1.0 INTRODUCTION

The North Warning System consists of a sequence of radar sites operating across the northern and eastern coasts of Canada from the Yukon in the west to the southern Labrador coast in the east. The North Warning System (NWS) is linked to the North Warning System Control Centre (NWSCC) located in Canadian Forces Base (CFB) North Bay, Ontario via the Long Haul Communications Network (LHCN), a satellite communications network.

There are a total of eleven (11) Long Range Radar (LRR) sites in the NWS. They are situated in the arctic region of Canada extending from Shingle Point, Yukon on the west to Cartwright, Labrador on the east coast and provide high level radar coverage. Two of these sites, (located at Cambridge Bay and Sanirajak, Nunavut), have radar and support sites combined in one facility. These sites are referred to as LRR/LSS stations and are each staffed by approximately ten people. The remaining nine sites are currently not permanently staffed, they are operated via remote monitor & control and local automation. However, staffing levels at all LRR sites are planned to increase beginning April 1st, 2022. Plans include gradually increasing staffing levels to year-round attendance of at least nine staff members as of October 1st, 2023.

The LRR site facilities consist of building groups which include accommodations, technical services, power generation system, fuel tank farms, radar towers, satellite ground terminals, weather compounds, helipads, roads, and beach fuel tanks. There are six LRR sites located in Nunavut that have Nunavut Water Board (NWB) licences. Some bulk fuel storage tanks at the six sites are surrounded by berms. Water from precipitation accumulates in the berms and must be pumped out to prevent damage to the fuel tanks. The berms around the bulk fuel storage at BAF-3 have been removed and therefore the monitoring program for berm water at that site is inactive.

Water samples are taken from within each berm. The sampling point is inside the berm and the final discharge point of the bermed fuel storage facility is just outside of the berm. Berm locations listed are in Table 1-1 and are shown in maps included in Appendix A. Berm locations listed are in Table 0-1 and are shown in Appendix A.

Table 0-1: NWS Berms on NWB Sites, including location

NWS Site	NWB Licence	Monitoring Station[1]	Berm	Berm Location on-site	Berm coordinates	
					North	West
CAM-M	3BC-CAM0919	CDL-3	CAM W22A	Summit	69° 7'2.76"N	105° 7'2.69"W
			CAM W20B&C	Airstrip	69° 6'12.01"N	105° 7'36.60"W
			CAM W22C & W20D	Beach	69° 6'11.41"N	105° 5'50.26"W
CAM-3	3BC-SHE0919	SHE-3	SHE W22A	Summit	68°47'42.00"N	93°26'19.58"W
			SHE W22C&D	Beach	68°48'7.82"N	93°36'50.12"W
FOX-M	3BC-FOH0919	FOH-3	HAL W22A	Summit	68°45'42.24"N	81°13'25.04"W
			HAL W22B	Summit	68°45'43.00"N	81°13'27.27"W
			HAL W20D&E	Airstrip	68°46'15.85"N	81°13'58.33"W

[1] Final Discharge Point of Bermed Fuel Storage Facility

NWS Site	NWB Licence	Monitoring Station[1]	Berm	Berm Location on-site	Berm coordinates	
					North	West
			HAL W20B	Beach	68°46'23.93"N	81°12'51.11"W
			HAL W20F	Beach	68°46'23.75"N	81°12'46.12"W
FOX-3	8BC-FOD1828	FOD-3	DEW W20D&E	Airstrip	68°37'24.90"N	71° 8'5.62"W
			DEW W22A&B	Summit	68°39'5.43"N	71°14'3.23"W
			DEW W22C&D	Summit	68°39'3.67"N	71°13'49.97"W
			DEW W22E[2]	Airstrip	68°37'26.59"N	71°8'23.67"W
DYE-M	3BC-DYE0919	DYE-3	DYE W20A	Summit	66°40'0.13"N	61°21'25.76"W
			DYE W22K,J,I &W20B	Summit	66°39'53.59"N	61°21'23.78"W
BAF-3	No berms present, monitoring station inactive					

