Environmental Monitoring Program and Quality Assurance/Quality Control Plan

Hamlet of Rankin Inlet, Nunavut

Water Licence No. 3BM-RAN1214

Updated by:

Government of Nunavut
Community and Government Services
P.O. Box 490
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Date: April 2015

Document Management

	Description	Prepared by	Date
1	Updated Environmental Monitoring Program and QA/QC Plan	GN-CGS	April 2015
2	Original Environmental Monitoring Program and QA/QC Plan	Nuna Burnside	December 2008
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1. Introduction

The Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan for the Hamlet of Rankin Inlet, was prepared as a requirement of Nunavut Water Board (NWB) Licence No. NWB3RAN0207, issued December 2002 and expired November 30, 2007. This Plan has been updated for the Amendment/Renewal of NWB Licence No. 3BM-RAN1214, issued May 20, 2012 and expired May 31, 2014. Although this plan was prepared as a condition of the expired licence, it reflects the current condition of Hamlet facilities, and outlines the Environmental Monitoring Program and QA/QC Plan for the Amendment/Renewal Application currently being processed. It is recommended that this document be a condition of the new licence.

2. Hamlet of Rankin Inlet

The Hamlet of Rankin Inlet is located within the Kivalliq Region of Nunavut, at general latitude 62°49'N and general longitude 92°05'W. The Hamlet is on the west coast of Hudson Bay, 96 km southwest of Chesterfield Inlet and 1088 km east of Yellowknife (Appendix A – Figure 1). The community has a population of approximately 2904 residents in 2015.

Rankin Inlet is affected by arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The Rankin Inlet area receives an average of 18.1 cm of rainfall and 107 cm of snowfall per annum. Mean annual precipitation totals 29.7 cm per annum. July mean high and low temperatures are 14.9°C and 5.9°C, respectively. January mean high and low temperatures are -28.3°C and -35.5°C, respectively. Winds are generally northwest, and average 23 km/h.

The Hamlet of Rankin Inlet operates the Solid Waste Site authorized under Water Licence No. 3BM-RAN1214. The Solid Waste Site is located approximately 0.5 km south of the community and approximately 0.5 km from the Hudson Bay to the east, south and west.

The Government of Nunavut, Community and Government Services (GN-CGS) provides water supply and sewage disposal services for Rankin Inlet and is authorized under a separate Water Licence. Refer to Water Licence No. 3AM-GRA1015, held by GN-CGS, for more information.

The locations of these activities are shown in Appendix A – Figure 2.

3. Environmental Monitoring and Quality Assurance/Quality Control Plan

3.1. Monitoring and Regulatory Requirement

Part H of the Water Licence No. 3BM-RAN1214 issued to the Hamlet of Rankin Inlet outlines Conditions Applying to the Monitoring Program. As per Part H, Item 14, the Hamlet is required to submit to the NWB a Quality Assurance/Quality Control (QA/QC) Plan. The submission of the QA/QC Plan shall include a covering letter from an accredited laboratory confirming acceptance of the Plan for analyses to be performed under this Licence.

3.2. Purpose of Plan

The purpose of this document is to provide guidance to ensure that the monitoring program samples collected in the field are done so with a high degree of quality, in order to confirm that they accurately reflect the physical and chemical nature of the matrix being tested.

The Solid Waste Site operates under Nunavut Water Board (NWB) Licence No. 3BM-RAN1214, issued on May 20, 2012 and expired May 31, 2014 (Appendix B). An Amendment/Renewal Application has been submitted to the NWB. The Licence requires the Hamlet to conduct a monitoring program, which includes regular water quality sampling and reporting. The Licence requires a Monitoring and Quality Assurance/Quality Control Plan (QA/QC Plan). The QA/QC Plan has been prepared to achieve the following objectives:

- To ensure that the collection of all samples taken in the field follows procedures and controls to maintain a high quality and ensure that the results obtained represent both the physical and chemical nature of the water at the sampling locations;
- To ensure best management practices (BMP) are used throughout the sampling program; and
- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and controls to be used by Hamlet operations staff when conducting environmental sampling under the monitoring program.

Although the QA/QC Plan is submitted to the Nunavut Water Board (NWB) as a condition of the Licence, it is intended to be read, understood, and implemented by Hamlet operations personnel responsible for environmental quality monitoring. The Licence requires Hamlet personnel to adhere to these procedures, which should be applied to all water quality samples taken by the Hamlet.

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Rankin Inlet.

3.3. Quality Assurance and Quality Control

Quality Assurance (QA) is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality (Wilson, 1995). As such the accuracy of the analytical results can be stated with a high level of confidence. A high level of quality assurance can be achieved by applying the following principles:

- Personnel involved in water sampling and analysis are well trained;
- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean;
- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized best management practices (BMP);
- Laboratory and field instruments are calibrated according to manufacturer recommendations or recognized as good operating practice;
- Supplies used in sampling and analysis are of consistent high quality and are not expired;
- Quality Control (QC) procedures are developed and implemented based on good operating practices to assess quality of analytical data and provide warning of unacceptable errors;
- Remedial action is promptly implemented when deficiencies are identified; and
- Results of the monitoring program are reported in the Annual Report as required in the Water Licence. The Annual Report must be submitted by March 31st of the year following the calendar year for which the report has been submitted.

Quality Control (QC) is a set of specific procedures used to measure the quality of the data produced and correct deficiencies in the sampling or analyses, as they occur. Quality control is used by the analyst and sampler to achieve standards of measurement for the three principles components of quality: precision, accuracy and reliability.

3.4. Lab Accreditation

All analyses shall be conducted by laboratories that are accredited by accredited by the Canadian Association for Laboratory Accreditation (CALA), formally known as the Canadian Association for Environmental Analytical Laboratories (CAEAL), for the monitoring program for the Licence.

Ideally, the same laboratory will be used for sample analysis for each sampling event, to ensure consistency in methodology and reporting. Although all accredited laboratories should be able to

provide the same result for a particular sample, some variation is expected, which is why consistent laboratory services are recommended.

Analytical methods and accreditation are usually dictated by the guideline criteria being followed. In most cases, the guideline criteria are the Canadian Environmental Quality Guidelines (CCME, 2007). These guidelines specify bottles, hold times, preservatives, sampling protocols, as well as lab accreditation, and analytical methodologies. Prior to any sampling, this information should be reviewed to ensure consistency with regulation and standards.

3.5. Lab Information

The laboratory the Hamlet uses to analyze the samples to fulfil the Monitoring Program requirements is ALS Environmental (Winnipeg). Their contact information is as follows:

ALS Environmental (Winnipeg)
1329 Niakwa Road East, Unit 12
Winnipeg, MB
R2J 3T4
Phone: (204) 255-9720

Appendix C includes a copy of ALS Environmental (Winnipeg)'s CALA Certificate of Accreditation and a list of the parameters for which they are certified (Scope of Accreditation).

ALS Environmental (Winnipeg) subcontracts the Oil and Grease and Total Phenols tests to ALS Environmental (Waterloo). Their contact information is as follows:

ALS Environmental (Waterloo)
60 Northland Road, Unit 1
Waterloo, ON
N2V 2B8
Phone: (519) 886-6910

Appendix D includes a copy of ALS Environmental (Waterloo)'s CALA Certificate of Accreditation and a list of the parameters for which they are certified (Scope of Accreditation).

4. Field Sampling

4.1 Sampling Procedures

All sampling, sample preservation and analyses is to be conducted in accordance with methods described in the current edition of Standard Methods for the Examination of Water and Wastewater (American Public Health Association, American Water Works Association, and Water Environment Federation, most current edition).

To obtain meaningful results from the analyses, the following six factors are of particular importance:

i) Sample collection as per schedule and location;
ii) Correct usage of container/sample bottle for parameter being tested;
iii) Correct labelling of sample bottles and filling out record/field sheet;
iv) Correct procedure for field sampling;
v) Proper and timely shipment of samples to the laboratory; and
vi) Timely delivery of samples to the laboratory from the air cargo facility.

4.2. Sample Collection

Effluent and surface water sampling is conducted to provide the Hamlet with effective environmental management information and to monitor regulatory compliance.

Sample collection must follow the specifics dictated by the CALA laboratory selected to do the analysis. These should conform to the protocols outlined in the Canadian Environmental Quality Guidelines (CCME, 2007). Exact sampling protocols need to be confirmed for each sampling event. Staff training is a necessary component to ensure quality monitoring.

4.2.1. Sampling Location and Frequency

The Monitoring Program created by Water Licence No. 3BM-RAN1214 includes specific requirements regarding sampling locations, sampling frequency, parameters to be analyzed, and effluent quality. The Monitoring Program is summarized in Table 1.

Table 1: Hamlet of Rankin Inlet Monitoring Program Locations

Monitoring Program Station Number	Description	Status	Frequency
RAN-1	Unassigned	Inactive	None
RAN-2	Runoff from the Old Landfill	Active	Monthly, May to August
RAN-3	Runoff from the New Landfill	Active Upon Commissioning	None
RAN-4	Discharge from the Landfarm Facility at the controlled point of release	Active	Prior to discharge
RAN-5	Monitoring well located up gradient of the Landfarm	Active	Annually, during summer
RAN-6	Monitoring well located down gradient of the Landfarm	Active	Annually, during summer

As per Part H, Item 3 of the Licence, weekly inspections at Monitoring Program Station RAN-2 will take place from May to August to identify effluent or water flow. A weekly inspection log sheet can be found in Appendix E. This record of inspection shall be retained and made available to an AANDC Inspector upon request.

The sampling stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an AANDC Inspector. Each sampling location must have its Global Positioning System (GPS) coordinates determined. This task should be completed prior to the first sampling to be completed under this QA/QC Plan. Samples shall be taken at the same location on each sampling occasion, unless the Inspector has approved a new location. Additional sampling and analysis may be requested by an

AANDC Inspector.

4.2.2. Parameters

As per Part H, Item 2 of the Licence, the following parameters shall be sampled monthly at Monitoring Program Station RAN-2 during periods of observed flow and annual discharges:

- Biochemical Oxygen Demand (BOD_5)
- Total Suspended Solids
- Conductivity
- Oil and Grease (visual)
- Magnesium
- Sodium
- Chloride
- Total Hardness
- Ammonia Nitrogen
- Total Cadmium
- Total Cobalt
- Total Chromium
- Total Copper
- Total Aluminum
- Fecal Coliforms
- pH
- Nitrate-Nitrite
- Total Phenols
- Calcium
- Potassium
- Sulphate
- Total Alkalinity
- Total Zinc
- Total Iron
- Total Manganese
- Total Nickel
- Total Lead
- Total Arsenic

All water from dewatering contaminated soil areas and discharge of effluent at Monitoring Program Station RAN-4 at the Landfarm Facility shall not exceed the effluent quality limits described in Table 2.

Table 2: Monitoring Station RAN-4 Effluent Quality Limits

Parameter	Maximum Concentration of Any Grab Sample (mg/L)
pH	6 to 9 (pH units)
Total Suspended Solids	50
Oil and Grease	15 and no visible sheen
Benzene	0.370
Toluene	0.002
Ethylbenzene	0.090

As per Part H, Item 10 of the Licence, the following parameters shall be sampled once annually in the summer at Monitoring Program Stations RAN-5 and RAN-6:

- Biochemical Oxygen Demand (BOD_5)
- Total Suspended Solids
- Conductivity
- Oil and Grease
- Magnesium
- Sodium
- Chloride
- Total Hardness
- Ammonia Nitrogen
- Total Cadmium
- Total Aluminum
- Total Chromium
- Total Copper
- Total Arsenic
- TPH (Total Petroleum Hydrocarbons)
- PAH (Polycyclic Aromatic Hydrocarbons)
- BTEX (Benzene, Toluene, Ethylbenzene, Xylene)
- Fecal Coliforms
- pH
- Nitrate-Nitrite
- Total Phenols
- Calcium
- Potassium
- Sulphate
- Total Mercury
- Total Alkalinity
- Total Zinc
- Total Iron
- Total Manganese
- Total Nickel
- Total Lead

4.2.3. Sampling Equipment

Dedicated latex or nitrile gloves (i.e., one pair per sample) are to be used during sample handling. Any sampling equipment used, such as sampling poles (see photo below), are to be cleaned with soap and water after each sample is collected to prevent cross-contamination.

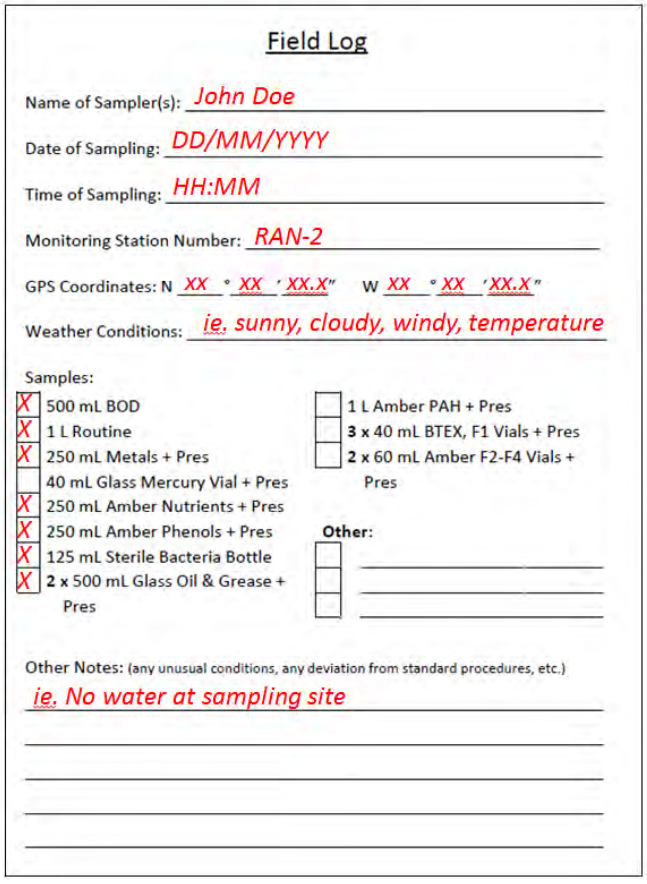
Figure 3: Sampling Pole

4.2.4. Field Sampling Log

The individual collecting the samples shall record the following at each location at the time of sampling:

- Date of sampling;
- Time of sampling;
- Weather conditions;
- Monitoring Station Number (i.e. RAN-2, etc.);
- Results of any field measurements (temperatures, PH, conductivity, etc.);
- Sampler shall also indicate if sample used preservatives;
- Any unusual conditions; and
- Any deviation from standard procedures.

A Field Log should be filled-out for every sampling location and kept on file. See below for a sample Field Log.



Field Log

Name of Sampler(s): John Doe

Date of Sampling: DD/MM/YYYY

Time of Sampling: HH:MM

Monitoring Station Number: RAN-2

GPS Coordinates: N XX ° XX ' XX.X" W XX ° XX ' XX.X"

Weather Conditions: ie. sunny, cloudy, windy, temperature

Samples:

- [X] 500 mL BOD
- [X] 1 L Routine
- [X] 250 mL Metals + Pres
- [ ] 40 mL Glass Mercury Vial + Pres
- [X] 250 mL Amber Nutrients + Pres
- [X] 250 mL Amber Phenols + Pres
- [X] 125 mL Sterile Bacteria Bottle
- [X] 2 x 500 mL Glass Oil & Grease + Pres
- [ ] 1 L Amber PAH + Pres
- [ ] 3 x 40 mL BTEX, F1 Vials + Pres
- [ ] 2 x 60 mL Amber F2-F4 Vials + Pres

Other:

Other Notes: (any unusual conditions, any deviation from standard procedures, etc.)

ie. No water at sampling site

Figure 4: Sample Field Log

A copy of the Field Log to be completed during sampling can be found in Appendix F.

4.2.5. Sampling Planning

To understand what sample containers, sampling techniques, and preservation methods are required, Hamlet personnel will review what parameters will be analyzed in the laboratory as outlined in Section 4.2.2. A selected CALA laboratory will be contacted and provided with the list of sampling parameters and comparative guidelines to be used. The lab will then supply the appropriate bottles with preservatives, chain of custody documents, and handling procedures.

4.2.6. Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers specific for the sampling program. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The laboratory shall be contacted at least one month prior to the sampling event in order to ensure that containers are available for sampling.

4.2.7. General Procedures for Sample Collection

General procedures for sample collection are outlined below. Different laboratories have slightly different bottle requirements and sample handling protocols. Sampling technicians must receive site specific training and laboratory procedures must take precedence over other protocols.

- Sample Locations and Sampling Frequency – The location and frequency of each sampling option has been carefully selected, and is part of site design and layout, as well as the Water Board Licence. Sampling will follow their requirements. Diversions must be recorded and submitted to the Water Board for approval.
- Preparation – Approximately one month prior to the sampling event the laboratory will be notified and the required bottles, blanks, and materials assembled. Plans for rapid return of the samples prepared.
- Field Collection – At each sampling station the specified samples will be collected.
- Handling Storage and Transportation – Appropriate personal protective equipment (gloves, safety glasses, etc.) will be used when handling samples. Samples will be stored a 4°C and protected from freezing until delivered to the laboratory. Chain of custody for sampling, storage, and delivery must be maintained. Laboratory sample sheets will be filled in as per laboratory protocols.

- Delivery to Laboratory – Samples will be delivered to the laboratory in the laboratory dictated method and within the hold times specified. Preplanning for rapid transport and delivery will usually be required.

Surface Water Sampling Procedures

All of the samples taken will be grab samples. Samples will normally be taken from natural lakes, streams, treatment ponds, or process streams. Where possible, samples shall be taken from just below the surface to avoid floating debris, which may contaminate the sample.

Freshwater Streams, Surface Drainage, and Wetlands

The samples shall be collected as close to the middle of the stream where water flows freely and is free of debris. Samples shall be collected upstream of the sampler. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially filled with the water to be sampled and rinsed with the lid in place. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed.

Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.

If possible, bottles shall be plunged into the stream to a depth of approximately half the total stream depth, and allow it to fill with the mouth of the bottle facing upstream. Where stream is too shallow to allow for sample bottle to be filled completely, without disturbing bottom sediment of the streambed, the sampler may use a smaller container that has been properly rinsed to transfer sample to the larger bottle. Do not use a smaller sample bottle containing preservatives.

When taking the sample, sufficient room shall be left to allow for the addition of preservatives, if required.

Lakes or Ponds

Surface sampling shall be collected using the same procedures as streams. Sample bottles shall be plunged to approximately 150 mm (6 inches) below the water surface.

4.2.8. Sample Identification

All samples collected are to be labelled according to standard identification procedures (Name of sampler, time and date of sampling, sample identifier, sampling method and type of sample). **Sample labels shall be water-resistant, and prepared prior to going into the field.**

The individual samples will be labelled with the following information:

- Sample ID #;
- Sample name;
- Date and time of collection;
- Parameter to be analyzed;
- Preservatives;
- Project number identifier; and
- Bottle number 1 of ___.

4.2.9. Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the laboratory. **If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical problems with transport aircraft, all samples must be stored in a refrigerator at 4°C.** Samples must not be frozen.

In all cases where samples cannot be delivered to the lab on the same day, specific preservatives must be added to the samples to prevent chemical changes that may alter the concentration of the parameters of interest. The samples must be preserved within two hours of sampling. Usually, samples can be preserved away from the field at the end of the site visit. In most cases, the laboratory can fill the bottles with preservative, and then ship them to the Hamlet to be filled and sent back for analysis.

4.2.10. Sample Transportation

The main objective of the sampler is to minimize any chemical changes to the sample between the time it is collected and delivery to the laboratory. Heat, light and agitation can all impact the water chemistry and the samples shall be protected from these effects. Effluent and surface water samples shall be stored and transported at a temperature of 4°C. Coolers and ice packs need to be available and are

usually provided by the laboratory. All samples are to be placed in clean coolers for transportation to the laboratory. Upon arrival at the laboratory, samples shall be refrigerated as soon as possible.

4.3. Sample Handling

All water samples are to be collected in laboratory-supplied containers with the proper preservative, where applicable. All sample containers are to be tightly sealed and properly labelled with the sample ID, date and time of sample collection, location of sample collection and parameters to be analyzed. The outside of the bottles are to be cleaned with soap and water after sampling and dried off prior to placing the samples in the cooler. The samples are to be stored on ice in a cooler until delivery to the laboratory. A Chain of Custody form is to be filled out completely and is used to track the samples and placed in the cooler with the samples, in a plastic bag. The last page of the Chain of Custody is to be kept on file for record.

