

Quality Assurance (QA) and Quality Control (QC) Plan CFS Eureka (ERK), Nunavut

In support of the
Nunavut Water Board Licence
No. 3BC-ERK1015

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1 Canadian Air Division,
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Originally prepared by:
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ACRONYMS

AGAT	AGAT Laboratories Ltd. (former contracted laboratory)
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFS	Canadian Forces Station
ERK	CFS Eureka
EXOVA	Exova Canada Inc. (current contracted laboratory)
HAWS	High Arctic Weather Station
NWB	Nunavut Water Board
PAH	Polycyclic Aromatic Hydrocarbons
pH	Measure of acidity and alkalinity
QA	Quality Assurance
QC	Quality Control
SNP	Surveillance Network Program
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids

1. INTRODUCTION

This document has been prepared in response to the requirements of the Nunavut Water Board (NWB) for the submission of a Quality Assurance (QA) and Quality Control (QC) Plan, under Licence number 3BC-ERK1015, issued to the Department of National Defence (DND) on June 18, 2010. This new Class B Water Licence issued allows for the disposal of waste during operation and maintenance of Canadian Forces Station (CFS) Eureka ("Eureka"). Eureka is located on Slidre Fiord on the west coast of Ellesmere Island within the Qikiqtani Region of Nunavut (latitude 79°59'20"N / longitude 85°56'30"W).

Eureka has been operational since 1947 and was originally established as a High Arctic Weather Station, and is currently a remote camp maintained by DND as a military detachment and training area. Eureka is located approximately 2 km from the Eureka High Arctic Weather Station (HAWS) operated by Environment Canada. This station is only seasonally active during the summer months, which may include June, July and August in the Arctic, and is used by DND, Environment Canada, and arctic research projects. During the summer months the peak population is 35 people, and on average ranges between 20 to 25 people.

This document has been prepared in accordance with the *QA/QC Guidelines for Use by Class "B" Licensees in Collecting Representative Water Sample in the Field and for Submission of a QA/QC Plan*, published in 1996 by the Department of Indian and Northern Affairs Canada Water Resources Division and the Northwest Territories Water Board. As outlined in the Licence, five (5) monitoring stations shall be maintained at Eureka at the following locations: Sewage Treatment Facility, Landfarm Facility, Landfill, Battery Dump and Barrel Dump, for the purpose of assessing water quality. The original QA/QC Plan at was approved by the NWB and implemented; this revised QA/QC Plan will be implemented one month after NWB approval.

2. SAMPLE COLLECTION

2.1 Sampling Locations

As part of the NWB Licence, the Surveillance Network Program (SNP) consists of five water monitoring stations at Eureka, which include:

- a) ERK-1: Final Discharge Point of the Sewage Treatment Facility
- b) ERK-2: Final Discharge Point of the Landfarm Facility
- c) ERK-3: Runoff/leachate from the Landfill
- d) ERK-4: Runoff/leachate from the Battery Dump
- e) ERK-5: Runoff/leachate from the Barrel Dump

To date water monitoring has not been conducted at Eureka. Sampling locations were established by the NWB and listed above and identified on Figure 1 (Appendix A). The exact sampling locations will be identified at the commencement of the sampling program in 2011, and if feasible with assistance from an

Inspector. GPS coordinates and photographic records of the sampling locations will be documented, and locations will be identified using markers for consistency and repeatability in subsequent months and years.

Timing of Sampling

Timing of the collection of the water samples at Eureka is outlined in the requirements of the NWB Licence, which specify:

- ERK-1 shall be sampled prior to the release of effluent from the Sewage Treatment Plant;
- ERK-2 shall be sampled prior to the release of effluent from the Landfarm Facility; and,
- ERK-3-4-5 shall be sampled monthly during periods of runoff or seepage from the Landfill, Battery Dump and Barrel Dump.

Documenting Non-Sampling Events

In the event that water samples are not successfully collected and submitted for analysis from the Landfarm (ERK-2), Landfill (ERK-3), Battery Dump (ERK-4) and/or the Barrel Dump (ERK-5) the following will be documented:

- Location(s) of the sampling attempts will be recorded (i.e., GPS coordinates, photographic records and the sampling locations will be identified on a map); and,
- Justification outlining why a sample was not successfully collected.