1.1 Purpose

This procedure applies to CAM-M, CAM-3, FOX-M, FOX-3, and DYE-M, listed in Table 0-1 at the monitoring stations for the final discharge point of each bermed fuel storage facility. It has been prepared to ensure that the stipulations of the Nunavut Water Board (NWB) licence for each site is met and the water discharged is not impacted by hydrocarbons. It has been prepared to meet the requirements of a "QA/QC Plan" in accordance with the NWS NWB licences. This procedure replaces *PLN-EHS-13 "QA/QC Plan for Berm Water Sampling at CAM-M, CAM-3, FOX-M, FOX-3, DYE-M and BAF-3".*

If required, sampling, sample preservation, and analyses are done in accordance with methods in the current edition of the Standard Methods for the Examination of Water and Wastewater as required by the NWB Water Licences listed above.

See Appendix B for a decision tree on the type of sampling that will be conducted. See Appendix C for the Discharge Criteria that the lab will be analyzing to.

1.2 Review

This plan shall be reviewed annually by Nasittuq and will be updated as required. Updated plans will be submitted to the NWB with an approval letter from a laboratory accredited to ISO/IEC Standard 17025.

2.0 PROCEDURE

2.1 Gather Equipment

Equipment is listed below. The Berm Water Testing Kit is only needed if laboratory analysis is required.

2.1.1 Personal Protective Equipment (PPE):

- eye protection (safety glasses or goggles)

[2] Tank W22E was demolished in 2012 and the berm was left intact.

- nitrile gloves
- filled portable eye wash or source of water to flush eyes

2.1.2 General Equipment:

- Water Sampling Form (FM-EHS-67)
- Permanent marker and pen
- Plastic bag (e.g., New garbage bag)
- Camera

2.1.3 Field Screening Equipment:

- Hydrocarbon Test Strips
- Test Strip Card (printed out from Appendix D and laminated)

2.1.4 Berm Water Testing Kit (cooler):

- Chain of Custody form;
- Cold packs; and
- Item 4007432: Berm Water Test Kit. The sample bottles required from the kit are listed in Table 1 below.
- Item 3002570: Disposable Filter (0.45 um pore size)
- Item 3002575: Disposable Syringe (to be used with filter)
- pH test strips (i.e., Litmus strips).

Note: The sample bottles are provided from the laboratory clean and free of contaminants. Bottles may contain preservatives; the type of preservative will be marked on the bottle by the lab. Preservatives can include acid (such as nitric acid) or tablets (such as sodium bicarbonate).

2.2 Health and Safety

Prior to sampling review any Safety Data Sheets associated with the preservatives in the Berm Water Testing Kit. Preservatives may include acid which is corrosive. Ensure proper PPE is worn prior to opening any sample bottles.

2.3 Field Screening

If there has not been a spill in the berm since the last lab sample, the water can be tested in the field with hydrocarbon test strips.

1. Fill out the Water Sampling Form with your observations (e.g., “No visible sheen”).
2. Don nitrile gloves.
3. Wet a test strip in each corner of the berm.
4. Place each test strip on the laminated “Test Strip Card”, See Appendix D for card template.
5. With all of the test strips in place, take a photo of the Test Strip Card with the tank and LOCID in the background. Use a camera that date stamps its photos.
6. Email the photo and scanned copy of the Water Sampling Form to

a. labResults@nasittuq.com and to NWS-Environment@nasittuq.com .

7. Await authorization to discharge.

2.4 Lab Analysis

Laboratory analysis is completed under the following circumstances:

1. There has been a spill in a berm since the last lab analysis, Nasittuq will raise a Work Order to have the berm water sampled and analysed by a lab; and/or,

2. The field screening indicates the presence of hydrocarbons.

The table below provides an overview of the sampling requirements.

