



OPERATION AND MAINTENANCE (O&M) PLAN FOR THE LANDFILL AND HANDLING OF SOLID WASTES AT FOX-3 ADDENDUM

Contract # W8485-100224/001/NX

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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 When the revised document is issued, the previous issue is automatically superseded.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	09-Jul-2018	W. Wyman	All	Initial Document Release



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1.0 INTRODUCTION

This addendum has been prepared by Raytheon Canada Limited (RCL) for the Department of National Defence, North Warning System Office (NWSO) in order to meet the requirements of the licence issued 08 June 2018 8BC-FOD1828 Type "B" item E2. On 12-Mar-2010, Environment Canada recommended that there be sampling of surface water (ponded water, standing water in proximity to landfills) and seepage areas to assess the landfill's performance the potential for environmental risk.

As of the acceptance of this addendum, the document entitled "Operation and Maintenance (O&M) Plan for the Landfill and Handling of Solid Wastes at FOX-3" is to be read with the following updates:

1. Page 1 - The licence number has changed to 8BC-FOD1828 type "B";
2. Page 3, Paragraph 4 – The North Warning System sites have been operated and maintained by Raytheon Canada Limited since 01-Aug-2014. Any inquiries about FOX-3 should be directed to either:
 - a. Mr. Scott Charland, North Warning System Office, 613-939-4973; or
 - b. William Wyman, Raytheon Canada Limited Environmental Services Officer, 613-787-3655.
3. Page 4 - The Spill Response Plan referenced has been replaced with 180117 3BC-FOD0919 NWS Spill Contingency Plan 01Apr16. The Spill Response Plan will be updated with the Nunavut Water Board as required.

2.0 OPERATION AND MAINTENANCE

As per the water licence application, all non-hazardous domestic solid waste is currently disposed of through a contract with the Hamlet of Hall Beach for the deposit of waste in the local municipal dump.

No waste is deposited in the on-site land fill.

3.0 FOX-3 SITE INVESTIGATION

In April 2008, the Environmental Working Group (EWG) noted that there was surface hydrocarbon contamination on the landfill, but there was no evidence for contaminant migration (Appendix 1). The landfill was not remediated during the DEW Line Clean-Up of FOX-3 in 2009 to 2011, because it was identified as being within the Required Operational Area for the North Warning System

In the 2006 Site assessment, the NWS Landfill was identified as "Lobe D". The section of the assessment describing Lobe D has been included in Appendix 2. The Environmental Sciences Group (ESG) sampling results and locations around Lobe D are included in Appendix 3

4.0 CONCLUSION

As no additional material has been added to the landfill and the Environmental Working Group determined that there was no evidence of contamination migration, the potential for environmental risk is low. NWSO is planning to implement a remediation project during summer 2018 to address two historical spills. Should that project proceed, the two small areas of hydrocarbon contaminated soil will be excavated and treated on site.



**APPENDIX 1 – NTI/DND ENVIRONMENTAL WORKING GROUP RECORD OF
RECOMMENDATIONS – DEWAR LAKES, NUNAVUT (FOX-3)**

NTI/DND Environmental Working Group

Record of Recommendations –

Dewar Lakes, Nunavut (FOX-3)

Landfills and Hydrocarbon Contaminated Areas

Prepared by:

Environmental Working Group, April 2008

Station West – Lobe D	A. 20 B. 15.5 C. 22	57.5	Low	This is an active landfill that will require a re-assessment at the time of closure. Based on the current conditions, it is recommended that the landfill be re-graded and covered.	TPH contaminated soil areas are to be excavated and managed in an on-site facility.
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A. Landfill Description

- Surface area: 990 m²
- Estimated depth: 2 m
- Contaminant migration: no evidence for contaminant migration
- Surface contamination: TPH
- Surface debris: 20 percent overall