Attempted unsuccessful sampling event(s) and justification will be reported to the NWB in the Annual Report for Eureka.

2.2 Sampling Equipment

As of June 2014, Exova Canada Inc. is the external CALA-accredited Laboratory in support of this licence.

No specialized equipment will be required for the collection of water samples at Eureka. New sample bottles will be supplied by an external CALA-accredited Laboratory and used for the collection of all water samples. Samples are not to be filtered.

The table below identifies the sample bottles necessary for each sampling round. Extra bottles will be requested for duplicate samples, field blanks and/or in case of breakage.

Sewage Treatment Facility (ERK-1)	Runoff/Leachate from Landfill/Dump (ERK-3-4-5)
4 Bottles: 1 x routine (pH) 1 x routine (TSS) 1 x BOD (BOD) 1 x sterile (fecal coliforms)	11 Bottles/Site: 1 x 1L glass amber bottle (extractable HC for TPH) 1 x 1L glass amber bottle (PAHs) 1 x 1L glass amber bottle (Oil and Grease) 2 x 40 mL vials (F1, BTEX) 1 x BOD (BOD)
Landfarm Facility (ERK-2)	
5 Bottles: 2 x 40 mL vials (benzene, toluene, ethylbenzene) 1 x 300 mL metals bottle (lead) 1 x 1L glass amber bottle (Oil and Grease) 1 x 100 mL glass amber bottle (phenols)	1 x routine (pH, NO ₂ -N, NO ₃ -N, Mg, Na, Ca, K, SO ₄ , conductivity, alkalinity, hardness) 1 x nutrient (NH ₃) 1 x routine (TSS) 1 x metals bottle (total As, Cu, Fe, Hg, Cd, Cr, Pb, Ni) 1 x 100 mL glass amber bottle (phenols) 1 x sterile (fecal coliform)

2.3 Sampling Methods

Methodology for the collection of the water samples:

Parameter	Instructions
Routine and Nutrients	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle 3. Keep cool at 4°C
BOD	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle 3. Keep cool at 4°C 4. Sample must be sent to laboratory within 24 hours
Microbiological (fecal coliforms)	1. Do not rinse bottle 2. Fill to top and cap bottle 3. Keep cool at 4°C 4. Sample must be sent to laboratory within 24 hours
Total Metals (including Lead)	1. Rinse bottle three (3) times with sample 2. Fill to near the top 3. Add contents of preservative vial (nitric acid) 4. Cap bottle and mix
Hexane Extractable Material (Oil and Grease)	1. Do not rinse bottle 2. Fill to shoulder of bottle 3. Add contents of preservative vial (sulphuric acid) 4. Cap bottle and mix
BTEX, THM and Purgeable Hydrocarbons	1. Do not rinse bottle 2. Fill bottle completely leaving no air bubbles 3. Keep cool at 4°C
Extractable Hydrocarbons (including PAH)	1. Do not rinse bottle 2. Fill to top and cap bottle 3. Keep cool at 4°C
Phenol	1. Rinse bottle three (3) times with sample 2. Fill to near top 3. Add contents of preservative vial (sulphuric acid) 4. Cap bottle and mix

Refer to Table 1 (Appendix B) for additional laboratory considerations, including minimum sample size, rinsing, filtering and storage requirements for the parameters. Additionally, samples for ERK-1 and ERK-2 will be collected prior to the release of any effluent to demonstrate compliance with the criteria set out by the NWB (refer to Section 4.4B).

3. SAMPLE HANDLING

3.1 Preservation

Samples will be preserved in accordance with requirements identified by an external CALA-accredited Laboratory for the parameters to be analysed (refer to 2.3 Sampling Methods and Appendix B).

Preservatives nitric acid (HNO₃) and sulphuric acid (H₂SO₄) are classified as Class 8 Dangerous Goods. Based on the quantity of preservative needed for sampling, these acids will be transported together in regular cargo as *dangerous goods in accepted quantities*. Nitric acid will be added to preserve lead and metals samples, and sulphuric acid will be added to preserve oil and grease, and phenols samples, immediately after the samples are collected. Samples requiring analysis within 24 hours will be collected immediately prior to shipping. All samples will be stored on ice and kept cool at approximately 4°C prior to and during shipping.