The following checks are generally performed by the laboratory upon receipt:

i. Verification of the integrity and condition of all sample coolers;
ii. Verification of the integrity and condition of all sample containers;
iii. Checks for leakage, cracked or broken closures or containers, evidence of grossly contaminated container exteriors or shipping cooler interiors, and obvious odours, etc.;
iv. Verification of receipt of complete documentation for each container;
v. Verification that sample identification numbers on sample transmittal forms corresponds to sample identification numbers on the sample containers; and
vi. Verifications that holding times were met and samples were kept cool during transit.

The samples are transported/submitted under Chain of Custody documentation. Included on a Chain of Custody form is the client information, the sample information, the analyses requested, the relevant regulations, the turnaround time for the analytical results, comments, and temperature of the samples at the time they arrived in the laboratory. An example of a Chain of Custody form is included in Appendix G. The copy page of the Chain of Custody form should be kept on file with the completed Field Logs.

4.4. Sample Collection Summary

Sampling should be done using the following method:

i. Label all bottles prior to going to sampling sites;
ii. Begin sampling at the “cleanest” sampling site;

iii. Complete Field Log at each sampling site;
iv. Put on new pair of gloves at each sampling site;
v. Face bottles upstream when collecting samples;
vi. Fill bottles partially with water and rinse with lid in place, empty water downstream, repeat 3 times;
vii. Do not rinse bottles when sampling for oil & grease, bacteria or if bottles contain preservatives;
viii. Plunge bottle to half depth of water or 15 cm below surface for deeper water, avoid floating debris;
ix. If preservatives are to be added, leave room so there is no overflow;
x. If preservative is already in the bottle, fill slowly so not to wash out preservative;
xi. Put bottles in cooler with ice/icepacks;
xii. Place Chain of Custody (COC) form in plastic bag and put in cooler;
xiii. Send samples to lab as soon as possible;
xiv. Call the lab to notify lab that the sample was shipped and what time it will be arriving; and
xv. Wash your hands when you are done handling samples.

As a general recommendation, please refrain from using insect repellant, disinfection hand gel or other chemical products before and during sample collection. Also refrain from smoking during sample collection.

5. Quality Control

Most commercial laboratories undertake QA/QC procedures with the volume of sample sent for analysis. Reports are usually provided with the Certificates of Analysis. It is recommended that the suggested QA/QC protocols by the laboratory be followed.

To ensure that the monitoring program maintains accepted quality control, field blanks and duplicate samples may be suggested by the laboratory. These samples are collected and analyzed for the sample parameters as the monitoring program in the licence as part of a quality control check on monitoring activities.

The Field Blanks shall accompany the sampler into the field, labelled as field blanks, preserved in the field and submitted to the laboratory with the field samples.

5.1. Replicate or Duplicate Samples

Replicate or duplicate sampling involves collecting more than one sample for a given sampling station subject to specific analysis. Standard procedures used for the routine sampling shall be applied. The replicate or duplicate samples are useful in identifying problems with accuracy and sampling methods.

Once per operating season for each active monitoring station a set of duplicate samples will be taken, representing as many of the routine analysis as possible. Where possible this shall be carried out in conjunction with the sampling undertaken by an AANDC Inspector.

6. Laboratory Analysis/Reporting

The laboratory will perform the analysis of all samples as outlined herein. The results shall be received by the Hamlet within the time frame agreed to with the laboratory. The results shall contain the limits of detection used for analysis of each parameter as supplied by the laboratory.

The laboratory results are compared to the limits of the Water Licence for each parameter, and/or to other comparative criteria such as the Canadian Environment Water Quality Guidelines. A copy of these guidelines is included in Appendix G.

As a condition of NWB Licence (Appendix B), the Hamlet is required to submit an Annual Report to the NWB, no later than March 31st of the year following the calendar year reported. Among other requirements, the Annual Report is required to include tabular summaries of all analytical data generated under the Monitoring Program.

7. Glossary

The following definitions that are relevant to this Plan include:

Quality Assurance (QA): is the definitive program for laboratory operation that specifies the measures required to produce defensible data of known precision and accuracy. QA includes quality control and quality assessment activities.

Quality Control (QC): is a set of measures within a sample analysis methodology to assure that the process is in control.

Quality Assessment: is a process to determine the quality of the laboratory measurements through internal and external QC evaluations. It includes performance evaluation samples, laboratory inter-comparisons samples and performance audits.

Trip Blank is a sample of clean water that was prepared by the analytical laboratory and shipped to the sample site in the cooler along with the empty sample bottles. This trip blank sample remains unopened and is transported back to the laboratory with the monitoring program samples. The trip blanks is analyzed by the laboratory along with the monitoring program samples. The purpose of the trip blank is the assess contamination introduced during shipping and field handling procedures.

CALA refers to the Canadian Association for Laboratory Accreditation, formally known as the Canadian Association for Environmental Analytical Laboratories (CAEAL).

Chain of Custody Documentation refers to the documentation that accompanies samples sent to an analytical laboratory. It is a legal document which ensures that the sample taken at a specific site is the same sample received in the laboratory. It also provides information on the sample condition and integrity as received by the laboratory.

8. References

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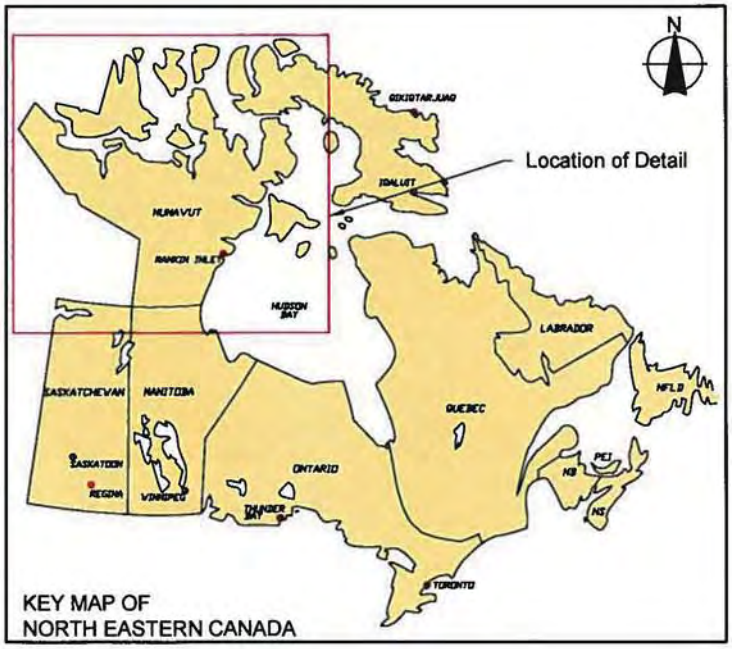
Appendix A – Figures

Map Reference:
Map Art Publishing



KEY MAP OF
NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT

ENVIRONMENTAL MONITORING PROGRAM &
QA / QC CONTROL PLAN

December 2008
Project Number: N-O14850

Prepared by: C. Sheppard

Verified by: J. Walls

N-O14850 ENVIRONMENTAL QA-QC - GOVERNMENT SL.dwg

Plot Time: Mar 05, 2009 - 11:49am

FIGURE 2

HAMLET OF RANKIN INLET

HAMLET OF RANKIN INLET, NUNAVUT

SOLID WASTE MANAGEMENT FACILITY O&M PLAN

COMMUNITY PLAN

Satellite Image Source:
Background 2006 satellite image covering the immediate community area obtained from MDA Geospatial Services.
Background colour satellite image covering the area beyond the immediate community obtained from the Google Earth Pro website.

N

0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4

Kilometres

1:30,000
August 2008
Project Number: N-O14850

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

NUNA BURNSIDE

N-O14850 SOLID WASTE O&M PLAN - HAMLET CP.dwg

Plot Time: Mar 05, 2009 - 12:41pm

Appendix B – NWB Licence No. 3BM-RAN1214

P.O. BOX 119
GJOA HAVEN, NU X0B 1J0
TEL: (867) 360-6338
FAX: (867) 360-6369

ᓄᓇᕗᑦ ᐃᒪᓕᕆᔨᑦ ᑲᑎᒪᔨᑦ
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYIT
OFFICE DES EAUX DU NUNAVUT

File No.: 3BM-RAN1214

March 22, 2012

Ms. Hilda Price
Senior Administrative Officer
Hamlet of Rankin Inlet
PO Box 310
Rankin Inlet, NU X0C 0G0
Email: sao@rankininlet.ca
BWestwell@gov.nu.ca

RE: NWB Licence No. 3BM-RAN1214

Dear Ms. Price:

Please find attached, renewal Licence No. 3BM-RAN1214 issued to the Hamlet of Rankin Inlet by the Nunavut Water Board (NWB) pursuant to its authority under Article 13 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*. The terms and conditions of the attached Licence related to waste disposal are an integral part of this approval.

If the Licensee contemplates the renewal of this Licence, it is the responsibility of the Licensee to apply to the NWB for its renewal. The past performance of the Licensee, new documentation and information, and issues raised during a public hearing, if the NWB is required to hold one, will be used to determine the terms and conditions of the Licence renewal. Note that if the Licence expires before the NWB issues a new one, then waste disposal must cease, or the Licensee may be in contravention of the *Nunavut Land Claims Agreement* (NLCA) and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA). However, the expiry or cancellation of a licence does not relieve the Licensee from any obligations imposed by the licence. The NWB recommends that an application for the renewal of this Licence be filed at least three (3) months prior to the Licence expiry date.

If the Licensee contemplates or requires an amendment to this licence, the NWB may decide, in the public interest, to hold a public hearing. The Licensee should submit applications for amendment as soon as possible to give the NWB sufficient time to go through the amendment

process. The process and timing may vary depending on the scope of the amendment, however a minimum of sixty (60) days is required from the time of acceptance by the NWB. It is the responsibility of the Licensee to ensure that all application materials have been received and acknowledged by the Manager of Licensing.

The NWB strongly recommends that the Licensee consult the comments[1] received from interested persons on issues identified during the review process. This information is attached for your consideration.

Sincerely,

Thomas Kabloona
Nunavut Water Board
Chair

TK/kt/pb

Enclosure: Licence No. 3BM-RAN1214
Comments: INAC, EC, GN-DoE, GN-CLEY and BGC Engineering Inc. technical memo

cc: Kivalliq Distribution List

[1] GN-DoE, August 30, 2009; GN-CLEY, August 28, 2009; INAC, August 28, 2009; EC, August 28, 2009; and BGC Engineering Inc, November 12, 2010.

P.O. BOX 119
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NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYIT
OFFICE DES EAUX DU NUNAVUT

DECISION

LICENCE NUMBER: 3BM-RAN1214

This is the decision of the Nunavut Water Board (NWB) with respect to an application received March 19, 2009 with supporting information submitted March 22, 2010 for a Licence renewal prepared by Nuna Burnside Engineering and Environmental Ltd. on behalf of the:

HAMLET OF RANKIN INLET

to allow for the disposal of solid wastes for the Hamlet of Rankin Inlet, located within the Kivalliq Region of Nunavut. With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence renewal.

DECISION

After having been satisfied that the application was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S. 12.3.2 of the *Nunavut Land Claims Agreement* (NLCA), the NWB decided that the application could proceed through the regulatory process. After reviewing the full submission of the Applicant and written comments expressed by interested parties, the NWB, having given due regard to the facts and circumstances, the merits of the submissions made to it and to the purpose, scope and intent of the *NLCA* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and determined that:

Licence Number 3BM-RAN0207 be renewed and issued as 3BM-RAN1214 subject to the terms and conditions contained therein. (Motion #: 2012-00-L12)

SIGNED this 20th day of May, 2012 at Gjoa Haven, NU.

Thomas Kabloona
Nunavut Water Board, Chair

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I. BACKGROUND

The Hamlet of Rankin Inlet (Hamlet) is located within the Kivalliq Region of Nunavut, at general latitude 64°49'N and general longitude 92°05'W.

Waste disposal infrastructure for the Hamlet of Rankin Inlet (Hamlet) consists of an Old Landfill that reached capacity in 2002, a New Landfill that was built between 2003 and 2006 which has yet to be commissioned, and a landfarm built in 2005. These facilities serve a population of approximately 2,266 people (Statistics Canada 2011).

Water supply and sewage disposal infrastructure for the Hamlet is operated by the Government of Nunavut (GN), on behalf of the Hamlet, under a separate water licence 3BM-GRA0207, which was renewed in June, 2010 as Type A licence 3AM-GRA1015.

The GN also applied to the Nunavut Water Board (NWB) in 2008 for a water licence for a new landfarm facility to be constructed in 2009. This was approved under Licence 1BR-RAN0914.

II. PROCEDURAL HISTORY

The water licence held by the Hamlet for solid waste disposal was issued on December 1, 2002 and expired on November 30, 2007 (3BM-RAN0207). The NWB received an application to renew the licence on March 19, 2009 with additional information received on June 10, 2009. Following a preliminary review by the NWB, the information was distributed to interested parties on July 30, 2009.

The renewal application information package was prepared by Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) on behalf of the Hamlet, and included the following documents:

- Cover Letter dated March 2, 2009;
- Application Form and additional information;
- Supplementary Questionnaire for Municipalities with additional Landfarm information;
- Executive Summary, English;
- Application Fee;
- 2008 Annual Report;
- Environmental Emergency Contingency Plan;
- Environmental Monitoring Program and Quality Assurance/Quality Control Plan;
- Solid Waste Management Facility, Operation and Maintenance (O&M) Plan;
- Translated Executive Summary (received June 10, 2009); and
- Signed Application Form (received June 10, 2009).

The application also included the following plan prepared by AECOM Canada Ltd, on behalf of the Hamlet:

- Rankin Inlet Solid Waste Site Abandonment and Restoration Plan (July 2009).

By the end of the comment period, on August 30, 2009 the NWB was in receipt of submissions from Indian and Northern Affairs Canada (INAC), Environment Canada (EC), Government of Nunavut Department of Environment (GN-DoE), and the Government of Nunavut Department of Culture Language Elders and Youth (GN-CLEY).

In its submission, INAC noted some uncertainty regarding the landfarm that was discussed by the Hamlet to be included in the licence renewal. It was unclear whether the landfarm was the same facility approved under licence 1BR-RAN0914, or if the Hamlet has two separate landfarms. In order to clarify, the NWB wrote to the Hamlet on December 14, 2009. In its letter to the Hamlet, the NWB also requested that parties confirm whether they had an opportunity to review the Abandonment and Restoration Plan (A&R Plan) for the old landfill.

On March 22, 2010 the NWB received a response from Nuna Burnside, on behalf of the Hamlet, clarifying that there are in fact two landfarms in the Hamlet. One landfarm is licensed to the GN under 1BR-RAN0914, and the second, for which the Hamlet was applying, was constructed in 2005 without an amendment application to the previous licence or an application for a new licence.

In response to the NWB's request that parties confirm their review of the A&R Plan, the NWB received written correspondence from the GN-DoE indicating that they had reviewed the A&R Plan and did not have any substantial comments. The NWB has since undertaken its own technical review of the A&R Plan through an independent consultant and included this assessment as part of the overall review process.

Based upon the results of the detailed assessment, including consideration of any potential accidents, malfunctions, or impacts to water that the overall project might have in the area, the Board has decided to renew licence No.3BM-RAN0207, and has issued licence 3BM-RAN1214.

III. ISSUES

Term of Licence

In accordance with section 45 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA or Act), the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of Aboriginal Affairs and Northern Development Canada (AANDC, previously INAC) site inspections and the compliance record of the applicant.

In review of the application and the comments received from interested parties, there were no comments provided with respect to the Hamlet's request for a term of five (5) years for the licence renewal. However, the Board has recently issued municipal licences for terms of no more than two (2) years where compliance issues have been a concern.

The NWB notes a number of compliance issues from the AANDC inspection reports occurring throughout the course of the previous licence term. Issues include, the failure to adhere to an Inspector's Direction issued to the Hamlet in 2008, which cites issues going back to 2003, failure to undertake the Monitoring Program outlined in the Licence, improper maintenance of the landfill, and improper storage of contaminated soils.

The most recent AANDC inspection report dated August 2, 2011 required the Hamlet to submit to the NWB and the Inspector a compliance plan outlining how the Hamlet will address the compliance issues. In addition the AANDC inspector required the Hamlet to resubmit a revised application for a renewal licence that accurately reflects the plans for the waste management facility, its continued operations and maintenance or abandonment and restoration.

To date the Board has not received a response from the Hamlet to the inspector's requests. The Board agrees with the Inspector regarding the need for a plan for compliance and as per Part B, Item 10 of the licence, the licensee is required to submit a plan that clearly demonstrates how the Hamlet will achieve full compliance with the licence conditions during the term of the licence.

In addition, following clarification provided by Nuna Burnside, on behalf of the Hamlet, the NWB is aware that the landfarm constructed in 2005 was done without an amendment application for the existing licence or an application for a new licence. Proceeding with the construction of a facility in this manner, without this Board's regulatory review and approval, is in direct contravention of section 12 of the Act.

In addition, although the renewal application contained the management plans requested by the NWB through the previous Licence, which has provided some assurance that the Hamlet intends to comply with the renewed Licence, the question of whether the new landfill will be operated and maintained in accordance with the plan submitted was raised as an issue:

> *We recommend that "Conditions" be added to the licence requiring that the recommendations in the O&M Plan be fully completed prior to commissioning the site. (Applicant response of March 22, 2010).*

The NWB appreciates the efforts made by Nuna Burnside, on behalf of the Hamlet, in preparing a complete application package. However, the two-year licence term is intended to provide the Hamlet time to take immediate action towards achieving full compliance with all licence requirements and demonstrate that the facilities can be operated, or decommissioned in the case

of the old landfill, in accordance with the plans submitted. Upon submission of an application to renew this licence, the Board fully expects the Hamlet to have achieved compliance with the Licence conditions.

Annual Report

Annual reports were not submitted for most years of the previous licence term. A 2008 annual report was submitted with the renewal application package by Nuna Burnside, on behalf of the Hamlet.

The NWB would like to emphasize the requirement to produce an annual report for submission, not later than March 31st of the year following the calendar year being reported. The requirement to produce annual reports is to ensure that the NWB has an accurate and timely annual update of municipal activities during a calendar year. This information is maintained on the public registry and is available to interested parties upon request. A *"Standardized Form for Annual Reporting"* is available for use from the NWB file transfer protocol (ftp) site under the public registry link at the NWB Website.

Link = ftp://nunavutwaterboard.org/ADMINISTRATION/Standardized%20Forms/

Although use of the standardized form is recommended for consistency, there may be additional information/collected that will require the submission of an addendum to the annual report for completeness.

Operational Plans

The application contained a detailed Operation and Maintenance (O&M) Plan for the new solid waste management facility, including the landfarm. The NWB finds that the O&M Plan is generally satisfactory; however, a revision to the O&M Plan must be provided to the Board for approval to reflect conditions of the renewed licence, including the landfarm effluent quality criteria and to address the comments received during the review of the document. The revised Plan is required within ninety (90) days of licence issuance as per Part F, Item 2 of the Licence. The revision should also include an executive summary in English and Inuktitut in accordance with Part B, Item 8 of the licence.

Part F, Item 4 of the previous licence (3BM-RAN0207) stated that in the event an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the licensee shall, among other actions, employ the appropriate contingency plan as provided for in the Operation and Maintenance Plan. The licensee has addressed this requirement with the submission of an Environmental Emergency Contingency Plan (EECP) with the renewal application. However, EC provided the following comments on the EECP:

- Secondary containment or surface liners (drip pans, fold a tanks, etc.) should be placed under all containers and vehicle fuel tank inlet and outlet points, hose connections and hose ends during fuel or hazardous substance transfers;
- That the appropriate spill response equipment and clean-up materials (absorbents, containment devices, etc.) be on hand during any transfer of fuel or hazardous substances and at vehicle maintenance areas; and
- The Plan should include locations of all hazardous materials, spill response equipment and clean up materials.