B. Transport Mechanisms

- Precipitation: 250 mm annually
- Grade: terrain slopes 8 percent toward the northwest
- Cover depth: occasional exposed debris
- Cover type: crushed sand and gravel
- Erosion/surface runoff: no erosion
- Distance to seasonal drainage channel: greater than 1 km

C. Receptors

- Proximity to aquatic environments: greater than 1 km
- Vegetation: 25 percent vegetation downgradient
- Habitat use: moderate. Caribou, foxes, wolves and lemmings have been observed in the area.
- Impact on humans: human use of the area is assessed as low with a moderate likelihood of contact as the landfill is in close proximity to the operational LRR. Consumption of local flora and fauna is assessed as low, and there are no drinking water sources in the vicinity.

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APPENDIX 2 – FOX-3 DEWAR LAKES, NUNAVUT SITE INVESTIGATION 2006

Lobe D is a well-defined landfill that covers 990 m² and is approximately 2 m deep (Photograph III-25) [Photo not included]. There is less than 2 percent surface debris on the landfill itself. Along the toe, 30 to 40 percent partly buried debris is visible. Lobe D has a thick cover of crushed sand and gravel, and no erosion was noted at the lobe (UMA, 2006). There is no vegetative cover on the surface of this landfill, and the downgradient terrain is mostly covered with boulders with 20 percent vegetation.

a) Results of Surface Assessment

Lobe D has less than 2 percent debris cover on the surface; therefore a grid was not used to collect samples from the surface of the lobe. Along the toe of the lobe 30 to 40 percent surface debris was noted, and samples were collected along its perimeter. Samples were analyzed for inorganics, PCBs and TPH but no contamination was identified.

On the eastern edge of the lobe where the service road ends, an area of dark staining was noted that extended to the edge of the pad. Sample 06-10670/71 collected within the area of staining contained 2,900 ppm Type A TPH. Type A area SWD-10670 covers 24 m², and is estimated to extend to a depth of 0.3 m.

Type B hydrocarbon area SWD-10668 (containing Type B TPH at a concentration of 12,000 ppm) is also located in the area of staining present on the surface of Lobe D. The area contains a low percentage (36 percent) of Type B hydrocarbons, and likely only extends to the limits of the staining present on the surface. The EWG matrix recommends excavation to 0.5 m or to the depth and extent at which TPH concentrations are less than 2,500 ppm.

b) Results of Landfill Area Assessment

There is no evidence of contaminant migration at Lobe D. PCBs were not detected in any of the downgradient test pits, and concentrations of inorganic elements were not elevated against up gradient or background averages.

c) Recommendations

Lobe D is considered to be low risk according to the EWG Landfill Evaluation Matrix. It is recommended that this landfill be regraded. Prior to regrading, area SWD- 10668 will need to be excavated to 0.5 m. Area SWD-10670 (Type A TPH) should also be excavated to 0.3 m or covered with a minimum of 0.3 m clean fill to minimize receptor exposure. This landfill is currently used as part of the NWS activities, and additional investigation at the time of closure is recommended.

Area	TPH	Water	Other Analyses	EWG Soil Recommendation	Comments
SWD-10668	<ul style="list-style-type: none">• Max TPH: 12,000 ppm• Average TPH: 12,000 ppm• Area: 22 m²• Average depth: 0.30 m	<ul style="list-style-type: none">• No monitoring wells	<ul style="list-style-type: none">• Type A hydrocarbon co contamination	<ul style="list-style-type: none">• Moderate likelihood of exposure• Moderate receptor sensitivity• Excavate to 0.5 m or to the depth and extent where TPH concentrations are <2,500 ppm. Backfill with clean fill	<ul style="list-style-type: none">• Sample taken in a dark area of staining and contains a high percentage of Type A TPH. Contamination is therefore likely restricted to the surface and extends only to a depth of 0.3 m which is typical for lube type stains