3.2 Sample Identification

Samples collected will be labelled using consistent terminology, identifying the water monitoring station (corresponding to the facility), followed by the year, month and sample number. For example, ERK-1-2011-06-1 denotes a water sample collected for the Sewage Treatment Facility, in June 2011, and is the first sample collected for the month.

Similarly, blind duplicate samples collected will be labelled using consistent terminology, identifying the station, followed by the year, month and duplicate sample number. For example, ERK-2011-06-DUP1 denotes a blind duplicate water sample collected at Eureka, in June 2011, and is the first duplicated collected for the month. Trip and field blanks will be labelled as such.

At the time of collection, sample identification will be recorded in a field notebook for consistency in terminology, and to ensure the sample identifiers are unique. Sample labels will also include the following information: name of organization, time and date. Information provided on the sample labels will be clearly printed in permanent (i.e., waterproof) non-smear ink (marker or pen).

A Chain-of-Custody shall be completed for each sampling round and will accompany the samples to the laboratory.

3.3 Transportation

Samples will be packed appropriately (i.e., packed upright, immobile) in coolers, sealed and shipped to CFS Alert via the Royal Canadian Air Force or a contractor by DND for furtherance south to the external CALA-accredited Laboratory. Samples are arranged to be picked up by DND (while the station is active) for furtherance to an external CALA-accredited Laboratory without delay.

In addition, the external CALA-accredited Laboratory will be immediately notified when the samples are in transit, in order to start analysis as quickly as possible on samples with a maximum storage of 24-48

hours. A Chain of Custody will accompany the sample shipment and will clearly identify the location of samples requiring immediate analysis.

4. LAB ANALYSIS

4.1 Lab Accreditation

An external CALA-accredited Laboratory* will analyze all the samples collected in support of this licence.

As of June 2014, Exova Canada Inc. is the external CALA-accredited Laboratory in support of this licence.

Exova Canada Inc. is accredited to conduct analysis on each of the required sampling parameters, with the exception of total hardness.

*Prior to Exova Canada Inc. (June 2014), AGAT Laboratories Ltd. in Mississauga, ON, was the previous DND contract holder from 2010-2013. Refer to Appendix C for proof of laboratory accreditation in accordance with ISO/IEC17025:2005 to conduct analyses on each of the required sampling parameters.

4.2 Detection Limits

Laboratory detection limits for all parameters required by the NWB are identified in Table 1 (Appendix B). The laboratory shall report the detection limits of the methods used for the analysis of the samples.

4.3 Methodology

The laboratory sample analysis methodology will follow the methods outlined in the *Standard Methods for the Examination of Water and Wastewater* (2012), if not described below in Appendix B.

4.4 Reporting Requirements

Duplicates and Blanks

Duplicate samples and blanks shall be submitted to and analysed by the accredited laboratory to provide an internal (i.e., laboratory) and external (i.e., at time of sampling, shipping) QA/QC check to verify the reliability of the sample results. Duplicates samples shall be collected for approximately 10 percent of the samples. A duplicate sample is a repeat sample collected and handled using the same methods and submitted blindly for analysis. Based on the analytical results the laboratory will match the blind duplicate to the corresponding sample.

Field blanks and travel blanks will also be analysed. Field blanks will consist of bottling distilled water during the sampling round, using the sampling methods used to collect the water samples, to ensure reliability of the sampling method. Travel blanks consist of distilled water and are provided by the laboratory to accompany a shipment of sample bottles roundtrip to confirm the integrity of the samples was maintained.

NWB Effluent Standards

Analytical results of effluent discharged from the Sewage Treatment Facility and the Landfarm Facility will be reported against the following effluent quality standards provided by the NWB:

Parameter	Maximum Concentration of any Grab Sample
<u>Sewage Treatment Facility (ERK-1)</u>	
BOD5	80 mg/L
Total Suspended Solids	70 mg/L
Fecal Coliforms	1 X 10 ⁶ CFU/100mL
Oil and Grease	No visible sheen
pH	between 6 and 9
<u>Landfarm Facility (ERK-2)</u>	
Benzene (µg/L)	370
Toluene (µg/L)	2
Ethylbenzene (µg/L)	90
Lead (µg/L)	1
Oil and Grease (mg/L)	15 and no visible sheen
Phenols (µg/L)	20

Effluent standards provided by the NWB are consistent with the *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories (1992)*, or are consistent with other municipal licences.