Table 2.4-1: Sample bottle requirements

Bottle	Parameters	Sampling	Storage Instructions
2 x 250 ml Amber Glass bottles (no preservative)	Oil & Grease (total)	Grab	Keep cool. Return to the laboratory within 7 days of sampling.
2 x 40 ml VOC vials	BTE	Fill slowly and completely – no air bubbles present. Do not discard preservative tablet. Do not dip into berm (fill by pouring from the 250 ml bottle).	Keep cool. Holding time is 14 days.
1 x 250 ml plastic bottle	pH	Fill to neck	Keep cool. Hold time extremely short Use pH strips to supplement analysis.
1 x 80 ml plastic with HNO3 acid	Lead – dissolved	Filter using the syringe and filter attachment. Fill to neck. Do not discard preservative liquid. Do not dip into berm.	Keep cool. Hold time is 6 months.

*If the preservative is supplied in a separate vial carefully add it to the sample after the sample is collected (while wearing PPE). The appropriate preservative will be colour-coded to match the colour of the bottle lid.

2.5 Sampling Instructions

2.5.1 Preparation

- Co-ordinate taking the samples with the air cargo flight schedule to minimize sample storage time.
- Gather the equipment listed in Section 2.1.
- The day before sampling, get the cold packs from the berm water testing kit and place in freezer overnight. If cold packs were not included in the cooler, then a Ziploc bag of ice can be used. Double-bag the Ziploc of ice before placing it in the cooler for shipment.
- Read the label of each bottle to determine which contain acid. Acid may be indicated by “H2SO4”, “HCl”, or “HNO3”.

- With permanent marker, mark each bottle with site, unique sample # (include tank ID), time, and date.

2.5.2 Assess the area for any signs of fuel

- Fill out the Water Sampling Form with your initial observations (note any sheens or odours).
- Don the PPE.

2.5.3 Collect the Dissolved Metals sample (filtered)

- Locate the bottle for Dissolved Metals (125 ml with acid preservative) and have it within arms reach.
- Use the Oil and Grease bottle to collect 1L of water to be decanted into the syringe.
- Attempt to collect water without suspended solids (try not to disturb the sediment, as a lot of sediment will make the filtering process slower). Assemble the filter and syringe.
- Fill the syringe with water from the Oil & Grease bottle.
- Gently push the syringe plunger down forcing the water through the filter, collect the filtered water into the Dissolved Metals bottle.
- If the water does not come through the filter, be patient and slowly push on the plunger without forcing. If water is still not coming through disassemble the filter and syringe and use a new filter.
- After you have collected the sample discard the filter and syringe (a new filter and syringe should be used for each sample).
- Write “Filtered” on the bottle (or check off the “filtered?” Checkbox).

2.5.4 Collect the BTE sample (unfiltered)

- Locate the BTE vials (2 x 40 ml) and have them within reach.
- Use the Oil and Grease bottle to collect 1L of water to be decanted into the vials.
- Slowly pour water from the Oil and Grease bottle into the vials until a meniscus form at the top. Cap the vials and place in a bubble wrap pouch.

2.5.5 Collect the pH and Oil and Grease sample (unfiltered)

- Use the Oil and Grease bottle to pour water on to a pH test strip to obtain an approximate pH reading. Note this on the sampling form.
- Simply fill the Oil and Grease bottle and the pH bottle to the top.

2.6 Results

2.6.1 Take photos

- Take a close up photo of all the bottles with the sample ID visible.
- Take a wide angle with the bottles and the tank berm in the background

2.6.2 Paperwork

- Complete the Chain of Custody form and the Water Sampling Form, a sample Chain of Custody is included in Appendix E.
- On the chain of custody include the following parameters

    1. Diss. Lead (filtered)
    2. BTE

3. pH
4. Oil & Grease

- Scan a copy of both forms and email to labresults@nasittuq.com

2.6.3 Storage and shipping

- Wrap glass bottles with bubble pack from kit.
- Place in cooler and add cold packs. Add additional bubble wrap so bottles don't move in shipment.
- Seal cooler with packing tape and ship the cooler to the laboratory. If any delay, keep samples cool but not frozen (4 to 10 °C).
- Seal cooler with packing tape and air freight as soon as possible to:

ALS Labs
190 Colonnade Road, Unit 7
Nepean ON
K2E7J5
613-225-8279

2.7 Await permission to discharge from Environmental Services.

3 ANALYSIS AND RESULTS

The laboratory is accredited to ISO/IEC Standard 17025. The laboratory has an established QA/QC program for the analyses required under this water licence.

