3.1. Location

The location for the construction of the landfarm facility at FOX-3 was based on the location of the previous landfarm facility which was constructed during the DEW Line Clean Up Project to remediation 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 54.2 m by 78.6 m facility has been prepared, the 600m³ of 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. 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 which where 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.

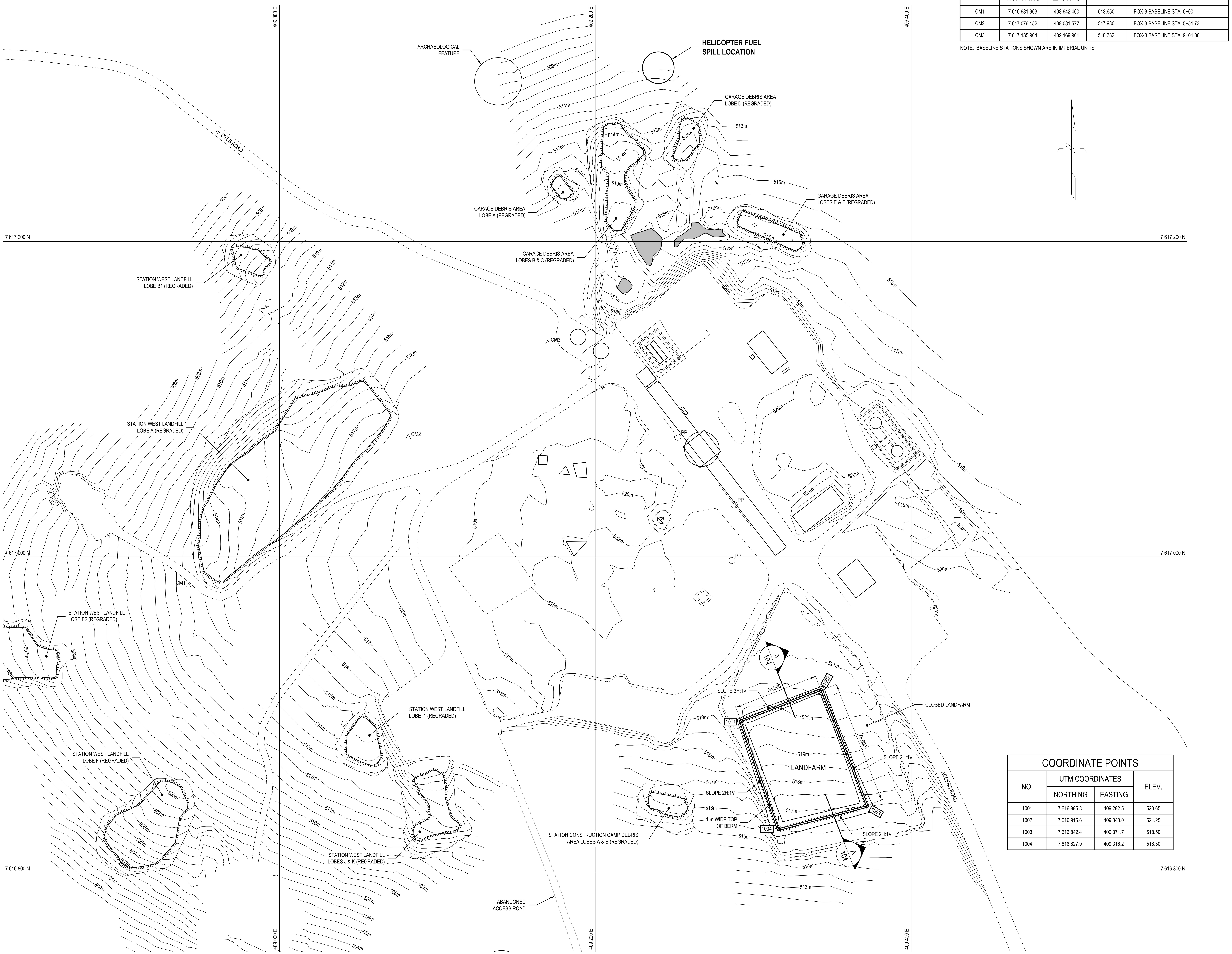
4.5. Closure

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
FOX-3 Site Plan – Landfarm Location



SURVEY CONTROL MONUMENTS

NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM1	7 616 981.903	408 942.460	513.650	FOX-3 BASELINE STA. 0+00
CM2	7 617 076.152	409 081.577	517.980	FOX-3 BASELINE STA. 5+51.73
CM3	7 617 135.904	409 169.961	518.382	FOX-3 BASELINE STA. 9+01.38

NOTE: BASELINE STATIONS SHOWN ARE IN IMPERIAL UNITS.

