BERM WATER SAMPLING STANDARD PROCEDURE

1.0 INTRODUCTION

The North Warning System (NWS) 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 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. One site is currently inactive (PIN-3). The remaining eight sites are LRR sites staffed by approximately ten people (as of April 1st 2022).

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.

Table 1.1: 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

[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
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
			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 1.1, above, 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 D for the Discharge Criteria that the lab will be analyzing for.

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

2.0 PROCEDURE

2.1 Gather Equipment

Equipment is listed below. If laboratory analysis is required, (see Appendix B for decision tree). follow instructions in Appendix D.

- Personal Protective Equipment (PPE):
  - eye protection (safety glasses or goggles)
  - Item 4001961: nitrile gloves
- General Equipment:
  - Water Sampling Form (FM-198)
  - Permanent marker and pen
  - Plastic bag (e.g., New and clean garbage bag)
  - Camera
- Field Screening Equipment:
  - Item 4003480: Hydrocarbon Test Strips
  - Test Strip Card (printed out from Appendix D and laminated)

2.2 Health and Safety

Prior to sampling, don the nitrile gloves and eye protection.

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. If a spill has occurred, follow the instructions in Appendix D for Sampling and Lab Analysis.

1. Examine the berm water for evidence of fuel or oil (fuel/oily sheen) or hydrocarbon odour.
   a. If you have observations, fill out the Water Sampling Form with your observations (e.g., “oily sheen visible”).
2. Don nitrile gloves.
3. Wet a test strip in each corner of the berm (use 1 strip for each corner, 4 strips total).
4. Find the tank’s Location ID label (LOCID). With all four test strips, take a photo with the test strips and the tank and LOCID in the background.
5. Email the photo (and, if you have observations to report, the Water Sampling Form) to
   a. labresults@nasittuq.com and to NWS-Environment@nasittuq.com .
6. Await authorization to discharge. Environmental Services will seek approval from CIRNAC.

2.4 Discharge Once Approved

Site staff must await permission to discharge from Environmental Services. If no concerns are noted, Environmental Services will seek approval from the NWB water resources officer for permission to discharge. At least 10 days notice is required prior to discharge, as per the water licence. When discharging, place the pump in a spill tray and discharge 31 metres above the ordinary high-water mark.

If concerns are noted by Environmental Services (e.g. oily sheen is visible, test strips indicate hydrocarbons, or a spill has occurred within the berm). The site crew will be instructed to conduct sampling and lab analysis (see Appendix D).

3.0 ACRONYMS

Table 3-1: 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
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