Results are emailed to labresults@nasittuq.com and nws-environment@nasittuq.com. Environmental Services will evaluate the results for compliance with the NWB licence and notify the NWB water resources officer. If the results comply, they will give the permission to discharge.

4 ACRONYMS

Table 4-1: Acronyms

Acronym	Definition
BTE	Benzene, Toluene, and Ethylbenzene
CFB	Canadian Forces Base
DND	Department of National Defence
H_2SO_4	Sulfuric acid
HNO_3	Nitric acid
IEC	International Electrotechnical Commission
ISO	International Standards Organization
$K_2Cr_2O_7$	Potassium dichromate
LRR	Long Range Radar

Acronym	Definition
LSS	Logistics Support Site
NWB	Nunavut Water Board
NWS	North Warning System
NWSCC	North Warning System Control Centre
PCBs	Polychlorinated Biphenyls
pH	power of Hydrogen (a measure of acidity and alkalinity of a solution)
PPE	Personal Protective Equipment
QA/QC	Quality Assurance / Quality Control
VOC	Volatile Organic Compound

APPENDIX A: BERM LOCATION MAPS

Figure 1: CAM-M Berm Locations

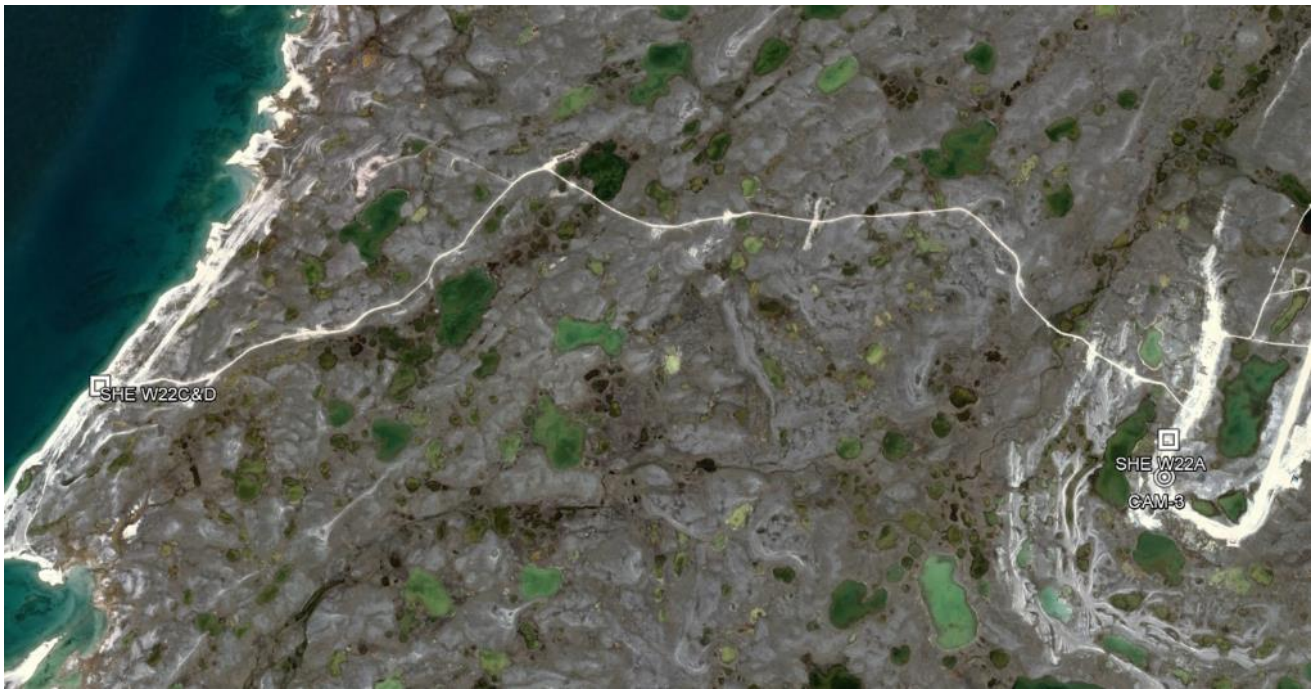