COORDINATE POINTS

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
1001	7 616 895.8	409 292.5	520.65
1002	7 616 915.6	409 343.0	521.25
1003	7 616 842.4	409 371.7	518.50
1004	7 616 827.9	409 316.2	518.50

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LEVEL OF SECURITY | NIVEAU DE SÉCURITÉ
TO BE REVIEWED | À ÊTRE RÉVISÉ

BORDER LAST UPDATED 2012-04-01

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Signature
Date August 3 2017
PERMIT NUMBER: P639
NWT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER — R. MERKOSKY — LICENSEE — NWT/NU
Aug 3/2017

NO.	DATE	REVISION	APPR.
A	2017/08/03	ISSUED FOR TENDER	R.M.

SCALE | ÉCHELLE 1:1000 (10 0 10 20 30 40 50 60 70 m)

LOCATION | EMPLACEMENT
FOX-3
DEWAR LAKES
NUNAVUT

PROJECT | PROJET
FUEL SPILL REMEDIATIONS

TRADE | MÉTIER: SITING
DATE: 2017/08/03

SUBJECT | SUJET
STATION AREA SITE PLAN

PRODUCTION	REVIEWED | REVU	
DESIGNED | ÉTUDIÉ R.M.		DES O | AGENT CONC N.F.
DRAWN | DESSINÉ C.E.		PROJ MGR | GEST PROJ S.C.
CHECKED | VÉRIFIÉ G.W.		DES MGR | GEST CONC I.C.
COORDINATION R.M.		FIRE | INCENDIE

WBS NO. | NO. OTP: N.001506.01.3
PF NO. | NO. DP:

DWG. NO. | NO. DESSIN: H-D76/1-9100 - 102

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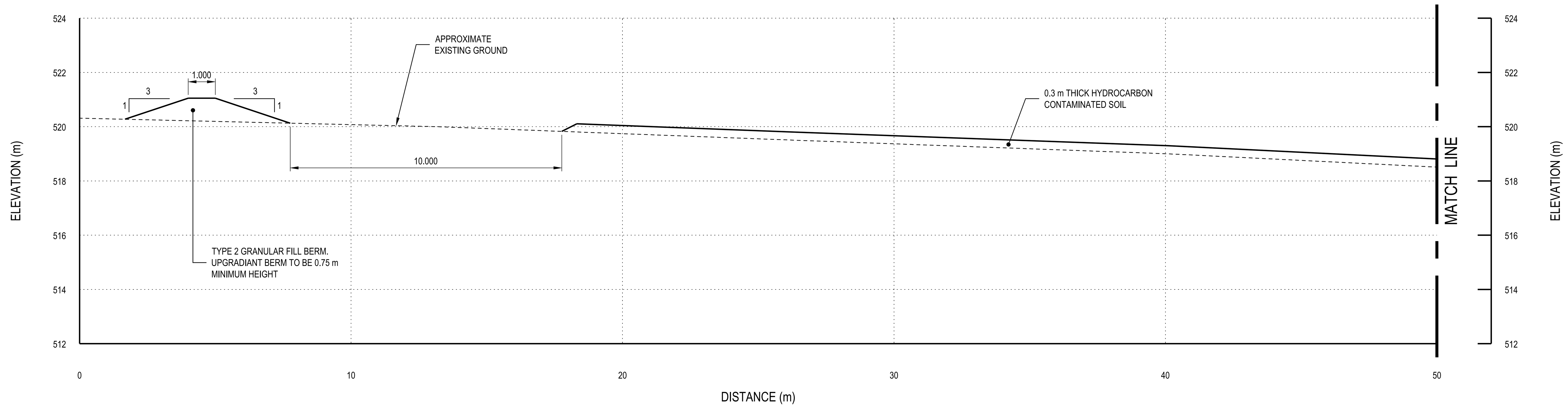
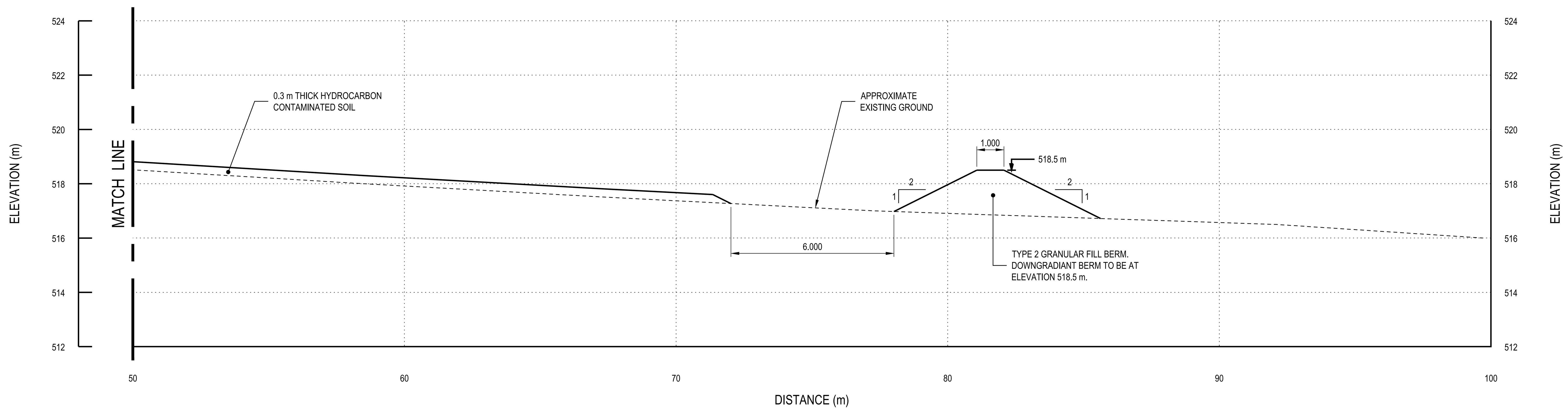
Sheet 2 of 4

Annex B
FOX-3 Landfarm Design Drawing





A / 102 SECTION
SCALE HORIZONTAL: 1:100
SCALE VERTICAL: 1:100

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LEVEL OF SECURITY | NIVEAU DE SÉCURITÉ
TO BE REVIEWED | À ÊTRE RÉVISÉ

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Signature
Date August 3, 2017
PERMIT NUMBER: P639
NWT/NU Association of Professional Engineers and Geoscientists

NO.	DATE	REVISION	APPR.
A	2017/08/03	ISSUED FOR TENDER	R.M.

SCALE | ÉCHELLE 1:100

LOCATION | EMPLACEMENT
FOX-3
DEWAR LAKES
NUNAVUT

PROJECT | PROJET
FUEL SPILL REMEDIATIONS

TRADE | MÉTIER: SITING
DATE: 2017/08/03

SUBJECT | SUJET
LANDFARM
CROSS SECTION

PRODUCTION	REVIEWED | REVU	
DESIGNED | ÉTUDIÉ R.M.		DES O | AGENT CONC N.F.
DRAWN | DESSINÉ C.E.		PROJ MGR | GEST PROJ S.C.
CHECKED | VÉRIFIÉ G.W.		DES MGR | GEST CONC I.C.
COORDINATION R.M.		FIRE | INCENDIE

WBS NO. | NO. OTP: N.001506.01.3
PF NO. | NO. DP:
DWG. NO. | NO. DESSIN: H-D76/1-9100 - 104

Canada

Annex C
CCME Criteria

CCME Criteria

CCME –Canadian Soil Quality Guidelines	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

Wastewater Discharge Criteria

Wastewater Discharge Criteria	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
Ethylbenzene	90