5. QA/QC PLAN REVIEW

This document, *QA/QC Plan for CFS Eureka*, shall be reviewed annually to ensure that this plan remains current and consistently reflects the operations, activities and technology at CFS Eureka. Any revisions required to this document shall be submitted to the NWB in the form of an Addendum with supporting letter of approval from the external CALA-accredited Laboratory, and subsequently implemented. Changes to this plan will also be reflected in the Annual Report.

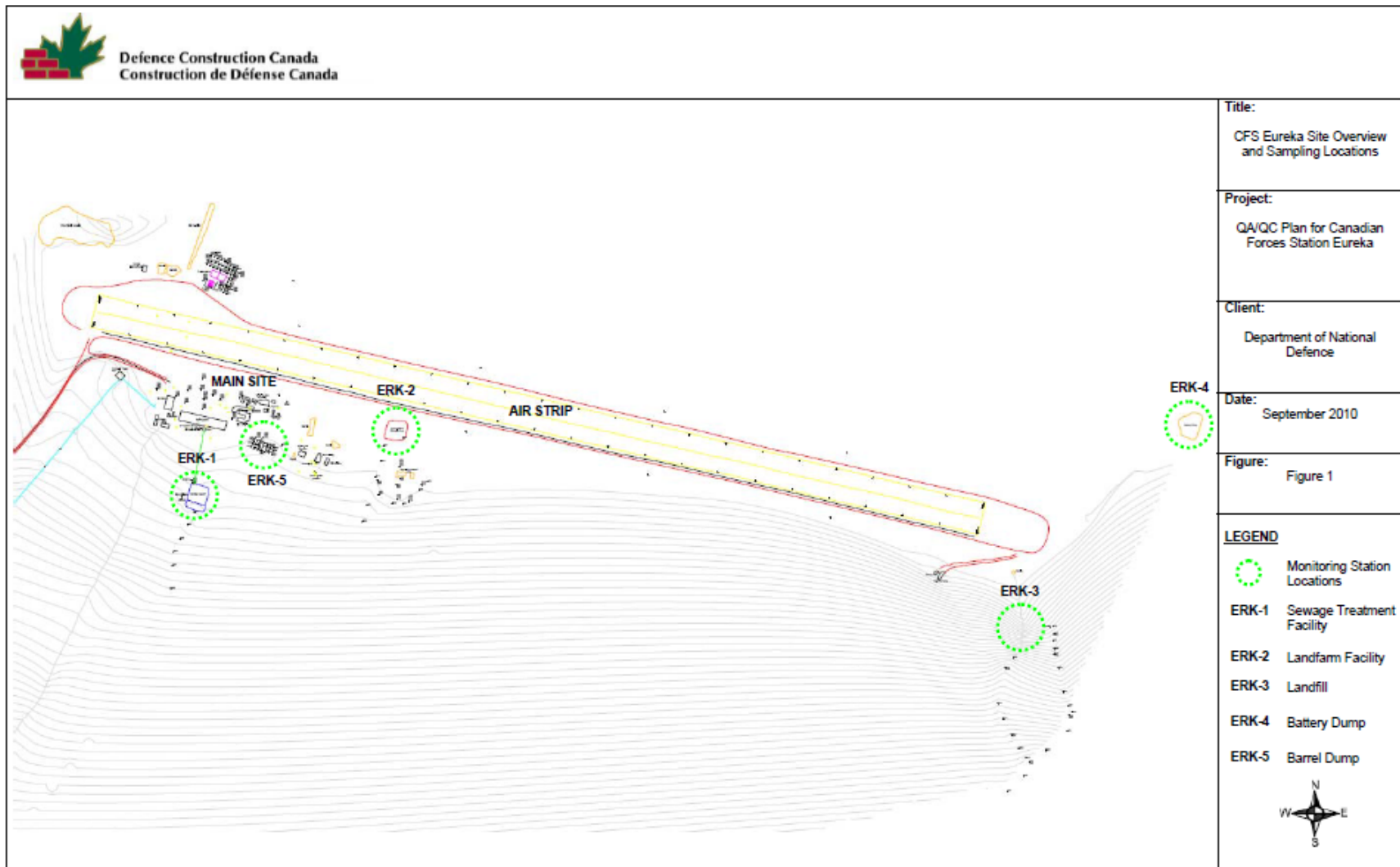
6. REFERENCES

Department of Indian and Northern Affairs Canada Water Resources Division and the Northwest Territories Water Board. *Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan*. July 1996.