Figure 2: CAM-3 Berm Locations

Figure 3: FOX-M Berm Locations

Figure 4: FOX-3 Berm Locations

Figure 5: DYE-M Berm Locations

APPENDIX B: SAMPLING DECISION TREE

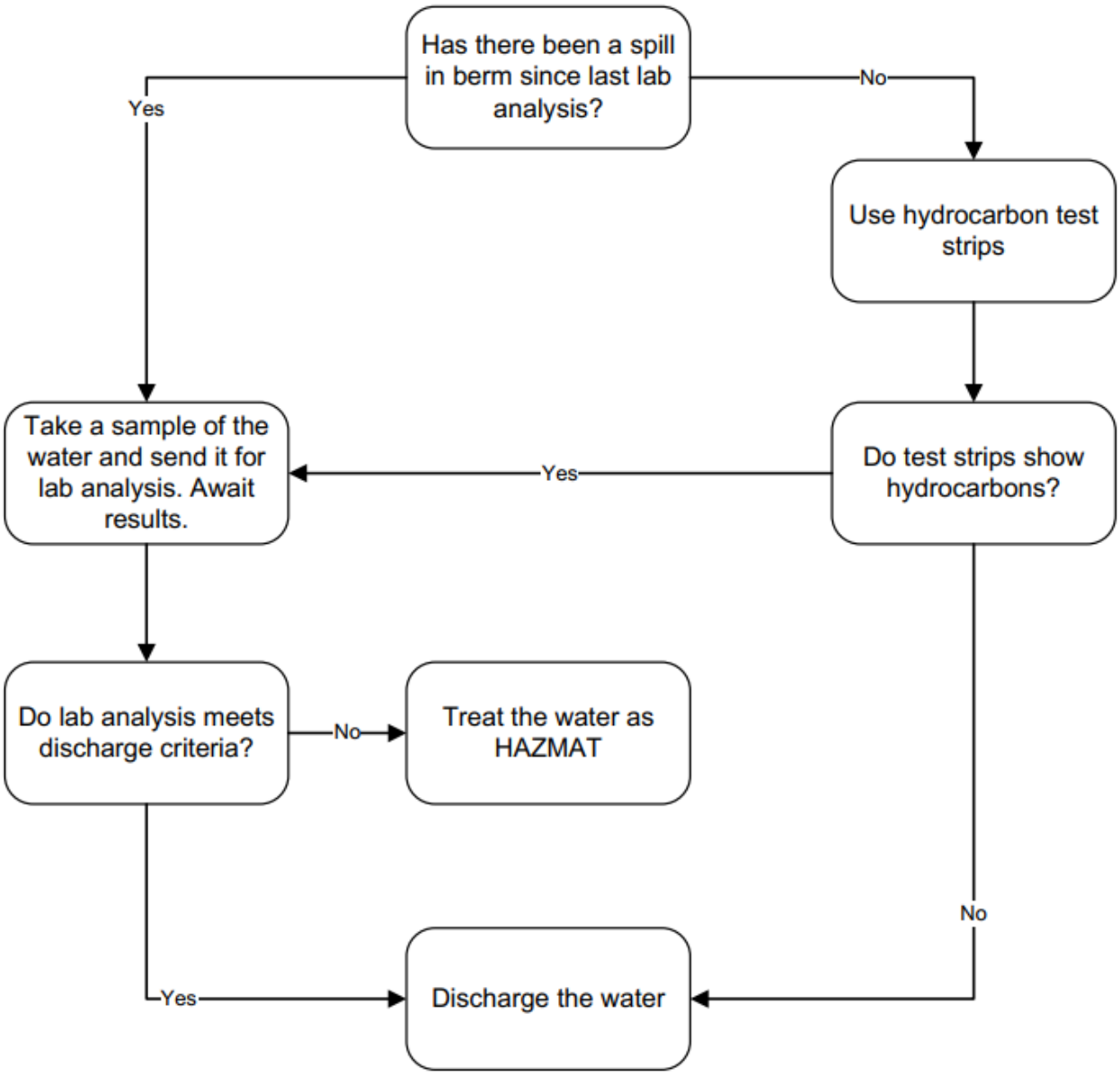


Figure 6: Berm water sampling decision tree

APPENDIX C: WATER DISCHARGE CRITERIA

Table C-1: Wastewater Discharge Criteria

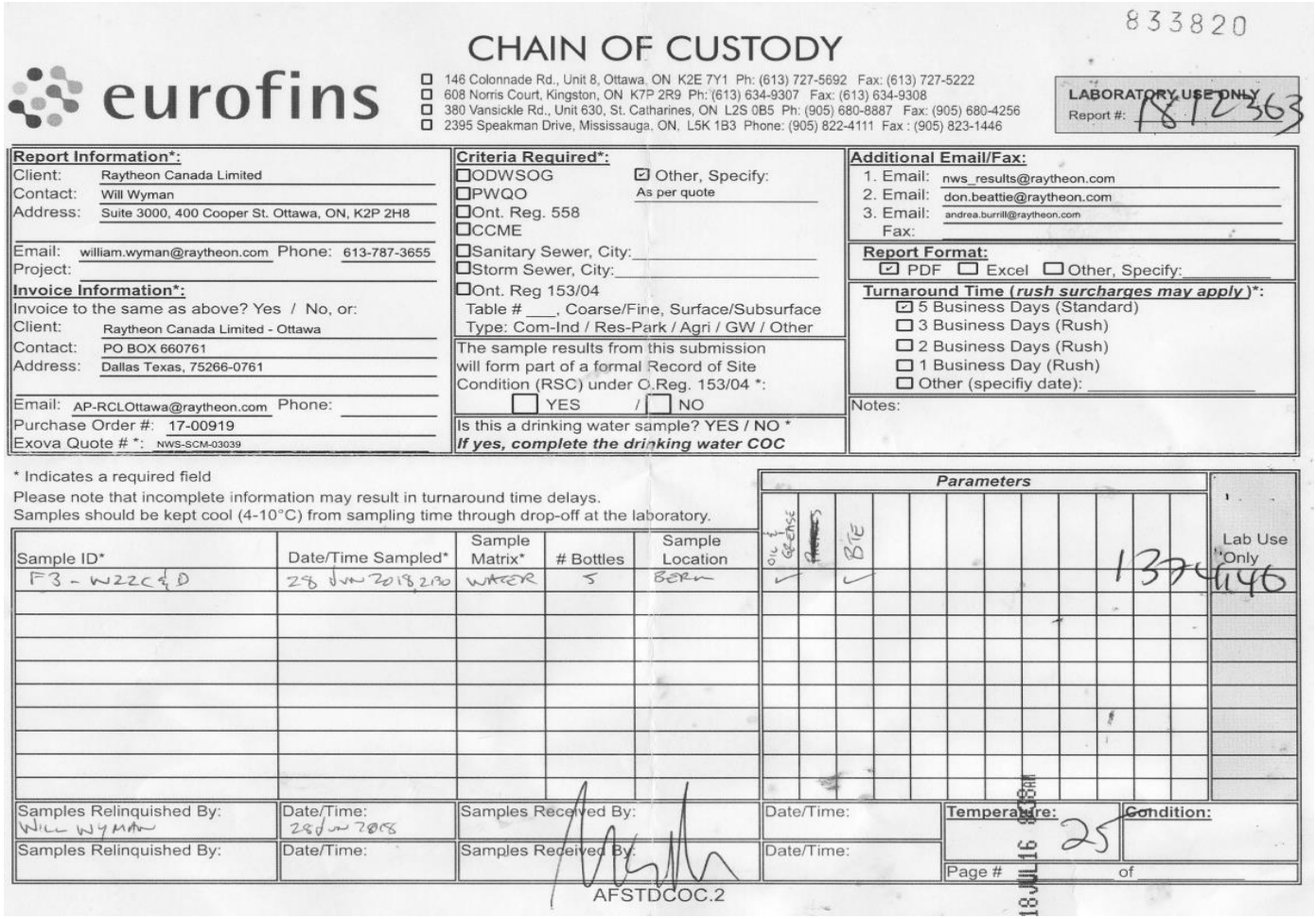
Parameter	Maximum Concentration of any Grab Sample (µg/L)
Oil and Grease	5000
Benzene	370
Toluene	2
Ethylbenzene	90
Lead (dissolved)	50
pH	6 to 9.5 (units)

