7 December 2018

Eqe Bay Exploration Program

Type ‘B’ Water Licence Application

Attachment 13

Water Sampling QA/QC Plan

Baffinland Iron Mines Corporation

Surface Water Sampling Program – Quality Assurance and Quality Control Plan

BAF-PH1-830-P16-0001

Rev 2

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TRACK CHANGES TABLE

A review and update of the Surface Water Sampling Program – Quality Assurance and Quality Control Plan has been undertaken, with the following salient revisions to the March 14, 2016 version (BAF-PH1-830-P16-0001, Rev 1).

Index of Major Changes/Modifications in Revision 2

Item No.	Description of Change	Relevant Section
1	Addition of MMER sampling protocol and clarification of QA/QC definitions	Section 4 Section 7

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1 INTRODUCTION

As required by Baffinland Iron Mines Corporation's (Baffinland) Type A Water Licence No. 2AM-MRY1325 Amendment No. 1 (Type A Water Licence) and Type B Water Licence No. 2BE-MRY1421 (Type B Water Licence) for the Mary River Project (Project), a review of Project Environmental Management and Monitoring Plans (EEMPs) was completed. This Quality Assurance and Quality Control (QA/QC) Plan was updated to meet the requirements of the Type A and B water licences. Further and continual modifications and revisions to this Plan shall be completed based on changes to operations, QA/QC procedures, and protocols. Updates to this Plan shall be completed in accordance to the terms and conditions of Baffinland's water licences, QIA Commercial Lease – Q13C301, issued September 6, 2013, the amended Project Certificate No. 005 issued by the Nunavut Impact Review Board (NIRB) and any subsequent requirements which may be issued.

This QA/QC Plan has been reviewed to fulfill the requirement of Part I, Item 16 of License No. 2AM-MRY1325 Amendment No. 1 approved by the Nunavut Water Board to Baffinland Iron Mines Corporation (Baffinland) on July 21, 2015.

In accordance with the stipulations of the Type A Water Licence No. 2AM-MRY1325 Amendment No. 1, this QA/QC Plan has been prepared following the general recommendations presented in *Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan (*INAC, 1996). A copy of the guidelines is included in Appendix A.

1.1 PURPOSE AND SCOPE

The purpose of this Plan is to identify Baffinland's framework for accurate and effective QA/QC management by providing instruction for standardised field sampling and laboratory analytical procedures.

For the purposes of this report, QA/QC is defined as:

- ***Quality Assurance*** - System of activities used to achieve quality control.
- ***Quality Control*** - Set of best practice methods and procedures used to ensure quality of data in terms of precision, accuracy and reliability.

The QA/QC best practices outlined in this management plan are designed to provide guidance to field staff and analytical laboratories in order to maintain a high level of confidence in the water quality, soil, and benthic data generated from Project Sites.

1.2 REGULATORY REQUIRMENTS

Baffinland's QA/QC Plan is regulated by the Nunavut Water Board (NWB) and is subject to Baffinland's Type A Water Licence No. 2AM-MRY1325 Amendment No. 1 which provides specific Terms and Conditions for the management of QA/QC procedures at the Project Sites.

Both federal and territorial legislation regulates water and soil quality and benthic communities in Nunavut. This legislation expects a professional standard and level of confidence when evaluating these parameters and therefore apply to this QA/QC management plan.

1.3 RELATIONSHIPS TO OTHER MANAGEMENT PLANS

This Plan is intended for use in conjunction with the following Plans:

1. Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
2. Aquatic Effects and Monitoring Plan (BAF-PH1-830-P16-0039)
3. Environmental Protection Plan (BAF-PH1-830-P16-0008)
4. Fresh Water Supply, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010)
5. Hazardous Materials and Hazardous Waste Management Plan (BHF-PH1-830-P16-0011)
6. Interim Mine Closure and Reclamation Plan (BAF-PH1-830-P16-0012)
7. Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026)
8. Terrestrial Environmental Management and Monitoring Plan (BAF-PH1-830-P16-0027)
9. Waste Management Plan (BAF-PH1-830-P16-0028)

2 BAFFINLAND POLICIES

2.1 HEALTH, SAFETY AND ENVIRONMENT POLICY

This Baffinland Iron Mines Corporation Policy on Health, Safety and Environment is a statement of our commitment to achieving a safe, healthy and environmentally responsible workplace. We will not compromise this policy for the achievement of any other organizational goals.