Eaton, A., Clesceri, L., Rice, E., and A. Greenberg. *Standard Methods for the Examination of Water and Wastewater – 21st Edition*. 2005.

Nunavut Water Board. *Letter, RE: NWB Licence No. 3BC-ERK1015*. June 18, 2010.

Appendix A: CFS Eureka Site Overview and Sampling Locations



Appendix B: Parameter Consideration

Parameter	Container	Minimum Amount	Rinse	Filter	Preservation	Maximum Storage Recommendation	Detection Limit	Method	Accredited
Sewage Treatment Facility (ERK-1)									
BOD5	1L plastic	500mL	3 times	n/a	keep cool at 4°C	7 days	1 mg/L	SM 5210 B	Yes
TSS	1L plastic	100mL	3 times	n/a	keep cool at 4°C	14 days	2 mg/L	SM 2540D	Yes
Fecal Coliforms	300mL plastic	100mL	No	n/a	Na2S2O3	2 days	0 CFU/100mL	SM9222:D	Yes
pH	1L plastic	50mL	3 times	n/a	keep cool at 4°C	14 days	0.1 unit	SM 4500-H B	Yes
Landfarm Facility (ERK-2)									
Benzene	40mL glass vial	2x40mL	No	n/a	keep cool at 4°C	7 days	0.05 mg/L	EPA 8260C	Yes
Toluene	40mL glass vial	2x40mL	No	n/a	keep cool at 4°C	7 days	0.05 mg/L	EPA 8260C	Yes
Ethylbenzene	40mL glass vial	2x40mL	No	n/a	keep cool at 4°C	7 days	0.05 mg/L	EPA 8260C	Yes
Lead	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.05 ug/L	EPA 200.8	Yes
Oil and Grease	1L amber glass	1000mL	No	n/a	keep cool at 4°C	7 days	1.0 mg/L	MOE DECPH-E-3421	Yes
Phenols	125mL amber glass	100mL	No	n/a	1mL 50% H2SO4	28 days	0.001 mg/L	SM 5530D	Yes
Runoff and Leachate from Landfill (ERK-3), Battery Dump (ERK-4), Barrel Dump (ERK-5)									
TPH	1L amber	1000mL	No	n/a	keep cool at 4°C	14 days	0.2 mg/L	MOE E3397A	Yes
Extractable HC	1L amber	1000mL	No	n/a	keep cool at 4°C	14 days	0.2 mg/L	EPA8015B	Yes
F1, BTEX	40mL glass vial	2x40mL	No	n/a	keep cool at 4°C	14 days	0.1-0.5 ug/L	EPA 8260C	Yes
PAH	1L amber glass	1000mL	No	n/a	keep cool at 4°C	14 days	Refer to Table 2	EPA SW856/8270C	Yes
BTEX	40mL glass vial	2x40mL	No	n/a	keep cool at 4°C	7 days	0.1-0.5 ug/L	EPA 8260C	Yes
BOD5	1L plastic	500mL	3 times	n/a	keep cool at 4°C	7 days	1 mg/L	SM 5210 B	Yes
pH	1L plastic	50mL	3 times	n/a	keep cool at 4°C	14 days	0.1 unit	SM 4500-H B	Yes
TSS	1L plastic	100mL	3 times	n/a	keep cool at 4°C	14 days	2 mg/L	SM 2540D	Yes
Nitrate-Nitrite	1L plastic	100mL	3 times	n/a	keep cool at 4°C	7 days	0.005-0.10 mg/L	SM 4500	Yes
Total Phenols	125mL amber glass	100mL	No	n/a	1mL 50% H2SO4	28 days	0.001 mg/L	SM 5530D	Yes
Total Hardness	125mL plastic	50mL	3 times	n/a	HNO3	60 Days	1.0 mg/L	Calculation	Yes
Magnesium	125mL plastic	50mL	3 times	n/a	HNO3	60 days	0.1 mg/L	EPA SW846 3050/SM3111	Yes
Sodium	125mL plastic	50mL	3 times	n/a	HNO3	60 days	0.05 mg/L	EPA SW846 3050/SM3111	Yes
Total Arsenic	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.1 ug/L	EPA SW846 3050/EPA 200.8	Yes
Total Copper	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.2 ug/L	EPA SW846 3050/EPA 200.8	Yes
Total Iron	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	30 ug/L	EPA SW846 3050/EPA 200.8	Yes
Total Mercury	125mL plastic	100mL	3 times	n/a	HCL	14 days	0.01 ug/L	SM 3112 B	Yes
Fecal Coliforms	300mL plastic	100mL	No	n/a	Na2S2O3	2 days	0 CFU/100mL	SM 9222 D	Yes
Conductivity	1L plastic	50mL	3 times	n/a	keep cool at 4°C	14 days	5 uS/cm	SM 2510 B	Yes
Oil and Grease	1L amber glass	1000mL	No	n/a	keep cool at 4°C	7 days	1.0 mg/L	MOE DECPH-E 3421	Yes
Ammonia Nitrogen	125mL plastic	100mL	3 times	n/a	H2SO4	28 days	0.02 mg/L	SM 4500 NH3 – F+G	Yes
Total Alkalinity	1L plastic	100mL	3 times	n/a	keep cool at 4°C	1 day	5 mg/L	SM 2320 B	Yes
Calcium	125mL plastic	50mL	3 times	n/a	HNO3	60 days	0.1 mg/L	EPA SW846 3050/EPA SM3111	Yes
Potassium	125mL plastic	50mL	3 times	n/a	HNO3	60 days	0.1 mg/L	EPA SW846 3050/EPA SM3111	Yes
Sulphate	1L plastic	100mL	3 times	n/a	keep cool at 4°C	28 days	1 mg/L	SM 4110 B	Yes
Total Cadmium	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.01 ug/L	EPA SW846 3050/EPA 200.8	Yes
Total Chromium	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.5 ug/L	EPA SW846 3050/EPA 200.8	Yes
Total Lead	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.05 ug/L	EPA SW846 3050/EPA 200.8	Yes
Total Nickel	125mL plastic	100mL	3 times	n/a	5mL 1:3 HNO3	60 days	0.5 ug/L	EPA SW846 3050/EPA 200.8	Yes