The NWB notes that the EECP acknowledges the requirement to update the information contained within it on an annual basis where necessary; however, given the timeline for submission of the O&M Plan revision, the licensee is also required to revise and resubmit the EECP within ninety (90) days of licence issuance, taking into account the recommendations made by EC.

Water Use

Water use is regulated by a separate licence held by the GN on behalf of the Hamlet. The previous Rankin Inlet solid waste licence (3BM-RAN0207) also included duplicate conditions for water use. As this Licence does not regulate water used by the Hamlet, the associated conditions have been removed in this renewal, Licence No. 3BM-RAN1214.

Sewage

Sewage treatment and disposal is not authorized under this Licence.

Solid Waste

Although the new landfill was considered in 2002 under the previous licence (3BM-RAN0207), the NWB notes that the O&M Plan contains some important recommendations for the commissioning of the facility. The NWB identified these recommendations in its letter to the applicant of December 14, 2009. Recommendations included:

- The design and construction of effective drainage of water surrounding the landfill;
- The need to construct a hazardous waste storage area; and
- Stockpiling of top soil in the fill area for use as cover material.

In its response to the NWB, Nuna Burnside acknowledged the recommendations and highlighted the following additional requirements prior to commissioning the new landfill:

- Background sampling of soil and water quality of the site should be completed;
- The O&M Plan be reviewed by a bird hazard expert; and

- A requirement for signed/as-built drawings be provided following the completion of the modification required for commissioning.

In order to ensure that the above-mentioned recommendations are undertaken, the NWB requires that an implementation report be submitted for NWB approval sixty (60) days prior to commissioning the landfill. The report shall detail the measures taken to address the items listed in Part F, Item 1 of the licence.

The NWB is also aware that the distance between an airport utilized by commercial aircraft and a landfill containing food wastes, which may attract birds, is to be a minimum of eight (8) kilometres, unless bird control measures acceptable to Transport Canada are employed. Therefore, the NWB requires that the Licensee consult with Transport Canada to obtain any authorizations and input needed prior to commissioning the new landfill.

Landfarm

In its submission, EC noted drawings of the landfarm, which indicate the presence of a water body in its vicinity. EC stated that a landfarm should be sited greater than 500 metres from a permanent surface water body. This issue clearly demonstrates the problems that arise when a waste disposal facility is built without the regulatory review and approval of the NWB, as is the case here with the Hamlet's landfarm. The licensee is reminded of it responsibility to ensure that leachate and runoff from the waste disposal facilities do not enter water.

In order to ensure that any surrounding water is not impacted, INAC recommended that a contingency plan be provided to deal with the possibility of seepage from the landfarm. INAC suggested the possibility of digging a trench around the landfarm with a liner to collect any seepage. The NWB agrees with the concerns raised by the parties and requires, in accordance with Part F, Item 3 (b) that the licensee submit a Landfarm Operational Contingency Plan outlining the measures that will be taken should seepage become an issue. The contingency plan is to be included as part of the addendum to the Environmental Emergency Contingency Plan due within ninety (90) days of licence issuance.

The Licensee will also be required to have a qualified engineer undertake an annual geotechnical inspection of the waste disposal facilities to report on their structural integrity and make recommendations on remedial works, where required. In addition, the NWB, in order to protect the receiving environment and in accordance with other municipal landfarms, has imposed effluent discharge criteria that must be met prior to any release of water from the facility to the environment.

Finally, the NWB has also imposed the requirement to install groundwater monitoring wells at the landfarm facility, with one located up-gradient and one down-gradient of the facility. This is a standard requirement in other landfarm licences including the licence issued to the GN for its

landfarm, also located in Rankin Inlet. Stamped as-built drawings of the facility shall also be provided to the NWB following the first geotechnical inspection in 2012 and installation of the groundwater monitoring wells.

Modifications and Construction

For the construction of new, or modifications to existing licensed facilities, the NWB generally requires that final design reports, accompanied by stamped and signed "for construction drawings" be provided to the NWB for review and approval **prior to the undertaking**. This provides assurance to the Board and interested persons that proper engineering practices will be in place through all phases of construction and operation.

Abandonment, Restoration and Closure

The Hamlet submitted an Abandonment and Restoration (A&R) Plan for the old landfill with the renewal application. The NWB acknowledges that this is a very important document given the issues on file with the facility and its location. No comments or concerns were raised by parties with respect to the A&R Plan, however the NWB undertook its own technical review and third party review of the document and believes there are a number of issues that need to be addressed prior to approving the Plan. The licensee is required to address the issues identified in the NWB's technical review, which have been highlighted in Part G, Item 1 of the licence. For further information, the NWB strongly recommends the Licensee review the NWB's technical evaluation of the A&R Plan as undertaken by BGC Engineering for the NWB. The report is attached for the licensee's information.

Finally, the NWB noted in its letter to the Hamlet of December 14, 2009 that the application stated a fuel spill occurred at the Nipissar Lake Pumphouse in Rankin Inlet with a few hundred litres of fuel oil spilling into the sand and gravel surface next to the pumphouse and a small amount reached the shore of the lake. EBA Engineering Ltd arranged the removal and disposal of the impacted soil at the Hamlet landfill.

In a response provided to the NWB on March 22, 2010 it was stated that no documentation is available to indicate the fate of the impacted soil after it went to the old landfill. If this soil has not been removed to the Landfarm, the issue will therefore need to be addressed as part of the abandonment and restoration of the facility.

Monitoring Program

A significant issue with the previous licence (3BM-RAN0207) was the lack of monitoring data collected and reported in accordance with the required monitoring program. This issue was highlighted in the 2008 inspection report. As a compliance component, it is the licensee's responsibility to comply with the monitoring program under Part H of the licence.

The monitoring program has been expanded to include the monitoring requirements for the landfarm and closure of the old landfill.

The NWB acknowledges receipt of a Quality Assurance Quality Control (QA/QC) Plan submitted with the renewal application. In accordance with Part H, Item 12 the licensee shall submit the QA/QC Plan to an analyst for approval. Upon approval, the licensee is required to provide the NWB with a covering letter from the accredited laboratory and analyst, confirming acceptance of the Plan for the analyses to be performed under this Licence.

When the licensee applies to renew the licence in approximately 18-months, the NWB will again consider the past performance of the licensee as well as compliance with the monitoring program. As previously stated, the NWB expects the licensee to be in full compliance with the terms and conditions of the Licence upon application to renew.

NUNAVUT WATER BOARD
WATER LICENCE

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF RANKIN INLET, NUNAVUT

(Licensee)

P.O. BOX 310, RANKIN INLET, NUNAVUT X0A 0S0

(Mailing Address)

hereinafter called the Licensee, the right to deposit of a waste for a period subject to restrictions and conditions contained within this Licence:

Licence Number/Type:	3BM-RAN1214 TYPE "B"
Water Management Area:	NUNAVUT 06
Location:	RANKIN INLET, KIVALLIQ REGION, NUNAVUT
Classification:	MUNICIPAL UNDERTAKING
Purpose:	DEPOSIT OF WASTE
Quantity of Water use not to Exceed:	N/A
Date of Licence Issuance:	MAY 20, 2012
Expiry of Licence:	MAY 31, 2014

This Licence, issued and recorded at Gjoa Haven, Nunavut, includes and is subject to the annexed conditions.

Thomas Kabloona,
Nunavut Water Board, Chair

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the deposit of waste for municipal undertakings at the Hamlet of Rankin Inlet, Kivalliq Region, Nunavut (64°49' N; 92°05'W);

b. This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be subject to such requirements; and

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from the responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

d. The Licensee shall, in relation to any application to renew or amend the Licence, have in place, approved by the Board in writing, a Plan for Compliance to achieve full compliance with the conditions of this Licence, or a Plan for Compliance must be submitted at the time of Application, in order for the Application to be deemed complete.

2. Definitions

In this Licence: **3BM-RAN1214**

"Act" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

"Amendment" means a change to original terms and conditions of this Licence requiring correction, addition or deletion of specific terms and conditions of the Licence; modifications inconsistent with the terms of the set terms and conditions of the Licence;

"Analyst" means an Analyst designated by the Minister under Section 85 (1) of the *Act*;

''Appurtenant undertaking'' means an undertaking in relation to which a use of waters or a deposit of waste is permitted by a licence issued by the Board;

"Board" means the Nunavut Water Board established under the *Nunavut Land Claims Agreement*;

"Effluent" means treated or untreated liquid waste material that is discharged into the environment from a structure such as the landfill or landfarm;

"**Engineer**" means a professional engineer registered to practice in Nunavut in accordance with the *Consolidation of Engineers and Geoscientists Act S. Nu 2008, c.2* and the *Engineering and Geoscience Professions Act S.N.W.T. 2006, c.16 Amended by S.N.W.T. 2009, c.12*;

"Final Discharge Point" in respect of an effluent, means an identifiable discharge point of a facility beyond which the operator of the facility no longer exercises control over the quality of the effluent;

"Geotechnical Engineer" means a professional engineer registered with the Association of Professional Engineers, Geologist and Geophysicists of Nunavut and whose principal field of specialization is with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments;

"Grab Sample" means a single water or wastewater Effluent sample taken at a time and place representative of the total discharge;

"Hazardous Waste" means waste classified as "hazardous" by Nunavut Territorial or Federal legislation, or as "dangerous goods" under the *Transportation of Dangerous Goods Act*;

"**Inspector**" means an Inspector designated by the Minister under Section 85 (1) of the Act;

"Landfarm Facility" means an area designed to biologically remediate petroleum hydrocarbon-impacted soil, as described in the renewal application filed by the applicant on March 19, 2009 and as described in the *Solid Waste Management Facility Operation and Maintenance Plan Hamlet of Rankin Inlet* (Nuna Burnside Engineering and Environmental December 2008);

"Licensee" means the holder of this Licence;

"Modification" means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work, but

does not include an expansion, and changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

"Monitoring Program" means a monitoring program established to collect data on surface water and groundwater to assess impacts to the freshwater aquatic environment of an appurtenant undertaking;

"New Landfill" means the facility described in the *Solid Waste Management Facility Operation and Maintenance Plan Hamlet of Rankin Inlet* (Nuna Burnside Engineering and Environmental December 2008);

"Nunavut Land Claims Agreement" (NLCA) means the "*Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*", including its preamble and schedules, and any amendments to that agreement made pursuant to it;

"Old Landfill" means the facility described in the *Rankin Inlet Solid Waste Site Abandonment and Restoration Plan* (AECOM, July 2009);

"Petroleum Hydrocarbon-Impacted Soil" means soil in which the primary petroleum product present, as determined by laboratory analysis consistent with that described in the *Canada-Wide Standards for Petroleum Hydrocarbons in Soil*, generally consists of fuel oil, diesel fuel, gasoline and/or jet fuel and does not include lubricating oil or grease;

"Treatment Objective" means the treatment objective for the soil within the Landfarm which is the Canadian Council of Ministers of the Environment (CCME) *Canada – Wide Standard for Petroleum Hydrocarbon (PHC) in Soil*, revised January 2008 as determined by the Government of Nunavut, Environmental Protection Division based on the 2009 Environmental Guideline for Site Remediation;

"Waste" means, as defined in S.4 of the Act, any substance that, by itself or in combination with other substances found in water, would have the effect of altering the quality of any water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any water that would have that effect because of the quantity or concentration of the substances contained in it or because it has been treated or changed, by heat or other means;

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Old Landfill and New Landfill; and

"Water" means water as defined in section 4 of the Act.

3. Enforcement

a. Failure to comply with this Licence will be a violation of the *Act*, subjecting the Licensee to the enforcement measures and the penalties provided for in the *Act*;
b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the *Act*; and
c. For the purpose of enforcing this Licence and with respect to the use of water and deposit or discharge of waste by the Licensee, Inspectors appointed under the *Act*, hold all powers, privileges and protections that are conferred upon them by the *Act* or by other applicable law;

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported, which shall contain the following information:

a. tabular summaries of all data generated under the "Monitoring Program";
b. the monthly and annual quantities in cubic metres of all Effluent discharged;
c. a summary of modifications and/or major maintenance work carried out on the Waste Disposal Facilities and Landfarm;
d. a list of unauthorized discharges and summary of follow-up action taken;
e. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;
f. Any addendum with updates or revisions for manuals and plans (i.e., *Operations and Maintenance Plan*) as required by changes in operation and/or technology;
g. a summary of any studies or reports requested by the Board that relate to waste disposal or restoration, and a brief description of any future studies planned; and
h. any other details on waste disposal requested by the Board by November 1st of the year being reported.

2. The Licensee shall comply with the "Monitoring Program" described in this Licence, and any amendments to the "Monitoring Program" as may be made from time to time, pursuant to the conditions of this Licence.

3. The "Monitoring Program" and compliance dates specified in the Licence may be modified at the discretion of the Board in writing.

4. The Licensee shall install, operate and maintain meters, devices or other such methods as approved by the Board in writing, used for measuring the volumes of waste discharged, to the satisfaction of an Inspector.

5. The Licensee shall maintain the necessary signs to appropriately identify the stations of

the Monitoring Program. Signs are to be posted at locations following confirmation by the Inspector and be in the Official Languages of Nunavut.

6. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130), any spills of Waste which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Waste Disposal Facilities or Landfarm Facility.

7. The Licensee shall ensure a copy of this Licence is maintained at the Municipal Office at all times. Any communication with respect to this Licence shall be made in writing to the attention of:

(a). Manager of Licensing:
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: licensing@nunavutwaterboard.org

(b). Inspector Contact:
Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4295
Fax: (867) 979-6445

8. The Licensee shall submit one paper copy and one electronic copy of all reports, studies, and plans to the Board. Reports, plans or studies submitted to the Board by the Licensee shall include a detailed executive summary in both English and Inuktitut.

9. The Licensee shall ensure that all documents and correspondence submitted by the Licensee to the Board are received and acknowledged by the Manager of Licensing.

10. The Licensee shall submit to the Board for approval, within thirty (30) days of Licence issuance, a Plan for Compliance that clearly demonstrates the measures the Licensee will undertake, including an implementation schedule, to achieve full compliance with the conditions of this Licence, including the issues raised in the Inspector's Reports.

11. The Licensee shall, for all Plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted, cannot be undertaken without subsequent

written Board approval and direction. The Board may alter or modify a Plan if necessary to achieve the legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the Plan.

12. The Licensee shall, for all Plans submitted under this Licence, implement the Plan as approved by the Board in writing.

13. Every Plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of this Licence, and any additional terms and condition imposed upon approval of a Plan by the Board become part of this Licence. All terms and conditions of the Licence should be contemplated in the development of a Plan where appropriate.

14. The Licensee shall review the Plans referred to in this Licence as required by changes in operation and/or technology and modify the Plans or Manuals accordingly. Revisions to the Plans or Manuals are to be submitted in the form of an addendum to be included with the Annual Report required by Part B, Item 1(j), complete with a revisions list detailing where significant content changes are made.

15. This Licence is not assignable except as provided in Section 44 of the Act.

PART C: CONDITIONS APPLYING TO WATER USE

1. Water use is not authorized under this Licence.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall locate areas designated for waste disposal at a minimum distance of thirty one (31) metres from the ordinary high water mark of any water body such that the quality, quantity or flow of Water is not impaired, unless otherwise approved by the Board in writing.

2. The Licensee shall dispose of and permanently contain all solid wastes at the Waste Disposal Facilities or as otherwise approved by the Board in writing.

3. The Licensee shall not open burn plastics, wood treated with preservatives, electric wire, styrofoam, asbestos or painted wood to prevent the deposition of Waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding waters, unless otherwise approved by the Board in writing.

4. The Licensee shall segregate and store all hazardous materials and hazardous waste, including waste oil, within the Waste Disposal Facilities in a manner to prevent the deposit of deleterious substances into any water, until such a time that the materials have been removed for proper disposal at licensed facility.

5. The Licensee shall implement measures to ensure leachate from the Waste Disposal Facilities and Landfarm Facility do not enter Water.

6. The Licensee shall treat all Petroleum Hydrocarbon Impacted Soil in the Landfarm Facility to the Treatment Objective, or as otherwise approved by the Board.

7. The Licensee shall provide at least ten (10) days notice in writing to an Inspector, of the intent to discharge Effluent from the Landfarm Facility.

8. All water from dewatering contaminated soil areas and discharge of Effluent at Monitoring Station RAN-4 at the Landfarm Facility, shall not exceed the following Effluent quality limits:

Parameter	**Maximum Concentration of any Grab Sample (mg/L)**
pH	6 to 9 (units)
Total Suspended Solids	50
Oil and Grease	15 and no visible sheen
Benzene	0.370
Toluene	0.002
Ethylbenzene	0.090

9. Effluent that exceeds the Effluent quality limits of Part D, Item 8 shall be considered hazardous waste and require further treatment or disposal off-site at an approved facility.

10. The discharge location for all treated Effluents described in Part D, Item 8 shall be to the satisfaction of an Inspector and shall be located at a minimum of thirty one (31) metres from the ordinary high water mark of any water body and where direct or indirect flow into a water body is not possible and no additional impacts are created.

11. The Licensee shall dispose of soils containing contaminants in excess of the Treatment Objectives, off site at an approved treatment facility.

12. The Licensee shall, prior to the removal of any treated soil from the Landfarm Facility, confirm with the Government of Nunavut Environmental Protection Service that the soils have been treated so as to meet all legislatively-required Soil Quality Remediation Objectives.

13. The Licensee shall maintain records of all Waste backhauled and records of confirmation of proper disposal of backhauled Waste. These records shall be made available to an Inspector upon request.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval in writing, construction design drawings stamped by a qualified Engineer, sixty (60) days prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

2. The Licensee may, without written approval from the Board, carry out modifications to the Waste Disposal Facilities or Landfarm provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

    a. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;
    b. these modifications do not place the Licensee in contravention of the Licence or the Act;
    c. the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days;
    d. the Board has not rejected the proposed modifications; and
    e. Modifications for which all of these conditions have not been met, may be carried out only with approval from the Board in writing.

3. The Licensee shall provide as-built plans and drawings of the Modifications referred to in this Licence within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

4. All construction and modification activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage.

5. The Licensee shall implement and maintain sediment and erosion control measures prior to and during activities carried out under this Part, to prevent the release of sediment and minimize erosion.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall submit to the Board for approval, at least sixty (60) days prior to commissioning the New Landfill, a Status Update Report and photographic record, which demonstrates implementation of the pre-commissioning recommendations outlined in the *Solid Waste Management Facility Operation and Maintenance (O&M) Plan, Hamlet of Rankin Inlet*, dated December, 2008, including:

    a. The design and construction of effective drainage of water surrounding the landfill;
    b. The need to construct a hazardous waste storage area;
    c. Stockpiling of top soil in the fill area for use as cover material.
    d. Background sampling of soil and water quality of the site;
    e. Review of the O&M Plan by a bird hazard expert;
    f. The provision of signed/as-built drawings of the New Landfill and Landfarm following the completion of the above measures;
    g. Confirmation of correspondence with Transport Canada and a copy of any authorizations or recommendations provided through this consultation confirming that Transport Canada requirements have been met; and
    h. A schedule of activities.

2. The Licensee shall submit to the Board for approval, within ninety (90) days of Licence issuance, a revision to the *Solid Waste Management Facility Operation and Maintenance (O&M) Plan Hamlet of Rankin Inlet*, dated December, 2008, to address the following:

    a. An executive summary in English and Inuktitut;
    b. Procedures for the testing and characterization of sewage sludge generated by the Hamlet of Rankin Inlet under Licence 3AM-GRA1015 to ensure the materials are non-hazardous and proper storage and/or handling and disposal at the Waste Disposal Facilities are provided;
    c. Updated monitoring requirements in accordance with the Monitoring Program outlined in Part H;
    d. Types of wastes suitable for treatment in the Landfarm Facility in accordance with the definition provided in Part A of the Licence for Petroleum Hydrocarbon Impacted Soil;
    e. Recommended depths of contaminated soil placed in the Landfarm Facility;
    f. Independent third party sampling and testing of treated soil prior to removal from the Landfarm Facility for reuse; and
    g. Landfarm Facility Effluent quality criteria in accordance with Part D;

3. The Licensee shall submit to the Board for approval, within ninety (90) days of Licence issuance, a revision to the *Environmental Emergency Contingency Plan, Hamlet of Rankin Inlet*, dated December 2008, consisting of:

a. An executive summary in English and Inuktitut;
b. A Landfarm Operational Contingency Plan to deal with seepage from the facility;
c. A map of the 50 year flood plain relative to the Landfarm Facility and Waste Disposal Facilities;
d. The use of secondary containment or surface liners (drip pans, fold a tanks, etc.) under all containers and vehicle fuel tank inlet and outlet points, hose connections and hose ends during fuel or hazardous substance transfers;
e. An outline of appropriate spill response equipment and clean-up materials (absorbents, containment devices, etc.) to be on hand during any transfer of fuel or hazardous substances and at vehicle maintenance areas;
f. Updated contact information for the AANDC Field Operations Division; and
g. The locations of all hazardous materials, spill response equipment and clean up materials.