We implement this Policy through the following commitments:

1. Continual improvement of safety, occupational health and environmental performance
2. Meeting or exceeding the requirements of regulations and company policies
3. Integrating sustainable development principles into our decision-making processes
4. Maintaining an effective Health, Safety and Environmental Management System
5. Sharing and adopting improved technologies and best practices to prevent injuries, occupational illnesses and environmental impacts
6. Engaging stakeholders through open and transparent communication.
7. Efficiently using resources, and practicing responsible minimization, reuse, recycling and disposal of waste.
8. Reclamation of lands to a condition acceptable to stakeholders.

Our commitment to provide the leadership and action necessary to accomplish this policy is exemplified by the following principles:

- As evidenced by our motto “Safety First, Always” and our actions Health and safety of personnel and protection of the environment are values not priorities.
- All injuries, occupational illnesses and environmental impacts can be prevented.
- Employee involvement and active contribution through courageous leadership is essential for preventing injuries, occupational illnesses and environmental impacts.
- Working in a manner that is healthy, safe and environmentally sound is a condition of employment.
- All operating exposures can be safeguarded.
- Training employees to work in a manner that is healthy, safe and environmentally sound is essential.
- Prevention of personal injuries, occupational illnesses and environmental impacts is good business.
- Respect for the communities in which we operate is the basis for productive relationships.

We have a responsibility to provide a safe workplace and utilize systems of work to meet this goal. All employees must be clear in understanding the personal responsibilities and accountabilities in relation to the tasks we undertake.

The health and safety of all people working at our operation and responsible management of the environment are core values to Baffinland. In ensuring our overall profitability and business success every Baffinland and business partner employee working at our work sites is required to adhere to this Policy.

Brian Penney
Chief Executive Officer
March 2017

2.2 SUSTAINABLE DEVELOPMENT POLICY

At Baffinland Iron Mines Corporation (Baffinland), we are committed to conducting all aspects of our business in accordance with the principles of sustainable development & corporate responsibility and always with the needs of future generations in mind. Baffinland conducts its business in accordance with the Universal Declaration of Human Rights and ArcelorMittal’s Human Rights Policy which applies to all employees and affiliates globally.

Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and with utmost respect for the cultural values and legal rights of Inuit. We expect each and every employee, contractor, and visitor to demonstrate courageous leadership in personally committing to this policy through their actions. The Sustainable Development and Human Rights Policy is communicated to the public, all employees and contractors and it will be reviewed and revised as necessary on a regular basis. These four pillars form the foundation of our corporate responsibility strategy:

1. Health and Safety
2. Environment
3. Upholding Human Rights of Stakeholders
4. Transparent Governance

1.0 HEALTH AND SAFETY

- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness, where everyone goes home safe everyday of their working life. Why? Because our people are our greatest asset. Nothing is as important as their health and safety. Our motto is “Safety First, Always”.
- We report, manage and learn from injuries, illnesses and high potential incidents to foster a workplace culture focused on safety and the prevention of incidents.
- We foster and maintain a positive culture of shared responsibility based on participation, behaviour, awareness and promoting active courageous leadership. We allow our employees and contractors the right to stop any work if and when they see something that is not safe.

2.0 ENVIRONMENT

- Baffinland employs a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.

- Baffinland applies the principles of pollution prevention, waste reduction and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation.
- We continuously seek to use energy, raw materials and natural resources more efficiently and effectively. We strive to develop more sustainable practices.
- Baffinland ensures that an effective closure strategy is in place at all stages of project development to ensure reclamation objectives are met.