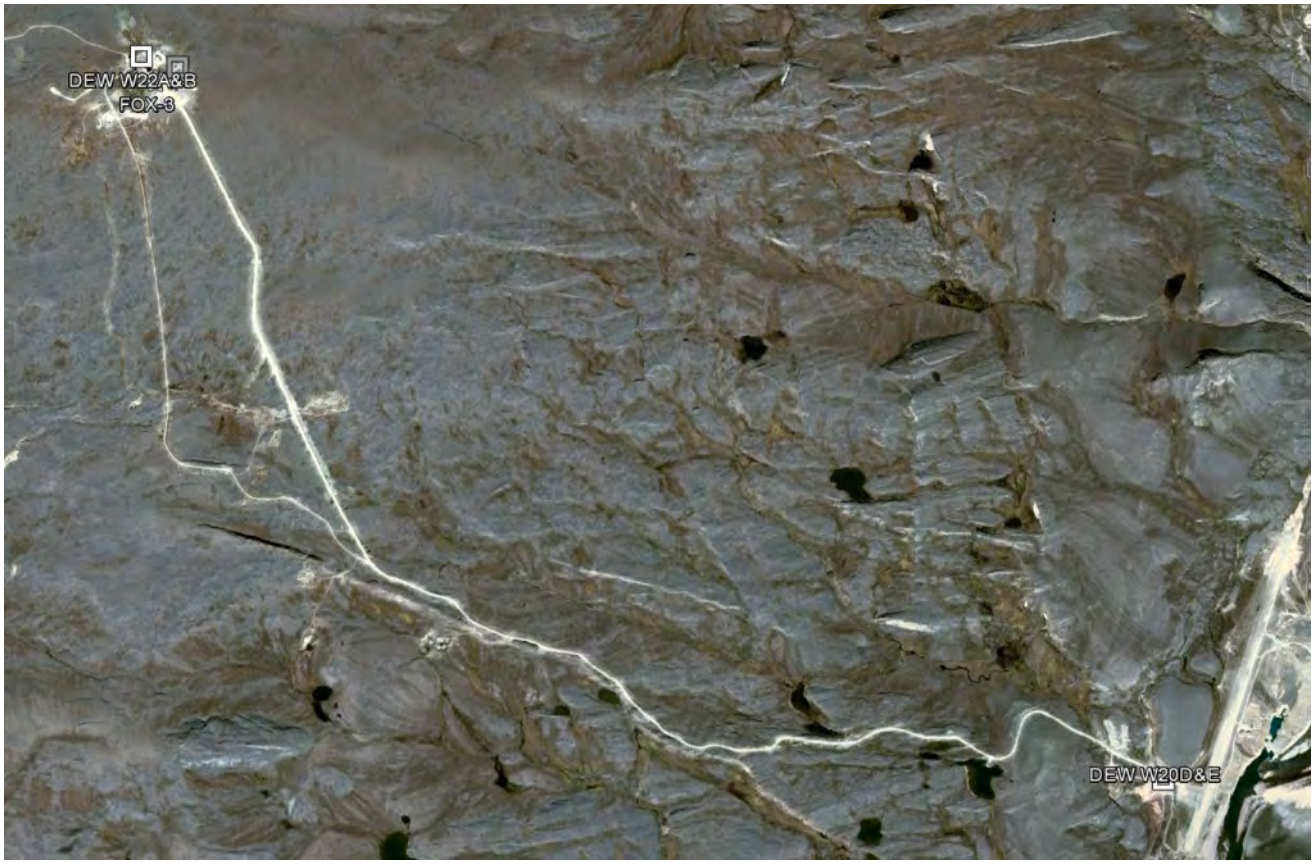


Figure 4: FOX-3 Berm Locations

Figure 5: DYE-M Berm Locations

APPENDIX B: SAMPLING DECISION TREE

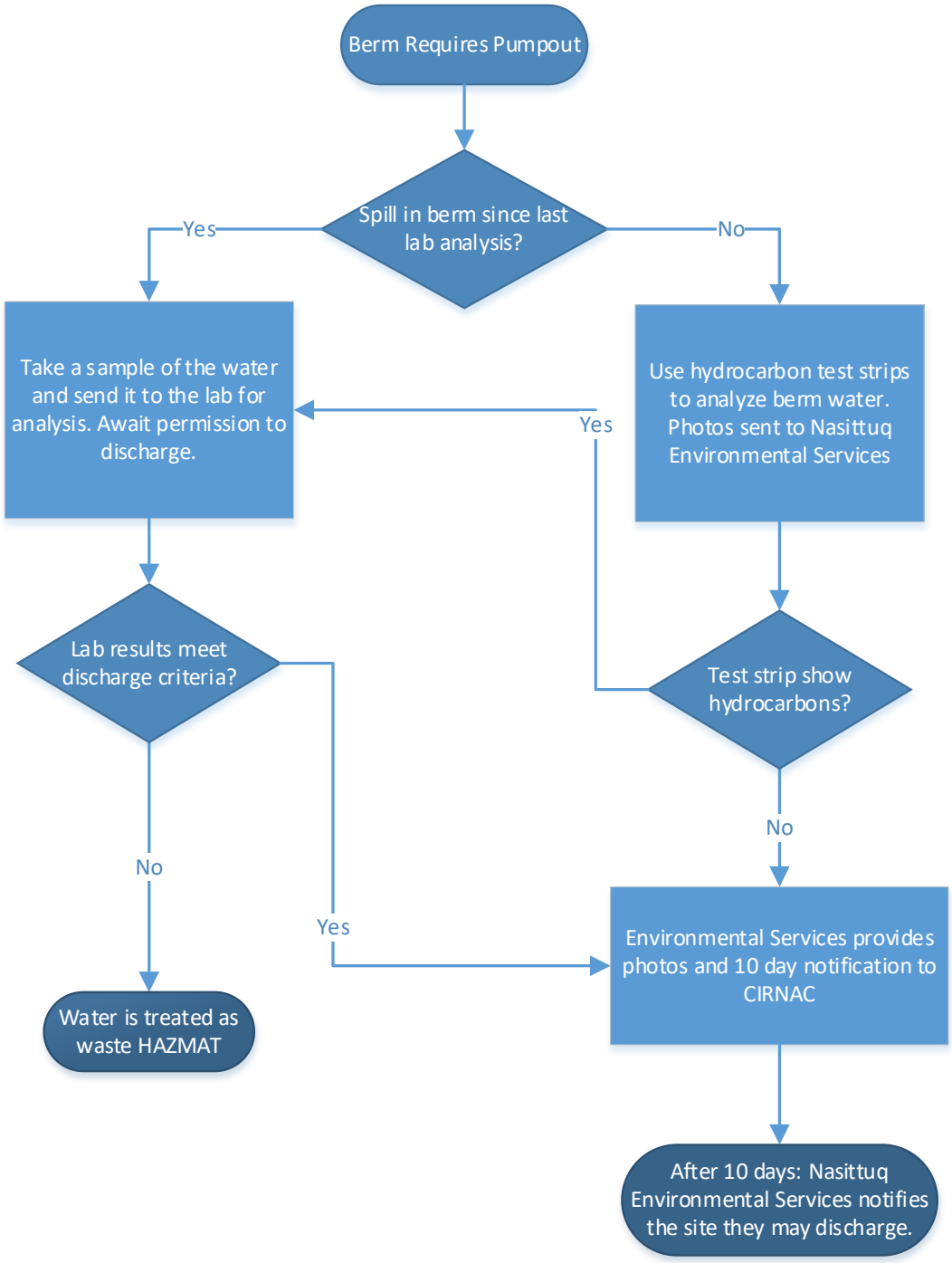


Figure 6: Berm water sampling decision tree

APPENDIX C: WASTEWATER DISCHARGE CRITERIA AND PHOTO EXAMPLE

Table C-1: Wastewater Discharge Criteria (if sampling required)

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)

Figure C-1: Example photo of test strips

APPENDIX D: SAMPLING AND LAB ANALYSIS INSTRUCTIONS

D-1.0 Introduction

If sampling and lab analysis is required, follow the procedure outlined below.

D-2.0 Procedure

D-2.1 Gather Equipment

Berm Water Testing Kit (cooler):

- Chain of Custody form (included in cooler);
- Ice packs (included in cooler) or ziplock bag of ice; and
- Item 4007432: Berm Water Test Kit. The required bottles are listed in Table D.1 below.
- Item 3002570: Disposable Filter (0.45 um pore size)
- Item 3002575: Disposable Syringe (to be used with filter)
- Item 1013260: pH test strips (i.e., Litmus strips).

D-2.2 Health and Safety

Prior to sampling review any Safety Data Sheets (SDS) associated with the preservatives in the Berm Water Testing Kit. Preservatives may include acid which is corrosive. Ensure proper PPE (e.g. nitrile gloves and safety glasses) is worn prior to opening any sample bottles.

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 liquid (such as nitric acid) or tablets (such as sodium bisulphate).

D-2.3 Field Screening

See instructions on page 2.

D- 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,
2. The field screening indicates the presence of hydrocarbons.

In either of these cases Nasittuq will raise a Work Order to have the berm water sampled and analysed by a lab. The table below provides an overview of the sampling requirements. The samples must be kept cool shipped to the laboratory as soon as possible as they must be analysed within the time frame stipulated by the laboratory (“hold time”, typically a maximum of 14 days).. Bottle size may vary slightly depending on laboratory requirements. Environmetental Services will confirm hold times, bottle types and preservatives, with the laboratory prior to analysis