4. An inspection of all engineered facilities related to the management of Waste shall be carried out annually in July or August by a Geotechnical Engineer. The engineer's report shall be submitted to the Board for review, within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan addressing the Geotechnical Engineer's recommendations.

5. The Licensee shall perform more frequent inspections of the engineered facilities at the request of an Inspector.

6. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:

a. employ the appropriate contingency measures within the Contingency Plan, approved for the Hamlet of Rankin Inlet;
b. report the incident immediately via the 24-Hour Spill Reporting Line at (867) 920-8130 and to the Inspector at (867) 975-4295; and
c. submit to the Inspector, a detailed report, not later than thirty (30) days after initially reporting the event, that provides the necessary information on the location (including the GPS coordinates), initial response action, remediation/clean-up, status of response (ongoing, complete), proposed disposal options for dealing with contaminated materials and preventative measures to be implemented.

PART G: CONDITIONS APPLYING TO ABANDONMENT, RESTORATION AND CLOSURE

1. The Licensee shall, within six (6) months of Licence issuance, revise and resubmit to the

Board for approval in writing, the *Hamlet of Rankin Inlet, Rankin Inlet Solid Waste Site Abandonment and Restoration (A&R) Plan*, dated July 2009, for the Old Landfill. The revision shall address the following:

a. A clear rationale for the decision to abandon and remediate the existing site rather than the option of removing and relocating the waste materials into a new engineered facility;
b. Design criteria for the cover, gas ventilation system and surface water management system;
c. Containment along the base given that the facility is unlined and test pit logs are unclear in specifying whether refusal was met in frozen ground when no bedrock was encountered;
d. Whether permafrost encapsulation was considered and the potential effects of saline permafrost conditions at the facility;
e. A geothermal design basis for the cover;
f. The need to monitor ground temperatures within the waste;
g. Concerns associated with the placement of the liner's outer edges on top of natural ground as indicated in Figure 9 of the A&R Plan;
h. Authorizations for the quarry source;
i. An assessment of alternative design strategies for the planned drainage ditches;
j. Describe how the area will be re-graded and what drainage and erosion protection measures will be implemented for the areas where contaminated soils are planned to be removed;
k. Justification for why the contaminated soil test pits were stopped at each of the respective depths;
l. Clarification that the estimated contaminated soil volumes are based on removing all the soil to the top of the permafrost table or bedrock;
m. Method for dealing with surface water flows and contact water during the planned excavation;
n. A contingency for dealing with seepage and drainage for soil excavated below the water table;
o. A contingency for dealing with free phase hydrocarbons and other potential liquid contaminants which may be encountered, especially near the bedrock or permafrost interfaces;
p. Reclamation and cover requirements for expose soils within the excavations following the removal of contaminated soil;
q. The need for water quality monitoring up-gradient of the landfill to establish background water quality; and
r. The need to install thermistors to monitor ground temperatures.

2. The Licensee shall submit to the Board for approval in writing, an *Abandonment and Restoration Plan*, at least six (6) months prior to abandoning any facilities or upon

submission of the final design drawings for the construction of new facilities to replace existing ones. Where applicable, the Plan shall include information on the following:

a. waste disposal sites and facilities;
b. petroleum and chemical storage areas;
c. any site affected by waste spills;
d. leachate prevention;
e. an implementation schedule;
f. maps delineating all disturbed areas, and site facilities;
g. consideration of altered drainage patterns;
h. type and source of cover materials;
i. future area use;
j. hazardous wastes; and
k. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

3. The Licensee shall complete the restoration work within the time schedule specified in the Plans approved under this Part, or as subsequently revised and approved by the Board in writing.

4. All disturbed areas shall be stabilized and re-vegetated as required, upon completion of work and restored as practically as possible to a pre-disturbed state.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

1. The Licensee shall maintain Monitoring Program Stations at the following locations:

Monitoring Program Station Number	Description	Status
RAN-1	Unassigned	Inactive
RAN-2	Runoff from the Old Landfill	Active
RAN-3	Runoff from the New Landfill	Active Upon Commissioning
RAN-4	Discharge from the Landfarm Facility at the controlled point of release	Active
RAN-5	Monitoring well located up gradient of the Landfarm	Active
RAN-6	Monitoring well located down gradient of the Landfarm	Active

2. The Licensee shall sample monthly at Monitoring Program Station RAN-2 and RAN-3 upon commissioning, during periods of observed flow and annual discharges, to be analyzed for the following parameters:

Biochemical Oxygen Demand (BOD_5)	Fecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease (visual)	Total Phenols
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Total Hardness	Total Alkalinity
Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Cobalt	Total Manganese
Total Chromium	Total Nickel
Total Copper	Total Lead
Total Aluminum	Total Arsenic

3. The Licensee shall carry out weekly inspections at Monitoring Program Stations RAN-2 and RAN-3 upon commissioning, from May to August inclusive, to identify effluent or water flow in order to fulfill the monitoring requirements of Part H, Item 2. A record of inspections shall be retained and made available to an Inspector upon request.

4. The Licensee shall measure and record the origin and volume of all soil, from all locations entering the Landfarm Facility.

5. The Licensee shall characterize through laboratory analysis and record the concentrations of petroleum hydrocarbons in Petroleum Hydrocarbon Impacted Soil entering the Landfarm Facility from all sources, as per the CCME *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*.

6. The Licensee shall record the date, amount of soil and soil quality and the final destination of all treated soil removed from the Landfarm Facility in order to meet the objectives of Part D, Item 12, and shall provide the ultimate final intended use and GPS coordinates of all soils removed.

7. The Licensee shall sample prior to discharge at Monitoring Program Station RAN-4, to verify compliance with the effluent quality limits under Part D, Item 8.

8. The Licensee shall record the volume of all Effluent discharged from the Landfarm Facility at Monitoring Program Station RAN-4.

9. The Licensee shall install groundwater monitoring wells at the Landfarm Facility. These wells shall be located with at least one located upstream of the facility for background data collection (RAN-5) and at least one downstream of the facility (RAN-6).

10. The Licensee shall sample at Monitoring Program Stations RAN-5 and RAN-6 once annually in the summer, giving consideration to adequate ground thaw and obtaining a representative groundwater sample. Samples shall be analyzed for the following parameters:

Biochemical Oxygen Demand (BOD_5)	Fecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease	Total Phenols
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Sulphate	Total Mercury
Total Hardness	Total Alkalinity
Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Aluminum	Total Manganese
Total Chromium	Total Nickel
Total Copper	Total Lead
Total Arsenic	
TPH (Total Petroleum Hydrocarbons)	
PAH (Polycyclic Aromatic Hydrocarbons)	
BTEX (Benzene, Toluene, Ethylbenzene, Xylene)	

11. Additional monitoring stations, sampling and analysis may be requested by the Board or an Inspector .

12. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board in writing.

13. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025 for all required analyses. The accreditation shall be current and in good standing.

14. The Licensee shall submit to the Board upon approval by an Analyst, a Quality Assurance/Quality Control (QA/QC) Plan. The Plan shall include up to date sampling methods to all applicable standards, acceptable to an accredited laboratory as required by

Part H, Item 12 and Part H, Item 13. The Plan shall include a covering letter from the accredited laboratory and Analyst, confirming acceptance of the Plan for analyses to be performed under this Licence.

15. The Licensee shall annually review the Quality Assurance/Quality Control Plan in Part H, Item 14 and modify it as necessary. Proposed modifications shall be submitted to the accredited laboratory for approval.

16. The Licensee shall include all of the data and information required by the "Monitoring Program" complete with an interpretation and discussion of the results, in the Licensee's Annual Report, as required *per* Part B, Item 1, or as requested by an Inspector.

17. Modifications to the Monitoring Program may be made only upon written approval of the Board.

Appendix C – ALS Environmental (Winnipeg) CALA Certificate of Accreditation and Scope of Accreditation

Canadian Association for Laboratory Accreditation Inc.

Certificate of Accreditation

ALS Environmental (Winnipeg)
ALS Canada Ltd.
1329 Niakwa Road East. Unit 12
Winnipeg, Manitoba

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation No.:	A1442
Issued On:	December 23, 2014
Accreditation Date:	January 3, 2005
Expiry Date:	June 22, 2017

President & CEO

CALA
Canadian Association for Laboratory Accreditation Inc.

CALA Directory of Laboratories

Membership Number: 1442
Laboratory Name: ALS Environmental (Winnipeg)
Parent Institution: ALS Canada Ltd.
Address: 1329 Niakwa Road East Unit 12 Winnipeg MB R2J 3T4
Contact: Ms. Kayla Harold
Phone: (204) 255-9745
Fax: (204) 255-9721
Email: kayla.harold@alsglobal.com; linda.neimor@ALSGlobal.com

Standard: Conforms with requirements of ISO/IEC 17025
Clients Served: All Interested Parties
Revised On: March 24, 2015
Valid To: June 22, 2017

Scope of Accreditation

Air (Inorganic)
Radon - Air (142)
WP-TM-1801; modified from EPA 402-R-92-004
ELECTRET RADON MONITOR
Radon

Air (Mycology)
Mould - Air (163)
WP-TM-1704; modified from ASTM D7391
DIRECT MICROSCOPIC EXAMINATION
Biocontaminant Identification
Biocontaminant Quantification

Air (Mycology)
Mould - Air (AGAR Strips) (055)
WP-TM-1703; modified from INTRO. TO FOOD-BOURNE FUNGI
MICROSCOPE
Biocontaminant Identification
Biocontaminant Quantitation

Food
Yeast and Mould - Food (168)
WP-TM-1211; MFHPB-22
POUR PLATE
Mould
Yeast

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Food (Microbiology)
Coliforms - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (153)
WP-TM-1210; MFHPB-19
MOST PROBABLE NUMBER
Escherichia coli (E.coli)
Fecal Coliforms
Total Coliforms

Food (Microbiology)
Coliforms - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (157)
WP-TM-1209; MFHPB-31
POUR PLATE
Total Coliforms

Food (Microbiology)
Heterotrophic Plate Count - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (152)
WP-TM-1208; MFHPB-18
POUR PLATE
Heterotrophic Plate Count

Food (Microbiology)
Listeria - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (151)
WP-TM-1202; AOAC 997.03
VISUAL IMMUNOPRECIPITATE ASSAY
Listeria monocytogenes

Food (Microbiology)
Listeria - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (156)
WP-TM-1201; MFHPB-30
SPREAD PLATE
Listeria monocytogenes

Food (Microbiology)
Listeria - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (158)
WP-TM-1203; MFLP-34
VISUAL IMMUNOPRECIPITATE ASSAY
Listeria monocytogenes

Food (Microbiology)
Salmonella - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (154)
WP-TM-1204; MFHPB-20
SPREAD PLATE
Salmonella

Food (Microbiology)
Salmonella - Meat, Poultry and Egg Products (160)
WP-TM-1206; USDA MLG 4
SPREAD PLATE
Salmonella

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Food (Microbiology)
Staphylococcus - Dairy Products (Except Unpasturized Milk for Payment Purposes) & Meat and Edible Meat Offal (Milk Powder, Egg, Cheese, Butter, Evaporated Milk, Meat) (155)
WP-TM-1207; MFHPB-21
SPREAD PLATE
Staphylococcus aureus

Solids (Biology)
Benthic Organisms - Sediment (075)
WP-TM-1301; modified from SM 10500
MICROSCOPE EXAMINATION
Benthos Enumeration
Benthos Identification

Solids (Inorganic)
Metals - TCLP Leachate - Waste (149)
NA-TM-1002/NA-TM-1700; EPA 1311 (LEACH) and modified from EPA 200.2 (ANALYSIS)
ICP/MS - TCLP
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Molybdenum
Nickel
Potassium
Selenium
Silver
Strontium
Thallium
Tin
Uranium
Vanadium
Zinc
Zirconium

Solids (Inorganic)
Total Mercury (TCLP Leachate) - Waste (162)
WP-TM-1007/WP-WI-3007/NA-TM-1700; EPA 1311 (LEACH) and modified from EPA 1631E I(ANALYSIS)
COLD VAPOUR ATOMIC FLUORESCENCE - TCLP
Mercury

Solids (Inorganic)
Total Mercury - Soil (128)
WP-TM-1007/NA-TP-2004/WP-WI-3007; modified from EPA 1631E
COLD VAPOUR ATOMIC FLUORESCENCE - DIGESTION
Mercury

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Solids (Inorganic)
Total Metals - Solids (131)
NA-TM-1002/NA-TP-2004; modified from EPA 200.2
ICP/MS - DIGESTION
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silver
Sodium
Strontium
Thallium
Thorium
Tin
Titanium
Uranium
Vanadium
Zinc

Solids (Organic)
Glycols - Soil (145)
WP-TM-1102; modified from ASTM D3695-82
GC/FID
Diethylene Glycol
Ethylene Glycol
Propylene Glycol
Tetraethylene Glycol
Triethylene Glycol

Solids (Organic)
Petroluem Hydrocarbons (PHC) - Soil (148)
NA-TP-2100/NA-TM-1100; modified from CCME TIER 1
GC/FID
F2: C10-C16
F3: C16-C34
F4: C34-C50

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Solids (Organic)
Petroluem Hydrocarbons (PHC) - Soil (150)
NA-TP-2100/NA-TM-1100; modified from CCME TIER 1
GRAVIMETRIC - TUMBLER
F4: Gravimetric

Solids (Organic)
Polychlorinated Biphenyls (PCB) - Soil (045)
WP-TM-0801; modified from EPA SW-846 3550A
GC/ECD - EXTRACTION
Arochlor 1016
Arochlor 1221
Arochlor 1232
Arochlor 1248
Arochlor 1262
Arochlor 1268
Aroclor 1242
Aroclor 1254
Aroclor 1260
Total PCB

Solids (Organic)
Polycyclic Aromatic Hydrocarbons (PAH) - Soil (051)
NA-TP-2103/WP-TP-2102; modified from EPA SW-846 3550C and EPA SW-846 8270D
GC/MS - SHAKE EXTRACTION
1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b&j) fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Chrysene
Dibenzo (a,h) anthracene
Fluoranthene
Fluorene
Indeno (1,2,3 - cd) pyrene
Naphthalene
Phenanthrene
Pyrene
Quinoline

Solids (Organic)
Volatile Fatty Acids - Soil (129)
WP-TM-1105; modified from ASTM D3695-
GC/MS - WATER EXTRACTION
Acetic Acid
Butyric Acid
Caproic Acid
Formic Acid
Isobutyric Acid
Isovaleric Acid

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Propionic Acid
Valeric Acid

Solids (Organic)
Volatile Organic Compounds (VOC) - Soil (141)
NA-WI-3006/NA-TM-1102; modified from EPA 5021A and EPA 8260C
GC/MS - METHANOL EXTRACTION/HEADSPACE

1,1-Dichloroethane
1,1-Dichloroethylene
1,1-Dichloropropene
1,1,1-Trichloroethane
1,1,1,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,3,5-Trimethylbenzene
1,4-Dichlorobenzene
2-Chlorotoluene
2,2-Dichloro-propane
4-Chlorotoluene
4-Isopropyltoluene
Acetone (2-Propanone)
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulfide
Carbon Tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dibromomethane
Dichlorodifluoromethane
Dichloromethane
Ethylbenzene
Ethylene Dibromide
Hexachlorobutadiene
Hexane
Isopropylbenzene

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m/p-xylene
Methyl ethyl ketone
Methyl isobutyl ketone
Methyl n-butyl ketone
Methyl t-butyl ether
n-Butylbenzene
Naphthalene
o-xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane
Vinyl chloride

Solids (Organic)
Volatile Petroleum Hydrocarbons (PHC) - Soil (140)
NA-WI-3006/NA-TM-1102; CCME PHC - PERFORMANCE BASED MODIFICATION
GC/FID - METHANOL EXTRACTION/HEADSPACE
F1: C6-C10

Tissue (Inorganic)
Total Mercury - Tissue (082)
NA-TP-2003/WP-TM-1008/WP-TM-1007; modified from EPA 1631E
COLD VAPOUR ATOMIC FLUORESCENCE - DIGESTION
Mercury

Tissue (Inorganic)
Total Metals - Tissue (070)
NA-TP-2003/NA-TM-1002; modified from EPA 200.3 and 200.8
ICP/MS - DIGESTION
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Cesium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium

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Rubidium
Selenium
Silver
Sodium
Strontium
Tellurium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

Water (Inorganic)
Acidity - Water (111)
WP-TM-1003; modified from SM 2310 B
TITRIMETRIC
Acidity as CaCO3 - LR

Water (Inorganic)
Alkalinity - Water (001)
WP-TM-1001; modified from SM 2320 B
TITRIMETRIC
Alkalinity (pH 4.5)

Water (Inorganic)
Ammonia - Water (135)
WP-TM-1011/WP-WI-3005; modified from SM 4500-NH3 F
COLORIMETRIC - DISCRETE ANALYZER
Ammonia

Water (Inorganic)
Anions - Water (134)
NA-TM-1001; modified from EPA 300.1
ION CHROMATOGRAPHY
Bromide
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

Water (Inorganic)
Biochemical Oxygen Demand (BOD) - Water (015)
WP-TM-1015; modified from SM 5210 B
D.O. METER
BOD (5 day)
CBOD (5 day)

Water (Inorganic)
Carbon - Water (038)
WP-TM-1024; modified from SM 5310 B
AUTO IR ANALYZER
Inorganic Carbon
Total Carbon

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Water (Inorganic)
Chemical Oxygen Demand (COD) - Water (060)
WP-TM-1017; modified from SM 5220D and HACH
COLOR - DIGESTION
COD

Water (Inorganic)
Chlorine - Water (147)
WP-TM-1013; modified from SM 4500-CL G
COLORIMETRIC
Free Chlorine
Total Chlorine

Water (Inorganic)
Colour - Water (136)
WP-TM-1010/WP-WI-3005; modified from SM 2120-COLOR
COLORIMETRIC - DISCRETE ANALYZER
True Colour

Water (Inorganic)
Conductivity - Water (003)
WP-TM-1001; modified from SM 2510 B
CONDUCTIVITY METER
Conductivity (25°C)

Water (Inorganic)
Cyanide - Water (018)
WP-TM-1006; modified from SM 4500-CN- O
COLOR - DISTILLATION
Cyanide (SAD)
Cyanide (WAD)

Water (Inorganic)
Dissolved and Extractable Metals - Water (056)
NA-TP-2002/NA-TM-1002; modified from EPA 200.8
ICP/MS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Cesium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium

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Rubidium
Selenium
Silicon
Silver
Sodium
Strontium
Sulfur
Tellurium
Thallium
Thorium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc
Zirconium

Water (Inorganic)
Dissolved Oxygen - Water (088)
WP-TM-1018; modified from SM 4500-O- C
IODOMETRIC - AZIDE MODIFICATION
Dissolved Oxygen

Water (Inorganic)
Mercury (Total and Dissolved) - Water (081)
WP-TM-1007/WP-TM-1008/WP-WI-3007/NA-TP-2002/NA-TP-2001; modified from EPA 1631E
CVAFS - BrCl DIGESTION
Mercury

Water (Inorganic)
Nitrate plus Nitrite - Water (007)
WP-TM-1025; modified from SM 4500-NO3- I
FIA COLORIMETRIC
Nitrate plus Nitrite

Water (Inorganic)
pH - Water (019)
WP-TM-1001; modified from SM 4500-H+ B
pH METER
pH

Water (Inorganic)
Phosphorus - Water (024)
WP-TM-1004; modified from SM 4500-P H
FIA COLORIMETRIC - DIGESTION
Dissolved Phosphate
Phosphate
Total Dissolved Phosphorus
Total Inorganic Phosphorus
Total Phosphorus