3.0 UPHOLDING HUMAN RIGHTS OF STAKEHOLDERS

- We respect human rights, the dignity of others and the diversity in our workforce. Baffinland honours and respects the unique cultural values and traditions of Inuit.
- Baffinland does not tolerate discrimination against individuals on the basis of race, colour, gender, religion, political opinion, nationality or social origin, or harassment of individuals freely employed.
- Baffinland contributes to the social, cultural and economic development of sustainable communities in the North Baffin Region.
- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions.
- We expect our employees and contractors, as well as community members, to bring human rights concerns to our attention through our external grievance mechanism and internal human resources channels. Baffinland is committed to engaging with our communities of interest on our human rights impacts and to reporting on our performance.

4.0 TRANSPARENT GOVERNANCE

- Baffinland will take steps to understand, evaluate and manage risks on a continuing basis, including those that may impact the environment, employees, contractors, local communities, customers and shareholders.
- Baffinland endeavours to ensure that adequate resources are available and that systems are in place to implement risk-based management systems, including defined standards and objectives for continuous improvement.
- We measure and review performance with respect to our safety, health, environmental, socio-economic commitments and set annual targets and objectives.
- Baffinland conducts all activities in compliance with the highest applicable legal & regulatory requirements and internal standards.
- We strive to employ our shareholder's capital effectively and efficiently and demonstrate honesty and integrity by applying the highest standards of ethical conduct.

4.1 FURTHER INFORMATION

Please refer to the following policies and documents for more information on Baffinland's commitment to operating in an environmentally and socially responsible manner:

Health, Safety and Environment Policy
Workplace Conduct Policy
Inuktitut in the Workplace Policy
Site Access Policy
Hunting and Fishing (Harvesting) Policy
Annual Report to Nunavut Impact Review Board
ArcelorMittal Canada Sustainability and Corporate Responsibility Report

If you have questions about Baffinland's commitment to upholding human rights, please direct them to contact@baffinland.com.

Brian Penney
Chief Executive Officer
March 2017

3 ENVIRONMENTAL RESPONSIBILITIES

3.1 ROLES AND RESPONSIBILITIES

The Baffinland Environmental Team is organised into two parts, on site as well as off site. The organisational structure for the Mary River Project in relation to the environment discipline is shown in Table 3-1 and 3-2 below.

TABLE 3-1: BAFFINLAND SENIOR MANAGEMENT

Baffinland Senior Management	
Position	**Responsibilities and Accountabilities**
Chief of Operations	- Reports to Baffinland's CEO - Overall accountability for the operation of the Project - Allocation of resources (human and financial) for the implementation of Baffinland's commitments and objectives related to health, safety and environment during operation - Accountable for on-site environmental, health and safety performance during operation
VP Sustainable Development	- Reports to Baffinland's CEO - Establish corporate environmental policies and objectives - Monitors and reports on Baffinland's performance related to environmental policies and objectives - Liaise with regulatory authorities - Obtains necessary permits and authorizations - Monitors compliance with terms and conditions of permits and licences
Chief Procurement Officer	- Reports to Baffinland's CEO - Accountable for procurement and purchasing - Ensure that environmental commitments, policies and objectives are included in all contract documents

Baffinland Senior Management	
Position	**Responsibilities and Accountabilities**
Director Inuit, Government and Stakeholder Relations	- Reports to VP Sustainable Development - Accountable for external communication (Governments, media, NGO, others) related to Baffinland's press release and overall communication of site incidents/events - Community liaisons report to position
Director of Sustainable Development	- Reports directly to VP Sustainable Development and indirect reporting and coordination with Chief of Operations - Liaises with the senior management, regulators and stakeholders - Ensures effective monitoring and auditing of environmental performance of departments and contractors on site and identifies opportunities for improvement - Monitors compliance with permits, licenses and authorizations - Ensures all regulatory environmental monitoring and reporting requirements (monthly, annual) are met - Leads and coordinates site permitting requirements. - Initiates and oversees environmental studies

Baffinland's Project Environmental Department provides direction and oversight for environmental activities on-site. Project departmental accountabilities and responsibilities are identified in Table 3-2.