Table D.1: Sample Bottle Requirements *

Bottle Colour Code / Parameter Group	Parameter	Sampling	Storage Instructions
Yellow / Oil & Grease: 2 x 250 ml or 100ml Amber Glass bottles	Oil & Grease (total)	Do NOT dip the bottles into the berm water. Fill to the neck using the General Chemistry bottle as a decanter. *May contain acid preservative*	Keep cool. Ship ASAP to lab.
Blue / VOCs: 2 x 40 ml glass vials	BTE	Do NOT dip the vials into the berm water. Vials should be filled to the lip or higher (convex meniscus) using the General Chemistry bottle as a decanter. *Preservative: sodium bisulphate tablets (acid)*	Keep cool. Ship ASAP to lab.
Red / Metals: 1 x 80 ml plastic	Lead – dissolved	Filter using the syringe and filter attachment. Fill to neck using the syringe and filter. Do not discard preservative liquid. Do not dip into berm. See instructions for filtering below. *Preservative: nitric acid*	Keep cool. Ship ASAP to lab.
Green / General Chemistry: 1 x 250 ml plastic bottle	pH	Fill to neck by dipping into water after the other bottles have been filled. *Use pH strips on site to supplement analysis*	Keep cool. Ship ASAP to lab.

*Exact bottles and preservatives may be subject to change based on current laboratory requirements as per ISO/IEC Standard 17025. Environmental Services will confirm exact bottles required prior to sampling.

D-2.5 Field Sampling Instructions

- **D-2.5.1 Preparation**
  - Co-ordinate taking the samples with zone logistics and the air cargo flight schedule to minimize sample storage time.
  - Gather the equipment listed above.
  - The day before sampling, get the ice 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.

- **D-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.

- **D-2.5.3 Collect the Dissolved Metals sample bottle (filtered)**

- Locate the bottle for Dissolved Metals and have it ready.
- Use the General Chemistry bottle to collect 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 General Chemistry bottle.
- Gently push the syringe plunger down, slowly forcing the water through the filter 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, the filter is likely clogged. Discard the filter and syringe and assemble a new one. Repeat with as many filters as needed until you have filled the dissolved metals bottle to the neck (or fill line if present).
- After you have collected the sample discard the filter and syringe (a new filter and syringe should be used for each sample to avoid cross-contamination).
- Write “Filtered” on the bottle (or check the “filtered?” Checkbox).

- **D-2.5.4-Collect the BTE sample vials (unfiltered)**
  - Locate the BTE vials from the bubble wrap pouch and have ready.
  - Use the General Chemistry bottle to collect water to be decanted into the vials.
  - Slowly pour water from the General Chemistry bottle into the vials until a meniscus forms at the top. Cap the vials and place back in the provided bubble wrap pouch.

- **D-2.5.5 Collect the pH and Oil and Grease sample bottles (unfiltered)**
  - Use a litmus strip to dip straight into the berm water and compare to the colour chart. Note the result.
  - Use the General Chemistry bottle to fill the Oil and Grease bottles to the neck (do not overfill).
  - Finally fill the General Chemistry bottle to the top.

D-2.6 Paperwork, Photos and Results

- **D-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

- **D-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

- **D-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 an ALS Environmental Lab depot location (such as):