Water (Inorganic)
Phosphorus - Water (164)
WP-TM-1016; modified from SM 4500-P BANDE
COLORIMETRIC - DISCRETE ANALYZER
Dissolved Phosphate
Phosphate

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Water (Inorganic)
Phosphorus - Water (165)
WP-TM-1016; modified from SM 4500-P BANDE
COLORIMETRIC - DISCRETE ANALYZER - DIGESTION
Total Dissolved Phosphorus
Total Inorganic Phosphorus
Total Phosphorus

Water (Inorganic)
Silica - Water (137)
WP-TM-1012/WP-WI-3005; modified from SM 4500-SIO2
COLORIMETRIC - DISCRETE ANALYZER
Reactive Silica

Water (Inorganic)
Solids - Water (014)
WP-TM-1014; modified from SM 2540 B, C, D
GRAVIMETRIC
Total Dissolved Solids
Total Solids
Total Suspended Solids
Volatile Suspended Solids

Water (Inorganic)
Total Kjeldahl Nitrogen (TKN) - Water (012)
WP-TM-1019; modified from SM 4500-NORG D
AUTO COLOR - DIGESTION
Total Kjeldahl Nitrogen

Water (Inorganic)
Total Metals - Water (057)
NA-TP-2001/NA-TM-1002; modified from EPA SW-846 3015 and SM 3030 E
ICP/MS - DIGESTION
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Cesium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Rubidium
Selenium

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Silicon
Silver
Sodium
Strontium
Sulfur
Tellurium
Thallium
Thorium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc
Zirconium

Water (Inorganic)
Turbidity - Water (068)
WP-TM-1009; modified from SM 2130 B
TURBIDIMETRIC
Turbidity

Water (Inorganic)
UV Absorbance/Transmittance - Water (166)
WP-TM-1027; modified from SM 5910 B
SPECTROPHOTOMETRIC
UV Absorbance
UV Transmittance

Water (Microbiology)
Coliforms - Water (026)
WP-TM-1219; modified from SM 9221 A, B, C
MOST PROBABLE NUMBER
Escherichia coli (E.Coli)
Fecal Coliforms
Total Coliforms

Water (Microbiology)
Coliforms - Water (039)
NA-TM-1300; modified from SM 9223 B and IDEXX
MOST PROBABLE NUMBER (QUANTI-TRAY)
Escherichia coli (E. coli)
Total Coliforms

Water (Microbiology)
Coliforms - Water (079)
WP-TM-1217; modified from HACH 10029 and SM 9222 B
MEMBRANE FILTRATION (mCOLIBLUE)
Escherichia coli (E. coli)
Total Coliforms

Water (Microbiology)
Cryptosporidium and Giardia - Water (053)
WP-TM-1212; modified from EPA 1623
IMS/FA - FILTRATION
Cryptosporidium Enumeration
Giardia Enumeration

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Water (Microbiology)
Fecal (Thermotolerant) Coliforms - Water (025)
WP-TM-1214; modified from SM 9222 D
MEMBRANE FILTRATION (mFC)
Fecal (Thermotolerant) Coliforms

Water (Microbiology)
Fecal (Thermotolerant) Coliforms - Water (167)
NA-TM-1300; modified from SM 9223 B
MOST PROBABLE NUMBER (QUANTI-TRAY)
Fecal (Thermotolerant) Coliforms

Water (Microbiology)
Heterotrophic Plate Count (HPC) - Water (041)
WP-TM-1216; modified from SM 9215 B
POUR PLATE
Heterotrophic Plate Count (HPC)

Water (Microbiology)
Legionella - Water (118)
WP-TM-1213; modified from ISO 11731 and SM 9260 J
MEMBRANE FILTRATION
Legionella-enumeration

Water (Microbiology)
Microcystins - Water (090)
WP-TM-1104; modified from TOXICON/ENVIROLOGIX
ELISA
Microcystins

Water (Microbiology)
Phytoplankton and Zooplankton - Water (076)
WP-TM-0102; modified from SM 10200
MICROSCOPE EXAMINATION
Phytoplankton Enumeration
Phytoplankton Identification
Zooplankton Enumeration
Zooplankton Identification

Water (Microbiology)
Pseudomonas aeruginosa - Water (093)
WP-TM-1215; modified from SM 9213 E
MEMBRANE FILTRATION (mPAC)
Pseudomonas aeruginosa

Water (Microbiology)
Total Coliforms - Water (078)
WP-TM-1218; modified from SM 9222 B
MEMBRANE FILTRATION (mENDO)
Total Coliforms

Water (Organic)
Alcohols and Glycols - Water (146)
WP-TM-1102; modified from ASTM D3695-82
GC/FID
Acetone
Diethylene Glycol
Ethanol
Ethylene Glycol
Isobutanol

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Isopropanol
Methanol
n-Butanol
n-Pentanol
Propylene Glycol
Sec-Butanol
Tetraethylene Glycol
Triethylene Glycol

Water (Organic)
Chlorophyll - Water (085)
WP-TM-1021; modified from SM 10200 H
ACETONE EXTRACTION - SPEC
Chlorophyll-a
Pheophytin

Water (Organic)
Chlorophyll A - Water (144)
WP-TM-1022; SM 10200H
FLUORESCENCE
Chlorophyll

Water (Organic)
Haloacetic Acids (HAA) - Water (124)
WP-TM-1103; modified from EPA 552.2
GC/ECD - LIQUID/LIQUID PARTITION
Bromochloroacetic Acid
Dibromoacetic Acid
Dichloroacetic Acid
Monobromoacetic Acid
Monocloroacetic Acid
Trichloroacetic Acid

Water (Organic)
Petroleum Hydrocarbons (PHC) - Water (132)
NA-TM-1104/NA-TP-2100; modified from EPA 3511 and EPA 8015D
GC/FID - EXTRACTION
F2: C10-C16
F3: C16-C34
F4: C34-C50

Water (Organic)
Polycyclic Aromatic Hydrocarbons (PAH) - Water (066)
NA-TP-2103/WP-TP-2101; modified from EPA SW-846 3510B and EPA SW-846 8270D
GC/MS
1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo (a) anthracene
Benzo (a) pyrene
Benzo(b&j)fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Chrysene
Dibenzo (a,h) anthracene

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Fluoranthene
Fluorene
Indeno (1,2,3 - cd) pyrene
Naphthalene
Phenanthrene
Pyrene
Quinoline

Water (Organic)
Total PCBs - Water (074)
WP-TM-0706; modified from EPA 8082A
GC/ECD - EXTRACTION
Arochlor 1016
Arochlor 1221
Arochlor 1232
Arochlor 1248
Arochlor 1262
Arochlor 1268
Aroclor 1242
Aroclor 1254
Aroclor 1260
Total PCB

Water (Organic)
Volatile Fatty Acids - Water (130)
WP-TM-1105; modified from ASTM D3695
GC/MS
Acetic Acid
Butyric Acid
Caproic Acid
Formic Acid
Isobutyric Acid
Isovaleric Acid
Propionic Acid
Valeric Acid

Water (Organic)
Volatile Organic Compounds (VOC) - Water (139)
NA-WI-3006/NA-TM-1102; modified from EPA 5021A and EPA 8260C
GC/MS - HEADSPACE
1,1-Dichloroethane
1,1-Dichloroethylene
1,1-Dichloropropene
1,1,1-Trichloroethane
1,1,1,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene

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1,3-Dichloropropane
1,3,5-Trimethylbenzene
1,4-Dichlorobenzene
2-Chlorotoluene
2,2-Dichloro-propane
4-Chlorotoluene
4-Isopropyltoluene
Acetone (2-Propanone)
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromodichloromethane - Formation Potential
Bromoform
Bromoform - Formation Potential
Bromomethane
Carbon disulfide
Carbon Tetrachloride
Carbon Tetrachloride - Formation Potential
Chlorobenzene
Chlorodibromomethane
Chlorodibromomethane - Formation Potential
Chloroethane
Chloroform
Chloroform - Formation Potential
Chloromethane
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dibromomethane
Dichlorodifluoromethane
Dichloromethane
Ethylbenzene
Ethylene Dibromide
Hexachlorobutadiene
Hexane
Isopropylbenzene
m/p-xylene
Methyl ethyl ketone
Methyl isobutyl ketone
Methyl n-butyl ketone
Methyl t-butyl ether
n-Butylbenzene
Naphthalene
o-xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethylene
Tetrachloroethylene - Formation Potential
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene

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Trichlorofluoromethane
Vinyl Chloride

Water (Organic)
Volatile Petroleum Hydrocarbons (VPH) - Water (138)
NA-TM-1102/NA-WI-3006; modified from EPA 5021A and EPA 8015D
GC/FID - HEADSPACE
F1: C6-C10
TVH (C5-C10)

Water (Toxicology)
Daphnia magna - Wastewater (017)
WP-TM-1401; EPS 1/RM/11 and EPS 1/RM/14
ACUTE LETHALITY (SURVIVAL)
Daphnia LC50 (48 h)
Single Concentration (48h)

Water (Toxicology)
Microtox - Liquid Phase - Wastewater (050)
WP-TM-1403; EPS 1/RM/24
BIOLUMINESCENCE
Microtox (30min.)
Microtox (5min.)
Microtox IC50 (15 min)

Water (Toxicology)
Rainbow Trout - pH Stabilization - Wastewater (161)
WP-TM-1402; EPS 1/RM/13 and EPS 1/RM/50
ACUTE LETHALITY (SURVIVAL)
Single Concentration (96h) - pH Stabilized
Trout LC50 (96 h) - pH Stabilized

Water (Toxicology)
Rainbow Trout - Wastewater (049)
WP-TM-1402; EPS 1/RM/9 and EPS 1/RM/13
ACUTE LETHALITY (SURVIVAL)
Single Concentration (96h)
Trout LC50 (96 h)

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Appendix D – ALS Environmental (Waterloo) CALA Certificate of Accreditation and Scope of Accreditation

Canadian Association for Laboratory Accreditation Inc.

CALA

Certificate of Accreditation

ALS Environmental (Waterloo)
ALS Canada Ltd.
60 Northland Rd., Unit 1
Waterloo, Ontario

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation No.: A3149
Issued On: July 24, 2014
Accreditation Date: January 3, 2005
Expiry Date: January 21, 2017

President & CEO

ilac-MRA CALA

CALA
Canadian Association for Laboratory Accreditation Inc.

CALA Directory of Laboratories

Membership Number: 3149
Laboratory Name: ALS Environmental (Waterloo)
Parent Institution: ALS Canada Ltd.
Address: 60 Northland Rd. Unit 1 Waterloo ON N2V 2B8
Contact: Mr. Jonathan Fisher
Phone: (519) 886-6910
Fax: (519) 886-9047
Email: ALSWT.Quality@alsglobal.com; linda.neimor@ALSGlobal.com

Standard: Conforms with requirements of ISO/IEC 17025
Clients Served: All Interested Parties
Revised On: December 19, 2014
Valid To: January 21, 2017

Scope of Accreditation

Air (Inorganic)
Fixed Gases - Air (180)
WT-TM-1703; modified from EPA 3C, ASTM D1946-90
- GC/FID & TCD
- Carbon Dioxide
- Carbon Monoxide
- Methane
- Nitrogen
- Oxygen

Biosolids (Microbiology)
Escherichia coli (E. coli) - Biosolids (087)
WT-TM-1200; modified from MOE/LSB-E3433
- MEMBRANE FILTRATION (mFC-BCIG)
- Escherichia coli (E. coli)

Biosolids (Organic)
Nonylphenol and Nonylphenol Ethoxylates - Biosolids (165)
WT-TM-1554; modified from JOURNAL OF CHROMATOGRAPHY A.849 (1999) 467-482
- LC/MS - EXTRACTION
- Bisphenol A
- Nonylphenol Diethoxylate
- Nonylphenol Monoethoxylates
- Nonylphenols
- Nonylphenols Ethoxylates
- Octylphenol
- Octylphenol Diethoxylate
- Octylphenol Monoethoxylate

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Oil (Organic)
Total PCBs - Oil (053)
WT-TM-1306; modified from EPA 8082-M, SW846 3580 A, SW846 3600 C, SW846 8082 A
GC/ECD - EXTRACTION
Total PCB

Soil
Particle Size - Soil (156)
WT-TM-1034; modified from SOIL SAMPLING AND METHODS OF ANALYSIS - CAN. SOCIETY OF SOIL SCIENCE (1993)
SEIVE
Particle Size

Soil
Perchlorate - Soil (176)
WT-TM-1505; modified from EPA 6860
LC-MS/MS
Perchlorate

Soil
Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) - Soil (175)
WT-TM-1557; modified from JOURNAL OF CHROMATOGRAPHY A. 1093 (2005), 89-97
LC-MS/MS
Perfluorooctane Sulfonate (PFOS)
Perfluorooctanoic Acid (PFOA)

Soil (Inorganic)
Hexavalent Chromium - Soil (158)
WT-TM-1035; modified from EPA 1636/EPA 3060
ION CHROMATOGRAPHY
Chromium (Hexavalent)

Soil (Inorganic)
Phenols - Soil (170)
WT-TM-1027; modified from EPA 9066
COLORIMETRIC
Total Phenolics

Soil (Organic)
Alkylated PAH's - Soil (177)
WT-TM-1114/WT-TM-1309; modified from EPA SW846-3500 C & SW846 8270 D
GC/MS - EXTRACTION
Acenaphthene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
benzo(e)pyrene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Biphenyl
C1-acenaphthenes
C1-Benzofluoroanthenes/Benzo(a)pyrenes
C1-Biphenyl
C1-Chrysenes

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C1-Dibenzothiopenes
C1-Fluoranthenes/Pyrenes
C1-Fluorenes
C1-Naphthalenes
C1-Phenanthrenes/Anthracene
C2-Benzofluoroanthenes/Benzo(a)pyrenes
C2-Biphenyl
C2-Chrysenes
C2-Dibenzothiopenes
C2-Fluoranthenes/Pyrenes
C2-Fluorenes
C2-Naphthalenes
C2-Phenanthrenes/Anthracene
C3-Chrysenes
C3-Dibenzothiopenes
C3-Fluoranthenes/Pyrenes
C3-Fluorenes
C3-Naphthalenes
C3-Phenanthrenes/Anthracene
C4-Dibenzothiopenes
C4-Fluoranthenes/Pyrenes
C4-Naphthalenes
C4-Phenanthrenes/Anthracene
Chrysene
Dibenzo (a,h) anthracene
Dibenzothiopene
Fluoranthene
Fluorene
Indeno (1,2,3 - cd) pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
Quinoline
Retene

Solids (Inorganic)
Ammonia - Soil (096)
WT-TM-1013; modified from EPA 350.1
COLORIMETRIC
Ammonia

Solids (Inorganic)
Anions - Soil, Sludge (041)
WT-TM-1008; modified from SM 4110C
ION CHROMATOGRAPHY
Bromide
Chloride
Fluoride
Nitrate
Nitrite
Sulphate

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Solids (Inorganic)
Anions - Solid Waste (136)
NA-TM-1700/WT-TM-1008; EPA 1311 (Leach)/ Modified from SM 4110 C AND EPA 300.0 (Analysis)
ION CHROMATOGRAPHY - TCLP
Fluoride
Nitrate
Nitrite

Solids (Inorganic)
Conductivity - Soil (109)
WT-TM-1028; modified from SM 2510 B, EPA 9050A
CONDUCTIVITY METER
Conductivity (25°C)

Solids (Inorganic)
Cyanide - Soil (079)
NA-TM-1003, WT-TP-2011; modified from SM 4500-CN E, G (SAD), 4500-CN I (WAD), modified from ISO/DIS 14403 & ASTM D7237
AUTO COLOR - DIGESTION
Cyanide (Free)
Cyanide (SAD)
Cyanide (WAD)

Solids (Inorganic)
Mercury - Soil, Sludge, Compost (050)
WT-TM-1018; modified from SW846 7471 B, EPA 245.2
CVAAS
Mercury

Solids (Inorganic)
Mercury - Solid Waste (139)
NA-TM-1700/WI-TM-1018; EPA 1311 (Leach)/ Modified from EPA 7470 A (Analysis)
COLD VAPOUR AA - SPECTROMETRIC - TCLP
Mercury

Solids (Inorganic)
Metals - Soil, Sludge, Compost, Sediment (006)
NA-TM-1002, NA-TP-2004; modified from EPA 6020 A/3050 B modified from 200.2, BC SALM (BC MOE)
ICP/MS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel

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Phosphorus
Potassium
Selenium
Silver
Sodium
Strontium
Sulphur
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

Solids (Inorganic)
Metals - Solid Waste (138)
NA-TM-1700/NA-TM-1002; EPA 1311 (Leach)/ Modified from EPA 6020 A (Analysis)
ICP/MS - TCLP
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Iron
Lead
Lithium
Magnesium
Manganese
Potassium
Selenium
Silver
Sodium
Strontium
Sulphur
Thallium
Tin
Zinc
Zirconium

Solids (Inorganic)
Oil and Grease - Soil, Sludge (031)
WT-TM-1100; modified from SM 5520 B, D, E, F, EPA 8015
GRAVIMETRIC - EXTRACTION
Mineral Oil and Grease
Total Oil and Grease (Solvent Extractables)

Solids (Inorganic)
pH - Soil (107)
WT-TM-1028; modified from SM 4500-H B
pH METER
pH

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Solids (Inorganic)
Solids - Soils, Sludge, Compost, Sediment (028)
WT-TM-1011; modified from SM 2540 B, E, G
GRAVIMETRIC
Fixed Solids
Total Solids
Volatile Solids

Solids (Inorganic)
Total and Free Cyanide - Solid Waste (140)
NA-TM-1700/NA-TM-1003; EPA 1311 (Leach)/ Modified from 4500-CN I ASTM D7237, ISO/DIS 14403 (Analysis)
COLORIMETRIC - TCLP
Cyanide (SAD)
Cyanide (WAD)

Solids (Inorganic)
Total Kjeldahl Nitrogen (TKN) - Soil (100)
WT-TM-1023; modified from SM 4500-NORG
COLORIMETRIC - DIGESTION
Total Kjeldahl Nitrogen

Solids (Inorganic)
Total Organic Carbon (TOC) - Soil (034)
WT-TM-1005; modified from CSSS METHOD 21.2
WET OXIDATION-REDOX
Total Organic Carbon (TOC)

Solids (Inorganic)
Totol Phosphorus - Soil/Sludge (039)
WT-TM-1020; modified from SM 4500-P E, F
AUTO COLOR - DIGESTION
Total Phosphorus

Solids (Organic)
1,4-Dioxane - Soil (173)
WT-TM-1407; modified from SW 846 8260 C/EPA 5021 A
GC/MS - HEADSPACE
1,4-Dioxane

Solids (Organic)
Base Neutral Acid Extractables (BNA) - Soil, Sediment, Sludge (016)
WT-TM-1101/WT-TM-1300; modified from EPA SW846-3500 C & SW846 8270 D
GC/MS - EXTRACTION
1-Chloronaphthalene
1-Methylnaphthalene
1,2-dichlorobenzene
1,2,4-Trichlorobenzene
1,3-Dichlorobenzene
1,4-dichlorobenzene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Nitrophenol
2,3,4-Trichlorophenol
2,3,4,5-Tetrachlorophenol
2,3,4,6-Tetrachlorophenol
2,3,5-Trichlorophenol
2,3,5,6-Tetrachlorophenol

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2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,6-Dichlorophenol
2,6-Dinitrotoluene
3,3'-Dichlorobenzidene
4-Bromophenyl Phenyl Ether
4-Chloro-3-Methylphenol
4-chloroaniline
4-Chlorophenyl Phenyl Ether
4-Nitrophenol
4,6-Dinitro-o-Cresol
5-Nitroacenaphthylene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Benzyl Butyl Phthalate
Biphenyl
Bis (2-Chlorethoxy) Methane
Bis (2-Chloroethyl) Ether
Bis (2-Chloroisopropyl) Ether
Bis (2-ethylhexyl) Phthalate
Camphene
Chrysene
Di-n-Butylphthalate
Di-n-Octylphthalate
Dibenzo (a,h) anthracene
Diethyl Phthalate
Dimethyl Phthalate
Diphenyl Ether
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno (1,2,3 - cd) pyrene
Indole
Isophorone
m/p-cresol
N-Nitrosodi-n-propylamine
Naphthalene
Nitrobenzene
o-Cresol