TABLE 3-2: BAFFINLAND PROJECT ENVIRONMENTAL DEPARTMENT (ONSITE)

Baffinland Project Environmental Department (Onsite)	
Position	**Responsibilities and Accountabilities**
Environmental Superintendent	- Reports to Director of Sustainable Development and indirect reporting and coordination with Chief of Operations - Overall accountability for environmental staff and performance at site - Coordinates implementation and monitors the performance of the Environmental Management System at site - Serves as the liaison for regulators during onsite inspections and visits - Provides ongoing environmental education and environmental awareness training to all employees and contract workers - Oversees investigations and reporting of environmental incidents to regulatory bodies, stakeholders and senior management - Reviews updates for management plans
Environmental Coordinator	- Reports to the Environmental Superintendent - Specific accountabilities for environmental monitoring and reporting - Provides day to day direction to Environmental staff onsite - Serves as a liaison for regulators during onsite inspections and visits. - Provides ongoing environmental education and environmental awareness training to all employees and contract workers

Baffinland Project Environmental Department (Onsite)	
Position	**Responsibilities and Accountabilities**
	- Assists with environmental database management - Prepare updates for management plans - Assist with monitoring and sampling activities as per the project's management plans
Environmental Monitor and Technician	- Reports to the Environmental Superintendent or designate - Assists with environmental database management - Assists with monitoring and sampling activities as per the Project's management plans
QIA Monitor	- Works alongside the Baffinland Environment Department to ensure the proper implementation of all environmental management and monitoring plans - Acts as the QIA liaison for onsite environmental matters
Environmental Support Groups (Consultants, etc.)	- Assists with sampling, monitoring and reporting activities as required by permits, licenses and environmental management plans - Provides technical expertise to various environmental studies

3.2 TRAINING AND AWARENESS

All site personnel (including contractors) are required to obtain a general level of environmental awareness and understanding of their obligations regarding compliance with regulatory requirements, commitments and best practices. Site personnel receive prescribed environmental training as part of Baffinland's Mary River Project Site Orientation.

Environment personnel performing environmental monitoring programs are required to understand and be proficient with the QA/QC procedures outlined in this management plan.

4 WATER SAMPLE COLLECTION

4.1 GENERAL

The samples will be collected following the general recommendations presented in *Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan* (INAC, 1996). A copy of the guidelines is included in Appendix A.

A summary of recommended water sample containers, sample volumes, sample preservatives and maximum sample holding times is presented in Table 9.1. Laboratory parameters such as pH, turbidity, BOD, nitrite, nitrate, total phosphorus, faecal coliforms, chlorophyll-a and pheophytin typically have maximum sample storage times varying from four (4) to 72 hours. Due to the remoteness of the site, it may not always be possible to get laboratory analysis done within the sample holding time window. Every effort will be made to get samples analysed within the preferred holding time window.

Every effort will be made to prevent accidental freezing of water samples (due to on-site climatic conditions) which could affect analytical results for parameters.

For a complete list of the required sample analyses at each monitoring station, please refer to the following documents:

- Baffinland's Type A Water Licence No. 2AM-MRY1325
- Baffinland's Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)
- Metal Mining Effluent Regulations (Environment and Climate Change Canada)

4.2 WATER QUALITY MONITORING LOCATIONS

The QA/QC Plan addresses the collection of freshwater surface water quality samples related to monitoring programs being carried out in support of Baffinland's Mary River Project, namely:

1. Collection of environmental surface water samples from area lakes, streams and rivers.
2. Collection of effluent samples from the current and future wastewater treatment facilities located at the Mine Site, Milne Port and Steensby Port.
3. Collection of drinking water samples from camp potable water sources.
4. Collection of surface water discharges from ore stockpiles and waste rock dumps.
5. Collection of surface water discharges from future bulk sample open pits.
6. Collection of water samples from fuel berms and dispensing facilities.
7. Collection of water samples from land-farm facilities and maintenance shops.
8. Collection of effluent samples from oily water treatment systems.
9. Collection of surface water discharges from landfill facilities at the Mine Site.

10. Collection of water samples representative of general site drainage before, during and after construction on Project Sites and the Tote Road.
11. Collection of water samples downstream of active Quarry locations
12. Measurement of water sample field parameters (e.g. pH, conductivity, temperature etc.).