APPENDIX D: HYDROCARBON TEST STRIP CARD

Site: _____

Test strip 1	Test strip 2	Test strip 3	Test strip 4
Colour Key from test strip kit			

APPENDIX E: EXAMPLE COMPLETED CHAIN OF CUSTODY FORM



833820

CHAIN OF CUSTODY

eurofins

146 Colonnade Rd., Unit 8, Ottawa, ON K2E 7Y1 Ph: (613) 727-5692 Fax: (613) 727-5222
608 Norris Court, Kingston, ON K7P 2R9 Ph: (613) 634-9307 Fax: (613) 634-9308
380 Vansickle Rd., Unit 630, St. Catharines, ON L2S 0B5 Ph: (905) 680-8887 Fax: (905) 680-4256
2395 Speakman Drive, Mississauga, ON, L5K 1B3 Phone: (905) 822-4111 Fax : (905) 823-1446

LABORATORY USE ONLY
Report #: 1812363

Report Information*:
Client: Raytheon Canada Limited
Contact: Will Wyman
Address: Suite 3000, 400 Cooper St. Ottawa, ON, K2P 2H8
Email: william.wyman@raytheon.com Phone: 613-787-3655
Project:

Invoice Information*:
Invoice to the same as above? Yes / No, or:
Client: Raytheon Canada Limited - Ottawa
Contact: PO BOX 660761
Address: Dallas Texas, 75266-0761
Email: AP-RCLOttawa@raytheon.com Phone:
Purchase Order #: 17-00919
Exova Quote # *: NWS-SCM-03039

Criteria Required*:
☐ ODWSOG ☑ Other, Specify: As per quote
☐ PWQO
☐ Ont. Reg. 558
☐ CCME
☐ Sanitary Sewer, City:
☐ Storm Sewer, City:
☐ Ont. Reg 153/04
Table # ___, Coarse/Fine, Surface/Subsurface
Type: Com-Ind / Res-Park / Agri / GW / Other

The sample results from this submission will form part of a formal Record of Site Condition (RSC) under O.Reg. 153/04 *:
☐ YES / ☐ NO

Is this a drinking water sample? YES / NO *
If yes, complete the drinking water COC

Additional Email/Fax:
1. Email: nws_results@raytheon.com
2. Email: don.beattie@raytheon.com
3. Email: andrea.burrill@raytheon.com
Fax:

Report Format:
☑ PDF ☐ Excel ☐ Other, Specify:

Turnaround Time (*rush surcharges may apply*)*:
☑ 5 Business Days (Standard)
☐ 3 Business Days (Rush)
☐ 2 Business Days (Rush)
☐ 1 Business Day (Rush)
☐ Other (specifiy date):

Notes:

* Indicates a required field
Please note that incomplete information may result in turnaround time delays.
Samples should be kept cool (4-10°C) from sampling time through drop-off at the laboratory.

Sample ID*	Date/Time Sampled*	Sample Matrix*	# Bottles	Sample Location	Parameters: Oil & Grease	Phenols	BTE	Lab Use Only
F3 - W22C & D	28 JUN 2018 2:30	WATER	5	BERM	✓		✓	1374146

Samples Relinquished By:	Date/Time:	Samples Received By:	Date/Time:	Temperature:	Condition:
WILL WYMAN	28 JUN 2018			25	
Samples Relinquished By:	Date/Time:	Samples Received By:	Date/Time:	Page #	of

18 JUL 16 0958

AFSTDCOC.2