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p-chloroaniline
Pentachlorophenol
Perylene
Phenanthrene
Phenol
Pyrene
Quinoline
Total Diphenylamine

Solids (Organic)
Base Neutral Acid Extractables (BNA) - Solid Waste (141)
NA-TM-1700/WT-TM-1300/WT-TM-1101; EPA 1311 (Leach)/ Modified from EPA SW 846 8270 (Analysis)
GC/MS - TCLP
2-Methylphenol
2,3,4,6-Tetrachlorophenol
2,4-Dichlorophenol
2,4-Dinitrotoluene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
3/4-Methylphenol
Benzo (a) pyrene
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane
Nitrobenzene
Pentachlorophenol

Solids (Organic)
F1 (C6-C10) - Soil (110)
NA-TM-1102; CCME TIER 1, modified from EPA 5021 A, EPA 8260 C
GC/FID - HEADSPACE
F1: C6-C10

Solids (Organic)
Glycols - Soil, Sediment, Sludge (089)
WT-TM-1601; modified from EPA 8015 B - MODIFIED
GC/FID
1,2 - Propylene Glycol
1,3 - Propylene Glycol
Diethylene Glycol
Ethylene Glycol

Solids (Organic)
Organochlorine Pesticides (OCP) - Soil (020)
WT-TM-1102/WT-TM-1302; modified from EPA SW846 3500 C, SW846 8270 D
GC/MS - EXTRACTION
Aldrin
alpha-BHC
alpha-Chlordane
beta-BHC
Chlordane
delta-BHC
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin

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Endrin Aldehyde
gamma-Chlordane
Heptachlor
Heptachlor Epoxide
Lindane
Mirex
o,p'-DDD
o,p'-DDE
o,p'-DDT
Oxychlordane
p,p'-DDD
p,p'-DDE
p,p'-DDT
p,p'-Methoxychlor

Solids (Organic)
Pesticides - Soil (150)
WT-TM-1107, WT-TM-1302; modified from EPA SW 846 8270, SW 846 3500 C
GC/MS - EXTRACTION
2,4-D
2,4,5-T
2,4,5-TP
Alachlor
Ametryn
Atrazine
Atrazine Desethyl
Azinphos-methyl
Bendiocarb
Bromoxynil
Carbaryl
Carbofuran
Chlorpyrifos
Cyanazine
Diazinon
Dicamba
Diclofop-methyl
Dimethoate
Dinoseb
Malathion
MCPA
Mecoprop
Metolachlor
Metribuzin
Parathion
Phorate
Picloram
Prometon
Prometryne
Propazine
Simazine
Temephos
Terbufos
Terbutryn
Triallate

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Trifluralin

Solids (Organic)
Petroleum Hydrocarbons (PHC) - Soil (065)
WT-TM-1307/WT-TM-1111; CCME TIER 1, MOE: DECPH E3398
GC/FID - EXTRACTION
F2: C10-C16
F3: C16-C34
F4: C34-C50

Solids (Organic)
Petroleum Hydrocarbons (PHC) F4 - Soil (071)
WT-TM-1307; CCME TIER 1, MOE: DECPH E3398
GRAVIMETRIC
F4: Gravimetric

Solids (Organic)
Polychlorinated Biphenyls (PCB) - Soil (018)
WT-TM-1105/WT-TM-1301; modified from EPA SW846 3500 C, SW846 8270 D
GC/MS - EXTRACTION
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Total PCB

Solids (Organic)
Polychlorinated Biphenyls (PCB) - Solid Waste (137)
NA-TM-1700/WT-TM-1301/WT-TM-1105; EPA 1311 (Leach)/ Modified from EPA SW 846 8270 (Analysis)
GC/MS - TCLP
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Total PCB

Solids (Organic)
Pyridine - Solid Waste (167)
WT-TM-1600/NA-TM-1700; modified from SW846 8260 B
GC/MS
Pyridine

Solids (Organic)
Volatile Organic Compounds (VOC) - Soil (112)
NA-TM-1102; modified from EPA 5021 A, EPA 8260 C
GC/MS - HEADSPACE
1,1-Dichloroethane
1,1-Dichloroethylene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
1,2-Dibromomethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene

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2-Hexanone
Acetone (2-Propanone)
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon Disulfide
Carbon Tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dibromochloromethane
Dibromomethane
Dichlorodifluoromethane
Dichloromethane
Ethylbenzene
Ethylene Dibromide
Hexane
m/p-xylene
Methyl ethyl ketone
Methyl isobutyl ketone
Methyl t-butyl ether
Methylene Chloride
o-xylene
Styrene
Tetrachloroethane
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane
Vinyl chloride

Solids (Organic)
Volatile Organic Compounds (VOC) - Solid Waste (142)
WT-TM-1017/WT-TM-1404; EPA 1311 (Leach), modified from EPA SW 846 8260 B (Analysis)
GC/MS - TCLP
1,1-Dichloroethylene
1,2-Dichlorobenzene
1,2-Dichloroethane
1,4-Dichlorobenzene
Benzene
Carbon tetrachloride
Chlorobenzene
Chloroform
Chloromethane
Dichloromethane
Ethylbenzene
Methyl ethyl ketone

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Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl chloride

Solids (Organic)
Volatile Organic Compounds (VOC) - Solid Waste (182)
WT-TM-1017/NA-TM-1002; EPA 1311 (Leach), modified from EPA SW 846 8260 (Analysis)
GC/MS - HEADSPACE - TCLP
1,1-Dichloroethylene
1,2-Dichlorobenzene
1,4-Dichlorobenzene
Benzene
Carbon tetrachloride
Chloroform
Dichloromethane
Ethylbenzene
m&p-xylene
Methyl ethyl ketone
o-xylene
Tetrachloroethylene
Toluene

Swab (Organic)
Polychlorinated Biphenyls - Swabs (164)
WT-TM-1105/WT-TM-1301; SW846 3500C/SW846 8270D
GC/MS - EXTRACTION
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Total PCB

Tissue (Inorganic)
Mercury - Tissue (147)
WT-TM-1018 AND NA-TP-2003; modified from SW 846 7471
COLD VAPOUR AA - SPECTROMETRIC
Mercury

Tissue (Inorganic)
Metals - Tissue (152)
NA-TM-1002/NA-TP-2003; modified from EPA 200.3
ICP/MS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium

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Magnesium
Manganese
Molybdenum
Nickel
Selenium
Silver
Strontium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

Water (Inorganic) OSDWA †
Alkalinity - Water (070)
WT-TM-1012; modified from SM 2320 B
MANUAL TITRATION
Alkalinity (pH 4.5)

Water (Inorganic) OSDWA †
Alkalinity - Water (094)
WT-TM-1032; modified from EPA 310.2
COLORIMETRIC
Alkalinity (pH 4.5)

Water (Inorganic) OSDWA †
Ammonia - Water (095)
WT-TM-1013; modified from EPA 350.1
COLORIMETRIC
Ammonia
Ammonia + ammonium

Water (Inorganic) OSDWA †
Anions - Water, Wastewater (003)
WT-TM-1008; modified from SM 4110C, modified from EPA 300.0
ION CHROMATOGRAPHY
Bromide
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

Water (Inorganic) OSDWA †
Biochemical Oxygen Demand (BOD) - Water (001)
WT-TM-1002; modified from SM 5210B
D.O. METER
BOD (5 day)
CBOD (5 day)

Water (Inorganic) OSDWA †
Bromate - Water (114)
WT-TM-1503/WT-TM-1505; modified from EPA 6850
LC-MS/MS - EXTRACTION
Bromate

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Water (Inorganic) Carbon - Water (047) WT-TM-1024; modified from SM 5310 B IR - COMBUSTION Organic Carbon	OSDWA †
Water (Inorganic) Chemical Oxygen Demand (COD) - Water (035) WT-TM-1006; modified from SM 5220 D REFLUX - COLORIMETRIC COD	OSDWA †
Water (Inorganic) Chlorine - Water (074) WT-TM-1021; modified from SM 4500-CL G, EPA 330.5 COLORIMETRIC Free Chlorine Total Chlorine	OSDWA †
Water (Inorganic) Colour - Water (097) WT-TM-1014; modified from SM2120 C COLORIMETRIC Apparent Colour True Colour	OSDWA †
Water (Inorganic) Conductivity - Water (048) WT-TM-1010; modified from SM 2510 B, EPA 9050A CONDUCTIVITY METER Conductivity (25°C)	OSDWA †
Water (Inorganic) Conductivity - Water (108) WT-TM-1028; modified from SM 2510 B PC TITRATE Conductivity (25°C)	
Water (Inorganic) Cyanate - Water (161) WT-TM-1036; modified from APHA 4500 CN L / 4500NH3 D SELECTIVE ION ELECTRODE Cyanate	OSDWA †
Water (Inorganic) Cyanide - Water, Wastewater (004) NA-TM-1003; modified from SM 4500-CN B, C, E, I COLOR - DISTILLATION Cyanide (Free) Cyanide (SAD) Cyanide (WAD)	OSDWA †
Water (Inorganic) Dissolved Metals - Water (005) NA-TM-1002; modified from EPA 200.8/6020 A ICP/MS Aluminum Antimony Arsenic Barium	OSDWA †

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Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silicon
Silver
Sodium
Strontium
Sulphur
Thallium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc
Zirconium

Water (Inorganic) OSDWA †
Hexavalent Chromium - Water (157)
WT-TM-1035; modified from EPA 1636/EPA 7199
ION CHROMATOGRAPHY
Chromium (Hexavalent)

Water (Inorganic) OSDWA †
Hydrogen Sulphide - Water (012)
WT-TM-1003; modified from SM 4500-S2, D, E, F
COLORIMETRIC
Hydrogen Sulfide

Water (Inorganic) OSDWA †
Mercury - Water, Wastewater (049)
WT-TM-1018; modified from EPA 7470A, EPA 245.2
COLD VAPOUR AA - SPECTROMETRIC
Mercury

Water (Inorganic) OSDWA †
Oil and Grease - Water (033)
WT-TM-1100; modified from 5520 B, D, E, F, EPA 1664
GRAVIMETRIC - EXTRACTION
Mineral Oil and Grease
Total Oil and Grease

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Water (Inorganic) OSDWA †
Perchlorate - Water (168)
WT-TM-1505; modified from EPA 6850
LC-MS/MS - EXTRACTION
Perchlorate

Water (Inorganic) OSDWA †
pH - Water (026)
WT-TM-1001; modified from 4500-H B
pH - METER
pH

Water (Inorganic) OSDWA †
pH - Water (106)
WT-TM-1028; modified from SM 4500-H B
PC TITRATE
pH

Water (Inorganic) OSDWA †
Phenols - Water (009)
WT-TM-1027; modified from SM 5530 B, D and modified from EPA 9066
COLORIMETRIC
Total Phenolics

Water (Inorganic) OSDWA †
Phosphorus (Low Level) - Water (098)
WT-TM-1025; modified from SM 4500-P B, F
COLORIMETRIC
Phosphate

Water (Inorganic) OSDWA †
Solids - Water (010)
WT-TM-1011; modified from SM 2540 D, E
GRAVIMETRIC
Total Suspended Solids
Volatile Suspended Solids

Water (Inorganic) OSDWA †
Solids - Water (056)
WT-TM-1011/NA-TM-1004; modified from SM 2540 B, C, E
GRAVIMETRIC
Total Dissolved Solids
Total Solids
Volatile Solids

Water (Inorganic) OSDWA †
Tannin and Lignin - Water (124)
WT-TM-1015; modified from SM 5550 B
COLORIMETRIC
Tannins & Lignins

Water (Inorganic)
Tannin and Lignin - Water (181)
WT-TM-1015; modified from SM 5550 B
COLORIMETRIC - DISCRETE ANALYZER
Tannin and Lignin

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Water (Inorganic) OSDWA †
Total Kjeldahl Nitrogen (TKN) - Water (099)
WT-TM-1023; modified from SM 4500-NORG D
COLORIMETRIC - DIGESTION
Total Kjeldahl Nitrogen

Water (Inorganic) OSDWA †
Total Metals - Water, Wastewater (032)
NA-TM-1002; modified from EPA 200.8/6020
ICP/MS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silicon
Silver
Sodium
Strontium
Sulphur
Thallium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc
Zirconium

Water (Inorganic) OSDWA †
Total Phosphorus - Water (011)
WT-TM-1020; modified from SM 4500-P E, F
AUTO COLOR - DIGESTION
Total Phosphorus

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Water (Inorganic) OSDWA †
Turbidity - Water (024)
WT-TM-1004; modified from SM 2130B
TURBIDIMETRIC
Turbidity

Water (Microbiology) OSDWA †
Coliforms - Water (155)
WT-TM-1200; modified from MOE/LSB MICROMFDC-E3407
MEMBRANE FILTRATION (DC)
Escherichia coli (E. coli)
Total Coliforms

Water (Microbiology) OSDWA †
Escherichia coli (E. coli) - Water (052)
WT-TM-1200; modified from ONTARIO MOE COMPARISON EVALUATION AND SM 9222D
MEMBRANE FILTRATION (mFC-BCIG)
Escherichia coli (E. coli)

Water (Microbiology) OSDWA †
Fecal (Thermotolerant) Coliforms - Water (051)
WT-TM-1200; modified from SM 9222 D
MEMBRANE FILTRATION (m FC)
Fecal (Thermotolerant) Coliforms

Water (Microbiology) OSDWA †
Fecal Streptococci - Water (088)
WT-TM-1202; modified from SM 9230 C
MEMBRANE FILTRATION (mENTEROCOCCUS)
Fecal Streptococci

Water (Microbiology) OSDWA †
Heterotrophic Plate Count (HPC) - Water (030)
WT-TM-1200; modified from SM 9215 D
MEMBRANE FILTRATION
Heterotrophic Plate Count (HPC)

Water (Microbiology) OSDWA †
Pseudomonas aeruginosa - Water (091)
WT-TM-1202; modified from SM 9213 E
MEMBRANE FILTRATION (mPAC)
Pseudomonas aeruginosa

Water (Microbiology) OSDWA †
Total Coliforms - Water (002)
WT-TM-1200; modified from SM 9222 B
MEMBRANE FILTRATION (m Endo)
Background Counts
Total Coliforms

Water (Organic) OSDWA †
1,4-Dioxane - Water (172)
WT-TM-1407; modified from SW 846 8260 C/EPA 5021 A
GC/MS - HEADSPACE
1,4-Dioxane

Water (Organic) OSDWA †
Aldicarb and Diuron - Water (135)
WT-TM-1502; modified from MOE E3438 AND E3436
LC-MS/MS - EXTRACTION
Aldicarb

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Diuron

Water (Organic)
Alkylated PAH's - Water (178)
WT-TM-1114/WT-TM-1309; modified from EPA SW 846-8270/SW846 3500 C
GC/MS - EXTRACTION
Acenaphthene
Acenaphthene
Acenaphthylene
Acenaphthylene
Acridine
Anthracene
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
benzo(e)pyrene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Biphenyl
C1-acenaphthenes
C1-Benzofluoroanthenes/Benzo(a)pyrenes
C1-Biphenyl
C1-Chrysenes
C1-Dibenzothiopenes
C1-Fluoranthenes/Pyrenes
C1-Fluorenes
C1-Naphthalenes
C1-Phenanthrenes/Anthracene
C2-Benzofluoroanthenes/Benzo(a)pyrenes
C2-Biphenyl
C2-Chrysenes
C2-Dibenzothiopenes
C2-Fluoranthenes/Pyrenes
C2-Fluorenes
C2-Naphthalenes
C2-Phenanthrenes/Anthracene
C3-Chrysenes
C3-Dibenzothiopenes
C3-Fluoranthenes/Pyrenes
C3-Fluorenes
C3-Naphthalenes
C3-Phenanthrenes/Anthracene
C4-Dibenzothiopenes
C4-Fluoranthenes/Pyrenes
C4-Naphthalenes
C4-Phenanthrenes/Anthracene
Chrysene
Dibenzo (a,h) anthracene
Dibenzothiopene
Fluoranthene
Fluorene
Indeno (1,2,3 - cd) pyrene
Naphthalene
Perylene

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Phenanthrene
Phenanthrene
Pyrene
Quinoline
Retene

Water (Organic) OSDWA †

Base Neutral Acid Extractables (BNA) - Water, Wastewater (015)
WT-TM-1101/WT-TM-1300; modified from EPA SW 846-8270/SW846 3500C
GC/MS - EXTRACTION
1-Chloronaphthalene
1-Methylnaphthalene
1,2,4-Trichlorobenzene
1,3-Dichlorobenzene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Nitrophenol
2,3,4-Trichlorophenol
2,3,4,5-Tetrachlorophenol
2,3,4,6-tetrachlorophenol
2,3,5-Trichlorophenol
2,3,5,6-Tetrachlorophenol
2,4-dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,4,5-Trichlorophenol
2,4,6-trichlorophenol
2,6-Dichlorophenol
2,6-Dinitrotoluene
3,3'-Dichlorobenzidene
4-Bromophenyl Phenyl Ether
4-Chloro-3-Methylphenol
4-chloroaniline
4-Chlorophenyl Phenyl Ether
4-Nitrophenol
4,6-Dinitro-o-Cresol
5-Nitroacenaphthylene
Acenaphthene
Acenaphthylene
Acrdine
Anthracene
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Benzyl Butyl Phthalate
Biphenyl
Bis (2-Chlorethoxy) Methane
Bis (2-Chloroethyl) Ether
Bis (2-Chloroisopropyl) Ether
Bis (2-ethylhexyl) Phthalate

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Camphene
Chrysene
Di-n-Butylphthalate
Di-n-Octylphthalate
Dibenzo (a,h) anthracene
Diethyl Phthalate
Dimethyl Phthalate
Diphenyl Ether
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno (1,2,3 - cd) pyrene
Indole
Isophorone
m/p-cresol
N-Nitrosodi-n-propylamine
Naphthalene
Nitrobenzene
o-Cresol
p-chloroaniline
Pentachlorophenol
Perylene
Phenanthrene
Phenol
Pyrene
Quinoline
Total Diphenylamine

Water (Organic) OSDWA †
Diquat and Paraquat - Water (134)
WT-TM-1506; modified from MDS SCIEX APPLICATION NOTE DIQUAT AND PARAQUAT LC-MS/MS - EXTRACTION
Diquat
Paraquat

Water (Organic) OSDWA †
Formaldehyde - Water (162)
WT-TM-1603; modified from EPA 556.1
GC/ECD
Formaldehyde

Water (Organic) OSDWA †
Glycols - Water (090)
WT-TM-1601; modified from EPA 8015 B - MODIFIED
GC/FID
1,2 - Propylene Glycol
1,3 - Propylene Glycol
Diethylene Glycol
Ethylene Glycol

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Water (Organic) OSDWA †
Glyphosate - Water (133)
WT-TM-1504; modified from MOE-GLYMS-E3415
LC-MS/MS - EXTRACTION
Glyphosate

Water (Organic) OSDWA †
Haloacetic Acids - Water (163)
WT-TM-1604; modified from EPA 552.3
GC/ECD
Bromoacetic Acid (BAA)
Bromochloroacetic Acid
Bromodichloroacetic Acid
Chloroacetic Acid (CAA)
Chlorodibromoacetic Acid
Dalapon (2,2-Dichloropropionic Acid)
Dibromoacetic Acid (DBAA)
Dichloroacetic Acid (DCAA)
Tribromoacetic acid (TBAA)
Trichloroacetic Acid (TCAA)

Water (Organic) OSDWA †
Hydrocarbons - Water (062)
WT-TM-1602; modified from EPA 600/R-98/128
GC/FID - HEADSPACE
Ethane
Ethene
Methane

Water (Organic) OSDWA †
Nitrilotriacetic Acid (NTA) - Water (036)
WT-TM-1007; modified from EPA 430.1
COLORIMETRIC
Nitrilotriacetic Acid (NTA)

Water (Organic) OSDWA †
Nonylphenol and Nonylphenol Ethoxylates - Water (116)
WT-TM-1521; IN-HOUSE
LC-MS/MS - EXTRACTION
Bisphenol A
Nonylphenol Diethoxylate
Nonylphenol Monoethoxylates
Nonylphenols
Nonylphenols Ethyoxylates
Octylphenol
Octylphenol Diethoxylate
Octylphenol Monoethoxylate