Exact locations and sampling frequency for designated monitoring stations are presented in Baffinland's Type A Water Licence No. 2AM-MRY1325 and Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039).

4.3 WATER SAMPLING METHODS AND EQUIPMENT

Water samples specified under Baffinland's Type A Water Licence, Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039) and the Federal Metal Mining Effluent Regulations are characterised by the following procedures.

4.3.1 GENERAL SAMPLING PROCEDURES

Generally, sampling procedures will consist of the following:

1. Sampler will wear a fresh pair of disposable nitrile gloves for each sampling event.
2. A fresh sample bottle(s) will be used at each monitoring station. Sample bottles will not be re-used.
3. Sampling will be carried out by either: i) rinsing the sample bottle with source water three times before immersing the sample bottle to fill it (after which preservative is added, as required), or ii) if the sample bottles are provided pre-charged with preservatives then it is generally convenient to transfer water samples from the source to the sample bottle using a 1-2L plastic jug. Plastic jugs will be rinsed in the source water three times before filling the sample bottle. A dedicated jug will be used for different sample types (e.g. sewage effluent, hydrocarbon impacted stormwater). Sample jugs will be replaced on a regular basis.
4. Rinse water will be disposed of so that it does not contaminate the source water where the sample will be collected e.g. downstream of the sampling location, or on the shore or berm edge.
5. Bottles labeled as "certified sterile" do not need to be rinsed.
6. For samples requiring preservatives, the sample bottle will be filled to the top (or to the indicator line marked on the bottle), the preservative will be added and the bottle securely sealed. Note that for some volatile contaminants (e.g. BTEX), the sample bottle must be filled with zero headspace.
7. Care will be taken to avoid disturbance of sediments and inclusion of disturbed suspended solids in the sample.
8. Sample details e.g. date, sample ID and analysis will be clearly marked on the bottle in permanent ink.
9. For dissolved metals analyses, if possible, the water sample will be filtered in the field immediately after sampling using a 0.45µm disposable filter and syringe. A fresh syringe and filter must be used at each monitoring station.

10. All samples will be sealed by ensuring their lids are tightly secured before placing the bottles into the coolers. Glass bottles will be protected with bubble wrap or other cushioning material.
11. All field parameters, notes, photo references and general observations shall be recorded in a notebook or log sheet to later be uploaded to Baffinland's environmental database.
12. All samples will be placed in an iced cooler as soon as possible after collection.

4.3.1.1 SAMPLE PRESERVATION

Sample bottles and preservative will be stored under clean conditions on site. Sample bottles will have the appropriate volume of preservative added in the field immediately after sample collection to minimize chemical alterations. Alternatively, sample bottles will be supplied by the analytical laboratory with preservatives already added. Ensure that the preservative container does not come in contact with the sample or inside of the sample bottle/lid. If a water sample requires filtration (e.g., analysis of dissolved metals), preservative must be added following filtration.

4.3.2 LAKE SAMPLING

For monitoring of water quality arising from vertical stratification in lakes, a depth sampler will be used (e.g. a 'Van Dorn' or 'Kemmerer'). Generally, depth samplers consist of a clear polycarbonate sample tube with two spring mounted rubber bungs, one located at each end. The depth sampler is lowered to the correct depth attached to a cord, whereupon a metal weight is released. The weight slides down the cord and strikes a release mechanism button which releases the two bungs which then seal both ends of the tube. The water sample is then pulled back to the surface.

Regardless of the brand, water samplers that are used will be suitable for collection of water samples for ultra-low metals analyses i.e. will have acrylic or PVC construction and silicone seals.