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

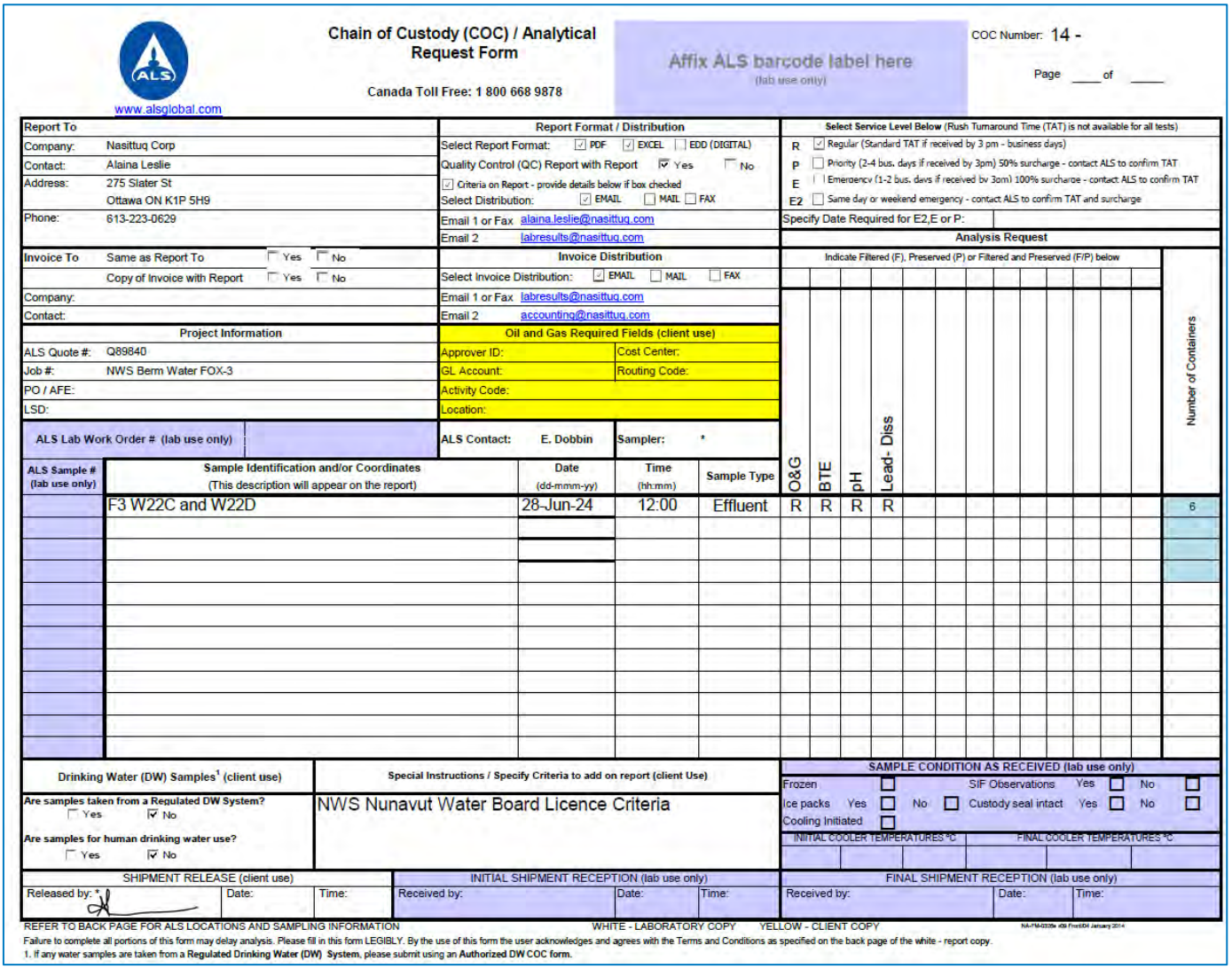
- **D-2.7 Await Permission to Discharge**
  - Nasittuq Environmental Services will provide the CIRNAC water resources officer with 10 Day notification to discharge if results comply with the licence.

D-3.0 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 with the required 10 day notification. If the results comply, and permission is granted by the water board inspector, (or 10 days has passed since notification has passed) they will give the permission to discharge to the site.

APPENDIX E: EXAMPLE COMPLETED CHAIN OF CUSTODY FORM



Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 14 -

Page ____ of ____

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Nasittuq Corp	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Alaina Leslie	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	275 Slater St Ottawa ON K1P 5H9	☑ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	613-223-0629	Email 1 or Fax alaina.leslie@nasittuq.com	Specify Date Required for E2,E or P:
		Email 2 labresults@nasittuq.com	Analysis Request

Invoice To	Same as Report To ☐ Yes ☐ No	Invoice Distribution	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:		Email 1 or Fax labresults@nasittuq.com	
Contact:		Email 2 accounting@nasittuq.com	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q89840	Approver ID:	Cost Center:
Job #:	NWS Berm Water FOX-3	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: E. Dobbin Sampler: *

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	O&G	BTE	pH	Lead- Diss	Number of Containers
	F3 W22C and W22D	28-Jun-24	12:00	Effluent	R	R	R	R	6

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No Are samples for human drinking water use? ☐ Yes ☑ No	NWS Nunavut Water Board Licence Criteria

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: *	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.