Water (Organic) OSDWA †
Organochlorine Pesticides (OC) - Water, Wastewater (019)
WT-TM-1102/WT-TM-1302; modified from EPA SW846-8270/SW846-3500C
GC/MS - EXTRACTION
A -BHC
a - Chlordane
Aldrin
beta-BHC
delta-BHC
Dieldrin

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Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Endrin Aldehyde
g - Chlordane
Heptachlor
Heptachlor Epoxide
Lindane (gamma-BHC)
Mirex
o,p' - DDT
o,p'-DDD
o,p'-DDE
Oxychlordane
p,p' - DDT
p,p' Methoxychlor
p,p'-DDD
p,p'-DDE

Water (Organic)
Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) - Water (174)
WT-TM-1557; modified from JOURNAL OF CHROMATOGRAPHY A.1093 (2005), 89-97
LC-MS/MS
Perfluorooctane Sulfonate (PFOS)
Perfluorooctanoic Acid (PFOA)

Water (Organic) OSDWA †
Pesticides - Water (023)
WT-TM-1107/WT-TM-1109-/WT-TM-1302; modified from EPA SW846-8270/SW846 3500C
GC/MS - EXTRACTION
2,4-dichlorophenoxyacetic acid
2,4,5-trichlorophenoxyacetic acid
Alachlor
Atrazine
Azinphos-methyl
Bendiocarb
Bromoxynil
Carbaryl
Carbofuran
Chlorpyrifos (ethyl)
Cyanazine
De-ethylated atrazine
Diazinon
Dicamba
Diclofop-methyl (as free acid)
Dimethoate
Dinoseb
Malathion
Metolachlor
Metribuzin
Parathion (ethyl)
Phorate
Picloram
Prometryne
Simazine

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Temephos
Terbufos
Triallate
Trifluralin

Water (Organic) OSDWA †
Petroleum Hydrocarbons (PHC) - Water (068)
WT-TM-1307/WT-TM-1112; modified from MOE:DECPH E3421
GC/FID - EXTRACTION
F2 (C10-C16)
F3 (C16-C34)
F4 (C34-C50)

Water (Organic) OSDWA †
Petroleum Hydrocarbons (PHC) - Water (069)
WT-TM-1307/WT-TM-1112; modified from MOE:DECPH E3421
GRAVIMETRIC
F4G (C34-C50)

Water (Organic) OSDWA †
Petroleum Hydrocarbons (PHC) - Water (111)
NA-TM-1102; modified from EPA 8260, EPA 5021 A
GC/FID - HEADSPACE
F1 (C6-C10)

Water (Organic) OSDWA †
Polychlorinated Biphenyls (PCB) - Water, Wastewater (017)
WT-TM-1105/WT-TM-1301; modified from EPA SW 846-8270/SW846-3500 B
GC/MS - EXTRACTION
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Total PCB

Water (Organic)
Steroids and Hormones - Water (166)
WT-TM-1555; modified from Journal of Chromatography B 879 (2011), 2998-3004
LC/MS - EXTRACTION
17a-Dihydroequilin
17a-Estradiol
17a-Ethinylestradiol
17b-Estradiol
Anderosterone
Androstendion
beta-Sitosterol
beta-Stigmastanol
Betamethasone
Campesterol
Cholestanol
Cholesterol
Coprostanol
Desmosterol
Desogestrel
Epi-coprostanol
Equilenin
Equilin
Ergosterol

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Estradiol-3-benzoate
Estriol
Estrone
Mestranol
Norethindrone
Norgestrel
Progesterone
Stigmasterol
Testosterone

Water (Organic) OSDWA †
Tetraethyl Lead - Water (159)
WT-TM-1308; modified from EPA 3510 C, 8270 D
GC/MS - DIGESTION
Teraethyl lead

Water (Organic) OSDWA †
Volatile Organic Compounds - Water (113)
NA-TM-1102; modified from EPA 8260 C, EPA 5021 A
GC/MS - HEADSPACE
1,1-Dichloroethane
1,1-Dichloroethylene
1,1,1-Trichloroethane
1,1,1,2- Tetrachloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Hexanone
Acetone (2-Propanone)
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulfide
Carbon Tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dichlorodifluoromethane
Dichloromethane
Ethylbenzene
Ethylene Dibromide
Hexane
m/p-xylene
Methyl ethyl ketone
Methyl isobutyl ketone
Methyl t-butyl ether

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o-xylene
Styrene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane
Vinyl Chloride

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Appendix E – Weekly Inspection Log Sheet

Nunavut Water Board Licence No. 3BM-RAN1214

Rankin Inlet, NU

Part H, Item 3: Weekly Inspections at Monitoring Program Sations, May to August

Week	Starting Date	RAN-2 Water Present (check) Yes	No	Frozen	Checked By
1	04-May-15				
2	11-May-15				
3	18-May-15				
4	25-May-15				
5	01-Jun-15				
6	08-Jun-15				
7	15-Jun-15				
8	22-Jun-15				
9	29-Jun-15				
10	06-Jul-15				
11	13-Jul-15				
12	20-Jul-15				
13	27-Jul-15				
14	03-Aug-15				
15	10-Aug-15				
16	17-Aug-15				
17	24-Aug-15				
18	31-Aug-15				

Monitoring Program Station Location:

RAN-2: Runoff from the Old Landfill

Appendix F – Field Log

Field Log

Name of Sampler(s): _____

Date of Sampling: _____

Time of Sampling: _____

Monitoring Station Number: _____

GPS Coordinates: N _____°_____’_____” W _____°_____’_____”

Weather Conditions: _____

Samples:

- ☐ 500 mL BOD
- ☐ 1 L Routine
- ☐ 250 mL Metals + Pres
- ☐ 40 mL Glass Mercury Vial + Pres
- ☐ 250 mL Amber Nutrients + Pres
- ☐ 250 mL Amber Phenols + Pres
- ☐ 125 mL Sterile Bacteria Bottle
- ☐ **2 x** 500 mL Glass Oil & Grease + Pres
- ☐ 1 L Amber PAH + Pres
- ☐ **3 x** 40 mL BTEX, F1 Vials + Pres
- ☐ **2 x** 60 mL Amber F2-F4 Vials + Pres

Other:

- ☐ _____
- ☐ _____
- ☐ _____

Other Notes: (any unusual conditions, any deviation from standard procedures, etc.)

_____

_____

_____

_____

_____

Appendix G – Chain of Custody Form

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Page ____ of ____

Report To	**Report Format / Distribution**	**Service Requested** (Rush for routine analysis subject to availability)
Company:	☑ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	☑ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Email 1:	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Email 2:	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone: Fax:	Email 3:	**Analysis Request**
Invoice To Same as Report ? ☐ Yes ☐ No	**Client / Project Information**	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report? ☐ Yes ☐ No	Job #:	
Company:	PO / AFE:	
Contact:	LSD:	
Address:		
Phone: Fax:	Quote #:	
Lab Work Order # (lab use only)	**ALS Contact:**	**Sampler:**

Sample #	**Sample Identification** (This description will appear on the report)	**Date** (dd-mmm-yy)	**Time** (hh:mm)	**Sample Type**	Number of Containers

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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 provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Appendix H – Canadian Environmental Quality Guidelines

Canadian Water Quality Guidelines for the Protection of Aquatic Life

SUMMARY TABLE

Update 7.0
September 2007

Summary of Canadian water quality guidelines for the protection of aquatic life.

	Freshwater		Marine	
Parameter[a]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Acenaphthene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Acridine [See Polycyclic aromatic hydrocarbons (PAHs)]				
Aldicarb	1[c]	1993	0.15[c]	1993
Aldrin + Dieldrin[d]	~~0.004~~[e,f]	1987		
Aluminium[d]	5–100[g]	1987		
Ammonia (total)	see factsheet	2001		
Ammonia (un-ionized)	19[h]	2001		
Aniline	2.2[i]	1993	Insufficient data	1993
Anthracene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Arsenic[j]	5.0[k]	1997	12.5[c]	1997
Atrazine	1.8[i]	1989		
Benz*(a)*anthracene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Benzene[j]	370[c, k]	1999	110[c]	1999
Benzo*(a)*pyrene [See Polycyclic aromatic hydrocarbons (PAHs)]				
2,2-Bis(*p*-chlorophenyl)-1,1,1-trichloroethane [See DDT (total)]				
Bromacil	5.0[c,i]	1997	Insufficient data	1997
Bromoform [See Halogenated methanes, Tribromomethane]				
Bromoxynil	5.0[i]	1993	Insufficient data	1993
Cadmium	0.017[c,l]	1996	0.12[i]	1996
Captan	1.3[c]	1991		
Carbaryl	0.20[i]	1997	0.32[c,i]	1997
Carbofuran	1.8[i]	1989		
Carbon tetrachloride [See Halogenated methanes, Tetrachloromethane]				
Chlordane[d]	~~0.006~~[e,f]	1987		
Chlorinated benzenes				
Monochlorobenzene	1.3[c,k]	1997	25[c,k]	1997
1,2-Dichlorobenzene	0.70[c,k]	1997	42[c,k]	1997
1,3-Dichlorobenzene	150[c,k]	1997	Insufficient data[k]	1997
1,4-Dichlorobenzene	26[c,k]	1997	Insufficient data[k]	1997
1,2,3-Trichlorobenzene	8.0[c,k]	1997	Insufficient data[k]	1997
1,2,4-Trichlorobenzene	24[c,k]	1997	5.4[c,k]	1997
1,3,5-Trichlorobenzene[d]	Insufficient data[k]	1997	Insufficient data[k]	1997

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Chlorinated benzenes—Continued				
1,2,3,4-Tetrachlorobenzene	1.8[c,k]	1997	Insufficient data[k]	1997
1,2,3,5-Tetrachlorobenzene[d]	Insufficient data[k]	1997	Insufficient data[k]	1997
1,2,4,5-Tetrachlorobenzene[d]	Insufficient data[k]	1997	Insufficient data[k]	1997
Pentachlorobenzene	6.0[c,k]	1997	Insufficient data[k]	1997
Hexachlorobenzene[d]	Insufficient data[e,f,k]	1997	Insufficient data[k]	1997
Chlorinated ethanes				
1,2-Dichloroethane	100[c,i]	1991	Insufficient data	1991
1,1,1-Trichloroethane	Insufficient data	1991	Insufficient data	1991
1,1,2,2-Tetrachloroethane	Insufficient data	1991	Insufficient data	1991
Chlorinated ethenes				
1,1,2-Trichloroethene (Tichloroethylene; TCE)	21[c,i]	1991	Insufficient data	1991
1,1,2,2-Tetrachloroethene (Tetrachloroethylene; PCE)	111[c,i]	1993	Insufficient data	1993
Chlorinated methanes [See Halogenated methanes]				
Chlorinated phenols[d]				
Monochlorophenols	7	1987		
Dichlorophenols	0.2	1987		
Trichlorophenols	18	1987		
Tetrachlorophenols	1	1987		
Pentachlorophenol (PCP)	0.5	1987		
Chlorine, reactive [See Reactive chlorine species]				
Chloroform [See Halogenated methanes, Trichloromethane]				
4-Chloro-2-methyl phenoxy acetic acid [See MCPA]				
Chlorothalonil	0.18[c]	1994	0.36[c]	1994
Chlorpyrifos	0.0035	1997	0.002[c]	1997
Chromium				
Trivalent chromium (Cr(III))	8.9[c,k]	1997	56[c,k]	1997
Hexavalent chromium (Cr(VI))	1.0[k]	1997	1.5[k]	1997
Chrysene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Colour	Narrative	1999	Narrative	1999
Copper[d]	2–4[m]	1987		
Cyanazine	2.0[c,i]	1990		
Cyanide[d]	5 (as free CN)	1987		
DDAC (Didecyl dimethyl ammonium chloride)	1.5[c]	1999	Insufficient data	1999
DDT (total)[d] (2,2-Bis(*p*-chlorophenyl)-1,1,1-trichloroethane; dichloro diphenyl trichloroethane)	~~0.001~~[e,f]	1987		
Debris (litter/settleable matter)			Narrative[c]	1996

Continued.

	Freshwater		Marine	
Parameter[a]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date**[b]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date**[b]
Deltamethrin	0.0004	1997	Insufficient data	1997
Deposited bedload sediment [See Total particulate matter]				
Dibromochloromethane [See Halogenated methanes]				
Dicamba	10[c,i]	1993		
Dichlorobenzene [See Chlorinated benzenes]				
Dichlorobromomethane [See Halogenated methanes]				
Dichloro diphenyl trichloroethane [See DDT (total)]				
Dichloroethane [See Chlorinated ethanes]				
Dichloroethylene [See Chlorinated ethanes, 1,2-Dichloroethane]				
Dichloromethane [See Halogenated methanes]				
Dichlorophenols [See Chlorinated phenols]				
2,4-Dichlorophenoxyacetic acid [see Phenoxy herbicides]				
Diclofop-methyl	6.1	1993		
Didecyl dimethyl ammonium chloride [See DDAC]				
Diethylene glycol [See Glycols]				
Di(2-ethylhexyl) phthalate [See Phthalate esters]				
Diisopropanolamine (DIPA)[aa]	1600[c]	2005	Insufficient data	2005
Dimethoate	6.2[c]	1993	Insufficient data	1993
Di-*n*-butyl phthalate [See Phthalate esters]				
Di-*n*-octyl phthalate [See Phthalate esters]				
Dinoseb	0.05	1992		
Dissolved gas supersaturation	Narrative	1999	Narrative	1999
Dissolved oxygen	5500–9500[k,n]	1999	>8000 and Narrative[c,k]	1996
Endosulfan[d]	0.02	1987		
Endrin[d]	~~0.0023~~[e,f]	1987		
Ethylbenzene[j]	90[c,k]	1996	25[c,k]	1996
Ethylene glycol [See Glycols]				
Fluoranthene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Fluorene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Glycols				
Ethylene glycol	192 000[k]	1997	Insufficient data	1997
Diethylene glycol	Insufficient data[k]	1997	Insufficient data	1997
Propylene glycol	500 000[k]	1997	Insufficient data	1997
Glyphosate	65[c]	1989		

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Halogenated methanes				
Monochloromethane (Methyl chloride)[d]	Insufficient data	1992	Insufficient data	1992
Dichloromethane (Methylene chloride)	98.1[c,i]	1992	Insufficient data	1992
Trichloromethane (Chloroform)	1.8[c,i]	1992	Insufficient data	1992
Tetrachloromethane (Carbon tetrachloride)	13.3[c,i]	1992	Insufficient data	1992
Monobromomethane (Methyl bromide)[d]	Insufficient data	1992	Insufficient data	1992
Tribromomethane (Bromoform)[d]	Insufficient data	1992	Insufficient data	1992
Dibromochloromethane[d]	Insufficient data	1992	Insufficient data	1992
Dichlorobromomethane[d]	Insufficient data	1992	Insufficient data	1992
HCBD [See Hexachlorobutadiene (HCBD)]				
Heptachlor (Heptachlor epoxide)[d]	~~0.01~~[e,f]	1987		
Hexachlorobenzene [See Chlorinated benzenes]				
Hexachlorobutadiene (HCBD)	1.3[c, k]	1999		
Hexachlorocyclohexane (Lindane)[d]	0.01	1987		
Hypochlorous acid [See Reactive chlorine species]				
Imidacloprid[aa]	0.23[c]	2007	0.65[c]	2007
Inorganic fluorides	120[c]	2002		
3-Iodo-2-propynyl butyl carbamate [See IPBC]				
IPBC (3-Iodo-2-propynyl butyl carbamate)	1.9[c]	1999		
Iron[d]	300	1987		
Lead[d]	1–7[o]	1987		
Lindane [See Hexachlorocyclohexane]				
Linuron	7.0[c]	1995	Insufficient data	1995
MCPA (4-Chloro-2-methyl phenoxy acetic acid; 2-methyl-4-chloro phenoxy acetic acid)	2.6[c]	1995	4.2[c]	1995
Mercury[v]				
Inorganic Mercury[v]	0.026	2003	0.016[c,w]	2003
Methylmercury[v]	0.004[c,w]	2003		
Methyl bromide [See Halogenated methanes, Monobromomethane]				
Methyl chloride [See Halogenated methanes, Monochloromethane]				
2-Methyl-4-chloro phenoxy acetic acid [See MCPA]				
Methylene chloride [See Halogenated methanes, Dichloromethane]				
Methyl *tertiary*-butyl ether [See MTBE]				
Metolachlor	7.8[c]	1991		
Metribuzin	1.0[c]	1990		
Molybdenum[j]	73[c]	1999		
Monobromomethane [See Halogenated methanes]				
Monochloramine [See Reactive chlorine species]				

Continued.

Parameter[a]	Freshwater		Marine	
	Concentration ($\mu g \cdot L^{-1}$)	Date[b]	Concentration ($\mu g \cdot L^{-1}$)	Date[b]
Monochlorobenzene [See Chlorinated benzenes]				
Monochloromethane [See Halogenated methanes]				
Monochlorophenols [See Chlorinated phenols]				
MTBE (methyl *tertiary*-butyl ether)	10 000[c]	2003	5 000[c]	2003
Naphthalene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Nickel[d]	25–150[p]	1987		
Nitrate	13 000[c,u,y]	2003	16 000[c,u,y]	2003
Nitrite[d]	60[z]	1987		
Nonylphenol and its ethoxylates	1.0[c,t]	2002	0.7[c,t]	2002
Nutrients	Guidance Framework[x]	2004	Guidance Framework [aa,bb]	2007
Organotins				
Tributyltin	0.008[c]	1992	0.001[c]	1992
Tricyclohexyltin	Insufficient data	1992	Insufficient data	1992
Triphenyltin	0.022[c,i]	1992	Insufficient data	1992
Oxygen, dissolved [See Dissolved oxygen]				
PAHs [See Polycyclic aromatic hydrocarbons (PAHs)]				
PCBs [See Polychlorinated biphenyls (PCBs)(total)]				
PCE [See Chlorinated ethenes, 1,1,2,2-Tetrachloroethene]				
PCP [See Chlorinated phenols, Pentachlorophenol]				
Pentachlorobenzene [See Chlorinated benzenes]				
Pentachlorophenol [See Chlorinated phenols]				
Permethrin[aa]	0.004[c]	2006	0.001[c]	2006
pH[d]	6.5–9	1987	7.0–8.7 and Narrative	1996
Phenanthrene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Phenols (mono- & dihydric)	4.0[k]	1999		
Phenoxy herbicides[d, q]	4.0	1987		
Phosphorus	Guidance Framework[x]	2004	Guidance Framework[bb]	2007
Phthalate esters				
Di-*n*-butyl phthalate	19[c]	1993	Insufficient data	1993
Di(2-ethylhexyl) phthalate	16[c]	1993	Insufficient data	1993
Di-*n*-octyl phthalate	Insufficient data	1993	Insufficient data	1993
Picloram	29[c]	1990		
Polychlorinated biphenyls (PCBs) (total)[d]	~~0.001~~[e,f]	1987	~~0.01~~[e,f]	1991

Continued.

	Freshwater		Marine	
Parameter[a]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date[b]**	**Concentration ($\mu g \cdot L^{-1}$)**	**Date[b]**
Polycyclic aromatic hydrocarbons (PAHs)				
Acenaphthene	5.8[c]	1999	Insufficient data	1999
Acridine	4.4[c]	1999	Insufficient data	1999
Anthracene	0.012[c]	1999	Insufficient data	1999
Benz*(a)*anthracene	0.018[c]	1999	Insufficient data	1999
Benzo*(a)*pyrene	0.015[c]	1999	Insufficient data	1999
Chrysene	Insufficient data	1999	Insufficient data	1999
Fluoranthene	0.04[c]	1999	Insufficient data	1999
Fluorene	3.0[c]	1999	Insufficient data	1999
Naphthalene	1.1[c]	1999	1.4[c]	1999
Phenanthrene	0.4[c]	1999	Insufficient data	1999
Pyrene	0.025[c]	1999	Insufficient data	1999
Quinoline	3.4[c]	1999	Insufficient data	1999
Propylene glycol [See Glycols]				
Pyrene [See Polycyclic aromatic hydrocarbons (PAHs)]				
Quinoline [See Polycyclic aromatic hydrocarbons (PAHs)]				
Reactive chlorine species (hypochlorous acid and monochloramine)	0.5 and Narrative	1999	0.5 and Narrative	1999
Salinity			<10% fluctuation[c]	1996
Selenium[d]	1.0	1987		
Silver[d]	0.1	1987		
Simazine	10	1991		
Streambed substrate [See Total particulate matter]				
Styrene	72[c]	1999		
Sulfolane[aa]	50 000[c]	2005	Insufficient data	2005
Suspended sediments [See Total particulate matter]				
TCE [See Chlorinated ethenes, 1,1,2-Trichloroethene]				
Tebuthiuron	1.6[c]	1995	Insufficient data	1995
Temperature	Narrative[s]	1987	Not to exceed ±1°C and Narrative[c]	1996
Tetrachlorobenzene [See Chlorinated benzenes]				
Tetrachloroethane [See Chlorinated ethanes]				
Tetrachloroethene [See Chlorinated ethenes]				
Tetrachloroethylene [See Chlorinated ethenes, 1,1,2,2-Tetrachloroethene]				

Continued.