Table 2: Exova PAH detection limits.

Parameter	Detection Limit
Naphthalene	0.1 ug/L
Acenaphthylene	0.1 ug/L
Acenaphthene	0.1 ug/L
Fluorene	0.1 ug/L
Phenanthrene	0.1 ug/L
Anthracene	0.1 ug/L
Pyrene	0.01 ug/L
Benzo(a)anthracene	0.01 ug/L
Chrysene	0.05 ug/L
Benzo(b)fluoranthene	0.05 ug/L
Benzo(k)fluoranthene	0.05 ug/L
Benzo(a)pyrene	0.01 ug/L
Indeno(123-cd)pyrene	0.1 ug/L
Dibenzo(ah)anthracene	0.1 ug/L
Benzo(ghi)perylene	0.1 ug/L

Appendix C: Proof of Laboratory Accreditation – EXOVA Canada Inc.



Note: As of June 2014, DND retained EXOVA Canada Inc. as the new external CALA-accredited laboratory. This is a copy of their valid Certificate of Accreditation.

Appendix D: Confirmation of Laboratory Acceptance of QA/QC Plan



Testing. Advising. Assuring.

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18th February 18, 2015

Subject : Acceptance of QA/QC Plan - CFS Eureka, Nunavut

Dear Mr. Cameron ;

This letter serves to confirm that Exova Canada Inc. Has accepted the QA/QC Plan for CFS Eureka (ERK) for the analysis to be performed under Licence No. 3BC-ERK1015

Best Regards,

A handwritten signature in dark ink, appearing to read "Josh Hiemstra", is written over a horizontal line.

Josh Hiemstra
Sales Executive
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