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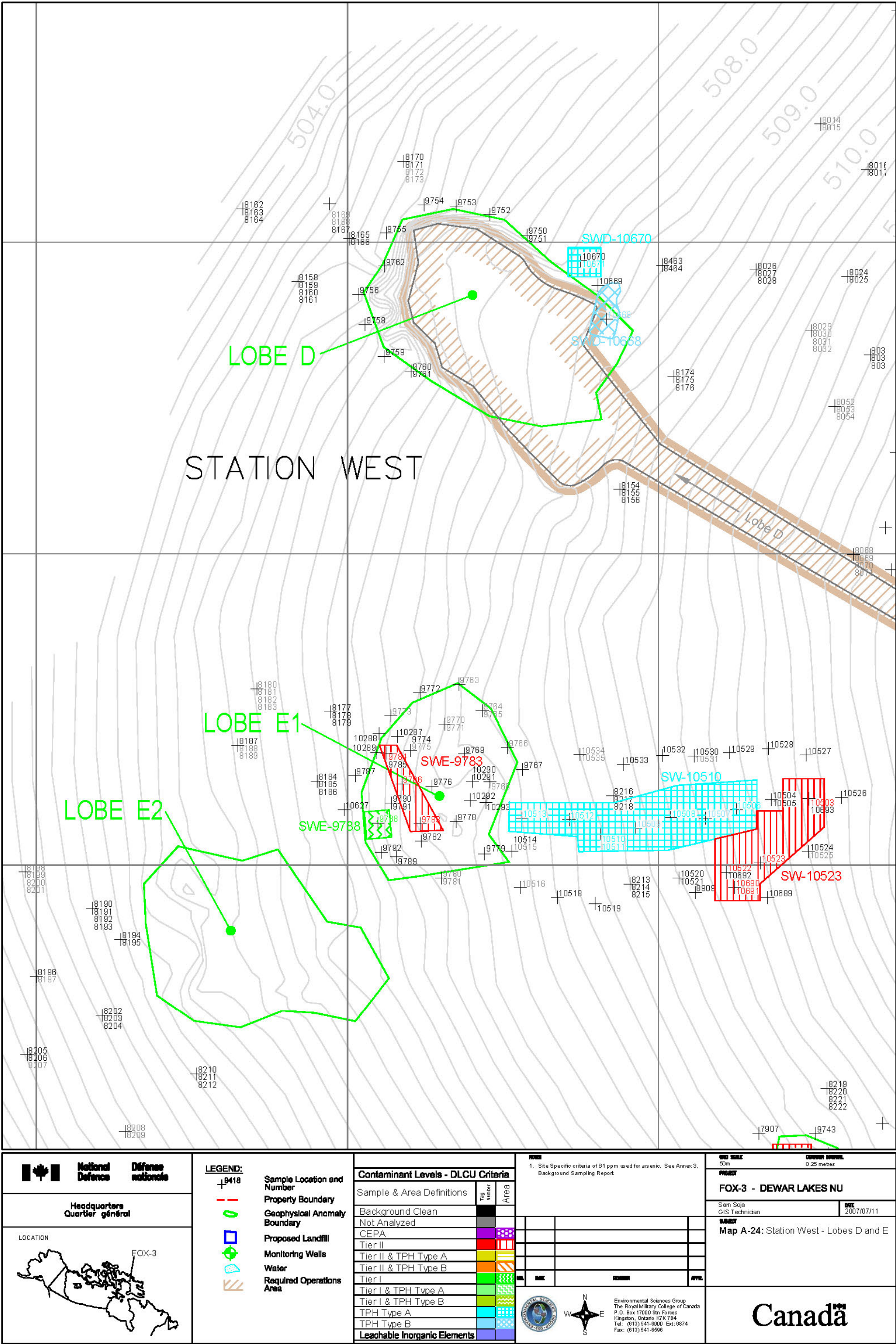
APPENDIX 3 – ANALYTICAL RESULTS**Table B-28: Analytical Results and Comparison to Background and Upgradient Samples for Station West Lobe D**