	Freshwater		Marine	
Parameter[a]	**Concentration ($\mu g \cdot L^{-1}$)**	**Date[b]**	**Concentration ($\mu g \cdot L^{-1}$)**	**Date[b]**
Tetrachloromethane [See Halogenated methanes]				
Tetrachlorophenols [See Chlorinated phenols]				
Thallium[j]	0.8	1999		
Toluene	2.0[c,j,k]	1996	215[c,k]	1996
Total particulate matter				
Deposited bedload sediment	Insufficient data	1999	Insufficient data	1999
Streambed substrate	Narrative	1999	Narrative	1999
Suspended sediments	Narrative	1999	Narrative	1999
Turbidity	Narrative	1999	Narrative	1999
Toxaphene[d]	~~0.008~~ [e,f]	1987		
Triallate	0.24[c]	1992		
Tribromomethane [See Halogenated methanes]				
Tributyltin [See Organotins]				
Trichlorobenzene [See Chlorinated benzenes]				
Trichloroethane [See Chlorinated ethanes]				
Trichloroethene [See Chlorinated ethenes]				
Trichloroethylene [See Chlorinated ethenes, 1,1,2-Trichloroethene]				
Trichloromethane [See Halogenated methanes]				
Trichlorophenols [See Chlorinated phenols]				
Tricyclohexyltin [See Organotins]				
Trifluralin	0.20[i]	1993		
Triphenyltin [See Organotins]				
Turbidity [See Total particulate matter]				
Zinc[d]	30	1987		

[a]Unless otherwise indicated, supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

[b]The guidelines dated 1987 have been carried over from *Canadian Water Quality Guidelines* (CCREM 1987) and no fact sheet was prepared. The guidelines dated 1989 to 1997 were developed and initially published in CCREM 1987 as appendixes on the date indicated. They are published as fact sheets in this document. Other guidelines dated 1997 and those dated 1999 are published for the first time in this document.

[c]Interim guideline.

[d]No fact sheet created. For more information on this guideline, please refer to *Canadian Water Quality Guidelines* (CCREM 1987).

[e]This guideline (originally published in *Canadian Water Quality Guidelines* [CCREM 1987 + Appendixes] in 1987 or 1991 [PCBs in marine waters]) is no longer recommended and the value is withdrawn. A water quality guideline is not recommended. Environmental exposure is predominantly via sediment, soil, and/or tissue, therefore, the reader is referred to the respective guidelines for these media.

[f]This substance meets the criteria for Track 1 substances under the national CCME Policy for the Management of Toxic Substances (PMTS) (i.e., persistent, bioaccumulative, primarily the result of human activity, and CEPA-toxic or equivalent), and should be subject to virtual elimination strategies. Guidelines can serve as action levels or interim management objectives towards virtual elimination.

[g]Aluminium guideline= 5 $\mu g \cdot L^{-1}$ at pH <6.5
= 100 $\mu g \cdot L^{-1}$ at pH ≥6.5

[h]Ammonia guideline: Expressed as μg unionized ammonia$\cdot L^{-1}$. This would be equivalent to 15.2 μg ammonia-nitrogen$\cdot L^{-1}$. Guideline for total ammonia is temperature and pH dependent, please consult factsheet for more information.

[i]Guideline value slightly modified from CCREM 1987 + Appendixes due to re-evaluation of the significant figures.

[j]The technical document for the guideline is available from the Ontario Ministry of the Environment.

[k]Substance has been re-evaluated since CCREM 1987 + Appendixes. Either a new guideline has been derived or insufficient data existed to derive a new guideline.

[l]Cadmium guideline $= 10^{\{0.86[\log(\text{hardness})] - 3.2\}}$.

[m]Copper guideline
= 2 $\mu g \cdot L^{-1}$ at a water hardness of 0–120 $mg \cdot L^{-1}$ (soft to medium) as $CaCO_3$
= 3 $\mu g \cdot L^{-1}$ at a water harness of 120–180 $mg \cdot L^{-1}$ (hard) as $CaCO_3$
= 4 $\mu g \cdot L^{-1}$ at a water harness >180 $mg \cdot L^{-1}$ (very hard) as $CaCO_3$

[n]Dissolved oxygen for warm-water biota: early life stages = 6000 $\mu g \cdot L^{-1}$
other life stages = 5500 $\mu g \cdot L^{-1}$
for cold-water biota: early life stages = 9500 $\mu g \cdot L^{-1}$
other life stages = 6500 $\mu g \cdot L^{-1}$

[o]Lead guideline
= 1 $\mu g \cdot L^{-1}$ at a water harness of 0–60 $mg \cdot L^{-1}$ (soft) as $CaCO_3$
= 2 $\mu g \cdot L^{-1}$ at a water harness of 60–120 $mg \cdot L^{-1}$ (medium) as $CaCO_3$
= 4 $\mu g \cdot L^{-1}$ at a water harness of 120–180 $mg \cdot L^{-1}$ (hard) as $CaCO_3$
= 7 $\mu g \cdot L^{-1}$ at a water harness >180 $mg \cdot L^{-1}$ (very hard) as $CaCO_3$

[p]Nickel guideline
= 25 $\mu g \cdot L^{-1}$ at a water harness of 0–60 $mg \cdot L^{-1}$ (soft) as $CaCO_3$
= 65 $\mu g \cdot L^{-1}$ at a water harness of 60–120 $mg \cdot L^{-1}$ (medium) as $CaCO_3$
= 110 $\mu g \cdot L^{-1}$ at a water harness of 120–180 $mg \cdot L^{-1}$ (hard) as $CaCO_3$
= 150 $\mu g \cdot L^{-1}$ at a water harness >180 $mg \cdot L^{-1}$ (very hard) as $CaCO_3$

[q]The guideline of 4.0 $\mu g \cdot L^{-1}$ for phenoxy herbicides is based on data for ester formulations of 2,4-dichlorophenoxyacetic acid.

[r]The technical document for the guideline is available from British Columbia Ministry of Environment, Lands and Parks.

[s]Temperature: (for more information, see CCREM 1987)

Thermal Stratification: Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins.

Maximum Weekly Average Temperature: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded.

Short-term Exposure to Extreme Temperature: Thermal additions to receiving waters should be such that the short-term exposures to maximum temperatures are not exceeded. Exposures should not be so lengthy or frequent as to adversely affect the important species.

[t]Expressed on a TEQ basis using NP TEFs, see Table 2 in factsheet.

[u]For protection from direct toxic effects; the guidelines do not consider indirect effects due to eutrophication.

[v]May not prevent accumulation of methylmercury in aquatic life, therefore, may not protect wildlife that consume aquatic life; see factsheet for details. Consult also the appropriate Canadian Tissue Residue Guideline for the Protection of Wildlife Consumers of Aquatic Biota.

[w]May not fully protect higher trophic level fish; see factsheet for details.

[x]Canadian Guidance Framework for Phosphorus is for developing phosphorus guidelines (does not provide guidance on other freshwater nutrients). It provides Trigger Ranges for Total Phosphorus (see Guidance Framework for Phosphorus factsheet):

ultra-oligotrophic <4 $\mu g \cdot L^{-1}$
oligotrophic 4-10 $\mu g \cdot L^{-1}$
mesotrophic 10-20 $\mu g \cdot L^{-1}$
meso-eutrophic 20-35 $\mu g \cdot L^{-1}$
eutrophic 35-100 $\mu g \cdot L^{-1}$
hyper-eutrophic >100 $\mu g \cdot L^{-1}$

[y]Guidelines are expressed in μg nitrate$\cdot L^{-1}$. These values are equivalent to 2900 μg nitrate-nitrogen$\cdot L^{-1}$, and 3600 μg nitrate-nitrogen$\cdot L^{-1}$, for freshwater and marine respectively.

[z]Guideline is expressed as μg nitrite-nitrogen$\cdot L^{-1}$. This value is equivalent to 197 μg nitrite$\cdot L^{-1}$.

[aa]Supporting documents are available from the Canadian Council of Ministers of the Environment at http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=125

[bb]The Canadian Guidance Framework for the Management of Nearshore Marine Systems is for developing nutrient (phosphorus and nitrogen) guidelines for nearshore marine systems. Refer to factsheet for details

Reference

CCREM (Canadian Council of Resource and Environment Ministers). 1987. Canadian water quality guidelines. Prepared by the Task Force on Water Quality Guidelines.

Reference listing:

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the protection of aquatic life: Summary table. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

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Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

SUMMARY TABLES

Update 7.0
September 2007

Table 1. Canadian Soil Quality Guidelines (mg·kg^{-1}).

Substance[y]	Year revised/ released[a]	Land Use and Soil Texture							
		Agricultural*		Residential/ parkland*		Commercial*		Industrial*	
		Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine
Arsenic (inorganic)	1997	12[b]		12[b]		12[b]		12[b]	
Barium	2003	750[c]		500[c]		2000[c]		2000[c]	
Benzene									
Surface[w]	2004	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Subsoil[w]	2004	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Surface[x]	2004	0.0095[t,u]	0.0068[t,u]	0.0095[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Subsoil[x]	2004	0.011[t,u]	0.0068[t,u]	0.011[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]	0.030[t,u]	0.0068[t,u]
Benzo*(a)*pyrene	1997	0.1[e]		0.7[f]		0.7[f]		0.7[f]	
Cadmium	1999	1.4[b]		10[g]		22[b]		22[b]	
Chromium									
Total chromium	1997	64[b]		64[b]		87[b]		87[b]	
Hexavalent chromium (VI)	1999	0.4[h]		0.4[h]		1.4[h]		1.4[h]	
Copper	1999	63[b]		63[b]		91[b]		91[b]	
Cyanide (free)	1997	0.9[b]		0.9[b]		8.0[b]		8.0[b]	
DDT (total)	1999	0.7[i]		0.7[i]		12[i,j]		12[i,j]	
Diisopropanolamine (DIPA)[z]	2006	180[b]		180[b]		180[b]		180[b]	
Ethylbenzene									
Surface	2004	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]
Subsoil	2004	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]
Ethylene glycol	1999	960[k]		960[k]		960[k]		960[k]	
Lead	1999	70[b]		140[b]		260[b]		600[b]	
Mercury (inorganic)	1999	6.6[b]		6.6[b]		24[b]		50[b]	
Naphthalene	1997	0.1[d]		0.6[h]		22[h]		22[h]	
Nickel	1999	50[l]		50[l]		50[l]		50[l]	
Nonylphenol (and its ethyloxylates)	2002	5.7[p]		5.7[p]		14[p]		14[p]	
Pentachlorophenol	1997	7.6[b]		7.6[b]		7.6[b]		7.6[b]	
Phenol	1997	3.8[b]		3.8[b]		3.8[b]		3.8[b]	
Polychlorinated biphenyls (PCBs)	1999	0.5[m]		1.3[l]		33[j,l]		33[j,l]	
Polychlorinated dibenzo-*p*-dioxins/ dibenzofurans (PCDD/Fs)	2002	4 ng TEQ·kg^{-1} [q]		4 ng TEQ·kg^{-1} [q]		4 ng TEQ·kg^{-1} [r]		4 ng TEQ·kg^{-1} [s]	
Propylene glycol	2006	Insufficient information[v]		Insufficient information[v]		Insufficient information[v]		Insufficient information[v]	
Selenium	2007	1[b]		1[b]		2.9[b]		2.9[b]	

Continued

Substance	Year revised/ released[a]	Land Use and Soil Texture							
		Agricultural*		Residential/ parkland*		Commercial*		Industrial*	
		Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine
Sulfolane[z]	2006	0.8[b]		0.8[b]		0.8[b]		0.8[b]	
Tetrachloroethylene	1997	0.1[e]		0.2[f]		0.5[f]		0.6[f]	
Thallium	1999	1[n]		1[o]		1[o]		1[o]	
Toluene									
Surface	2004	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Subsoil	2004	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Trichloroethylene	2006	0.01[b,u]		0.01[b,u]		0.01[b,u]		0.01[b,u]	
Uranium[z]	2007	23[t]		23[t]		33[t]		300[t]	
Vanadium	1997	130[l]		130[l]		130[i]		130[i]	
Xylenes									
Surface	2004	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Subsoil	2004	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Zinc	1999	200[l]		200[l]		360[l]		360[l]	

Notes: SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health.

*For guidelines derived prior to 2004, differentiation between soil texture (coarse/fine) is not applicable.

[a]Guidelines released in 1997 were originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited, and reprinted here. Guidelines revised/released in 1999 are published here for the first time (see Table 2).

[b]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de novo* guideline for this land use, derived in accordance with the soil protocol (CCME 1996; 2006). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

[c]Data are insufficient/inadequate to calculate an SQG_{HH}, a provisional SQG_{HH}, an SQG_E, or a provisional SQG_E. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use (see table 2).

[d]Data are sufficient and adequate to calculate only a provisional SQG_E. It is greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[e]Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[f]Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are less than corresponding interim soil quality criterion (CCME 1991). Therefore the soil quality guideline supersedes the interim soil quality criterion for this land use.

[g]The soil–plant–human pathway was not considered in the guideline derivation. If produce gardens are present or planned, a site-specific objective must be derived to take into account the bioaccumulation potential (e.g., adopt the agricultural guideline as objective). The off-site migration check should be recalculated accordingly.

[h]Data are sufficient and adequate to calculate only a provisional SQG_E, which is less than the existing interim soil quality criterion (CCME 1991). Therefore the provisional soil quality guideline supersedes the interim soil quality criterion for this land use.

[i]Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_E becomes the soil quality guideline.

[j]In site-specific situations where the size and/or the location of commercial and industrial land uses may impact primary, secondary, or tertiary consumers, the soil and food ingestion guideline is recommended as the SQG_E.

[k]Data are sufficient and adequate to calculate only a provisional SQG_E.

[l]Data are sufficient and adequate to calculate only an SQG_E, which is less than the interim soil quality criterion (CCME 1991) for this land use. Therefore the SQG_E becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[m]Data are sufficient and adequate to calculate only an SQG_E, which is greater than the interim soil quality criterion (CCME 1991) for this land use. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[n]Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is equal to the SQG_E and to the existing interim soil quality criterion (CCME 1991) and thus becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[o]Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is less than the SQG_E and thus becomes the soil quality guideline for this land use.

[p]Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for these substances, therefore, the SQG_E becomes the soil quality guideline.

[q]Data are sufficient and adequate to calculate only a provisional SQG_{HH}, which is less than the existing interim soil quality criterion (CCME 1991). Thus the provisional SQG_{HH} becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[r]Data are sufficient and adequate to calculate only a provisional SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the provisional SQG_{HH} becomes the soil quality guideline.

[s]Data are sufficient and adequate to calculate only an SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_{HH} becomes the soil quality guideline.

[t]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de novo* guideline for this land use.

[u]This guideline value may be less than the common limit of detection in some jurisdictions. Contact jurisdictions for guidance.

[v]Data are sufficient and adequate to calculate only a preliminary SQG_{FWAL} (Soil Quality Guideline for freshwater aquatic life). This value is 6,210 $mg \cdot kg^{-1}$. See accompanying factsheet for further information.

[w]10^{-5} Incremental Risk

[x]10^{-6} Incremental Risk

[y]Unless otherwise indicated, supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

[z]Supporting documents are available from the Canadian Council of Ministers of the Environment at http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=125

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Table 2. Interim remediation criteria for soil ($mg \cdot kg^{-1}$) that have not yet been replaced by Canadian Soil Quality Guidelines[1].

Parameter	Year released	Land use			
		Agricultural	Residential/ parkland	Commercial	Industrial
General Parameters					
Conductivity [dS/m]	1991	2	2	4	4
pH	1991	6 to 8	6 to 8	6 to 8	6 to 8
Sodium adsorption ratio	1991	5	5	12	12
Inorganic Parameters					
Antimony	1991	20	20	40	40
Beryllium	1991	4	4	8	8
Boron (hot water soluble)	1991	2	—	—	—
Cobalt	1991	40	50	300	300
Fluoride (total)	1991	200	400	2000	2000
Molybdenum	1991	5	10	40	40
Silver	1991	20	20	40	40
Sulphur (elemental)	1991	500	—	—	—
Tin	1991	5	50	300	300
Monocyclic Aromatic Hydrocarbons					
Chlorobenzene	1991	0.1	1	10	10
1,2-Dichlorobenzene	1991	0.1	1	10	10
1,3-Dichlorobenzene	1991	0.1	1	10	10
1,4-Dichlorobenzene	1991	0.1	1	10	10
Styrene	1991	0.1	5	50	50
Phenolic Compounds					
Chlorophenols[a] (each)	1991	0.05	0.5	5	5
Nonchlorinated[b] (each)	1991	0.1	1	10	10
Polycyclic Aromatic Hydrocarbons (PAHs)					
Benzo*(a)*anthracene	1991	0.1	1	10	10
Benzo*(b)*fluoranthene	1991	0.1	1	10	10
Benzo*(k)*fluoranthene	1991	0.1	1	10	10
Dibenz*(a,h)*anthracene	1991	0.1	1	10	10
Indeno(1,2,3-c,d)pyrene	1991	0.1	1	10	10
Phenanthrene	1991	0.1	5	50	50
Pyrene	1991	0.1	10	100	100
Chlorinated Hydrocarbons					
Chlorinated aliphatics[c] (each)	1991	0.1	5	50	50
Chlorobenzenes[d] (each)	1991	0.05	2	10	10
Hexachlorobenzene	1991	0.05	2	10	10
Hexachlorocyclohexane	1991	0.01	—	—	—
Miscellaneous Organic Parameters					
Nonchlorinated aliphatics (each)	1991	0.3	—	—	—
Phthalic acid esters (each)	1991	30	—	—	—
Quinoline	1991	0.1	—	—	—
Thiophene	1991	0.1	—	—	—

[1]**Notes:**

All values are in $mg \cdot kg^{-1}$ unless otherwise stated.

Guidelines released in 1991 were published in "Interim Canadian Environmental Quality Criteria for Contaminated Sites" (CCME, 1991).

These interim remediation criteria are considered generally protective of human and environmental health and were based on experience and professional judgement.

These interim criteria (CCME, 1991) should only be used when soil quality guidelines based on the CCME soil protocol (CCME, 1996; 2006) have not yet been developed for a given chemical. Also, because the interim remediation criteria were not developed using the soil protocol and its integral checks, they cannot be modified through the site specific remediation objective procedure.

[a]Chlorophenols include
- chlorophenol isomers (ortho, meta, para)
- dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)
- trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,4- 3,4,5-)
- tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)

[b]Nonchlorinated phenolic compounds include
- 2,4-dimethylphenol
- 2,4-dinitrophenol
- 2-methyl 4,6-dinitrophenol
- nitrophenol (2-,4-)
- phenol
- cresol

[c]Aliphatic chlorinated hydrocarbons include
- chloroform
- dichloroethane (1,1- 1,2-), dichloroethene (1,1- 1,2-)
- dichloromethane
- 1,2-dichloropropane, 1,2-dichloropropene (cis and trans)
- 1,1,2,2-tetrachloroethane, tetrachloroethene
- carbon tetrachloride
- trichloroethane (1,1,1- 1,1,2-), trichloroethene

[d]Chlorobenzenes include
- all trichlorobenzene isomers
- all tetrachlorobenzene isomers
- pentachlorobenzene

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