Sample #	Reference Tag/Test Pit #	Depth	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity	
														% Fuel Oil	% Lube Oil & Grease
			[cm]	[ppm]	[ppm]	[ppm]	[ppm]	[ppm]	[ppm]	[ppm]	[ppm]	[ppm]	[ppm]		
Background Value			33	28	11		13	59	67	10					
3 X Background Value			99	84	33		39	180	200	30					
Tier I Criterion							200					1			
Tier II Criterion			100	100	50	5	500	500	250	30	2	5	2,500		
CEPA												50			
Site Specific Criterion										61					
1. Surface Delineation															
06-9750/51		0	44				<30	86							
06-9752		0	60				<30	150							
06-9753		0	52				<30	80							
06-9754		0	55				<30	140							
06-9755		0	<40				<30	75							
06-9756		0	51				48	100							
06-9758		0	54				<30	120							
06-9759		0	45				<30	150							
06-9760/61		0	<40				<30	70							
06-9762		0	<40				<30	89				<0.5	910		
06-10668		0										<0.5	12,000	36	64
06-10669		0	<40				<30	81				<0.5	2,200	4	96
06-10670/71		0										<0.5	2,900	20	81
2. Landfill Assessment															
Upgradient Average			42	31	13	<1.0	<10	69	77	11		<0.1			
3 X Upgradient Average			120	94	40	<3.0	<30	210	230	33		<0.3			
3 X Background Value			99	84	33		39	180	200	30					
Upgradient Samples															
06-8154	8154	10	41	31	14	<1.0	<10	70	73	11		<0.1			
06-8155	8154	45	41	32	14	<1.0	<10	70	77	12		<0.1			
06-8156	8154	80	41	31	13	<1.0	<10	66	73	14		<0.1			
06-8174	8174	5	37	25	11	<1.0	<10	62	69	12		<0.1	<40	n/a	n/a
06-8175	8174	40	49	32	14	<1.0	<10	77	79	13		<0.1			
06-8176	8174	70	36	28	13	<1.0	<10	64	72	7.8		<0.1	<40	n/a	n/a
06-8463	8463	10	47	36	14	<1.0	<10	74	88	10					
06-8464	8463	50	41	35	13	<1.0	<10	71	84	7.8					
Downgradient Samples															
06-8158	8158	10	40	31	12	<1.0	<10	66	76	14					
06-8159	8158	40	37	29	12	<1.0	<10	76	75	13		<0.1			
06-8160/61	8158	75	39	28	13	<1.0	<10	70	80	17		<0.1			
06-8161	8158	75	38	28	13	<1.0	<10	70	78	16					
06-8162	8162	10	40	29	10	<1.0	<10	66	74	5		<0.1			
06-8163	8162	40	45	32	13	<1.0	<10	73	81	15		<0.1			
06-8164	8162	65	33	27	12	<1.0	<10	60	70	11		<0.1			
06-8165	8165	10	37	26	11	<1.0	<10	69	74	11		<0.1			
06-8166	8165	60	31	27	12	<1.0	<10	64	66	7.3		<0.1			
06-8167	8167	80	36	27	12	<1.0	<10	68	72			<0.1			
06-8168	8167	40													
06-8169	8167	10													
06-8170/71	8170	10										<0.1			
06-8172	8170	45													
06-8173	8170	85													

- 1.) Downgradient samples were compared to the average of background samples.
 - 2.) Concentrations that are greater than or equal to three times average background concentration are underlined and in italics.
 - 3.) Concentrations that are greater than or equal to Tier II criteria are in bold italics.
 - 4.) Concentrations that are greater than or equal to three times average background concentrations and are above or equal to Tier II criteria underlined and in bold italics
 - 5.) Detectable levels of PCBs and TPH in downgradient samples are underlined and in italics
 - 6.) Where the analyte was not detectable in a sample, the result was assumed to equal one-half the detection limit for the purposes of calculating an average.
- n/a = not applicable

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