For depth sampling, the following considerations will be taken into account to ensure sample QA/QC:

1. Sampling station locations will be dependent upon the monitoring program objectives and the lake dimensions. When sampling from a watercraft all efforts will be made to anchor the boat stationary. Map coordinates for lake sampling stations will be recorded using a handheld GPS unit.
2. A vertical stratification profile (if required), profiling in-situ water quality measurements (e.g pH, temperature, dissolved oxygen, conductivity and turbidity), will be determined using a water quality multi-meter (e.g. YSI Sonde) equipped with a long cord with metre intervals marked on it.
3. Depending upon the purpose of the monitoring program, water quality samples may be collected from the different stratified layers. The depth sampler must be slowly lowered in the 'open' position (i.e. to let water enter it) until it reaches the required depth.
4. The depth sampler will be held at this depth temporarily to allow flushing of water inside the apparatus.
5. The metal weight (messenger) will be released (to activate the closing mechanism) and the depth sampler will be pulled back to the surface. Field measurements can be taken at depth or by filling a bottle with the sampled water and taking measurements from that immediately after sampling.

6. When collecting samples close to the lake bed care must be taken to ensure that the depth sampler does not disturb lake bed sediments (which could contaminate the sample).
7. Depending upon the lake area and depth, multiple sampling stations will likely be required to adequately characterize lake water quality.

4.3.3 RIVER SAMPLING

Depending upon the size of the water body, river sampling methods are the same as those presented in Sections 4.3.1 and 4.3.2. To avoid inclusion of floating detritus in the sample, the sample bottle must be fully immersed in the river water. Care will be taken to ensure that disturbed sediments are not included in the sample.

For river sampling, the additional following considerations will be taken into account to ensure sample QA/QC:

1. Grasp the bottle well below the neck and remove the lid, taking care not to touch the inside of the lid.
2. Facing upstream, plunge the bottle beneath the surface of the water to a depth of 20 cm (if possible) with the opening facing downward, then tilt the bottle opening upward into the current to fill.
3. Once the bottle is full, remove the bottle from the water in one motion by forcing the opening upward and into the current and seal the bottle securely.

When selecting water quality monitoring station locations on rivers, care will be taken where a tributary joins a river, since complete mixing of the two waters may not be achieved within several hundred metres downstream of the confluence (or further). When in doubt, vertical profile monitoring across the river's width using a field parameter such as pH, temperature or conductivity will be used to assess if complete mixing has occurred.

4.3.4 METAL MINING EFFLUENT REGULATIONS (MMER)

Water samples from stations that fall under MMER must be taken from a designated sampling port which the mine does no longer exercise control over the quality of discharge. Samples taken from these designated ports can be composite samples or grab samples.

The general sampling procedures of section 4.3.1 should be followed, and the additional considerations will be taken into account to ensure MMER QA/QC is met:

1. MMER sampling should be performed by trained personnel, and if possible a second person should be present for verification purposes.
2. Notification must be given ahead of time to a certified laboratory to ensure MMER acute lethality and sub-lethal toxicity samples can be analysed.
3. In-situ water quality monitoring will accompany all external samples taken (Refer to Section 4.3.6)

4. After collecting samples and preserving as needed, a chain of custody (COC) seal shall be applied to each bottle cap.
5. All sampling activities, notes, flow volumes, photo references and general observations shall be kept in a dedicated MMER field log book.
6. MMER samples shall be sent to the ALS lab with their own COC and should not be combined with samples from other monitoring programs.

For more information and technical guidance, Environment and Climate Change Canada's 2001 *Guidance Document for the Sampling and Analysis of Metal Mining Effluents* should be consulted.

4.3.5 SAMPLING FOR TOXICITY TESTING

Sampling for lethal toxicity testing is a condition of Baffinland's Type A Water Licence for various monitoring programs. Sub-lethal toxicity testing is a condition of Environmental Effects Monitoring (EEM) and Metal Mining Effluent Regulations (MMER). Depending on the regulatory and analysis requirements, one or more 4L effluent samples are required. Depending upon the objectives of the toxicity testing, variables that will require confirmation prior to testing include:

- Type of effluent sample to be collected e.g. instantaneous grab sample, or composite sample collected over a period of time
- Type of dilution water to be used by the testing laboratory e.g. standard synthetic laboratory dilution water, receiving water collected upstream of the discharge etc.
- Preferred test organism e.g. *Daphnia magna* and/or rainbow trout

Details concerning laboratory methods are presented in Appendix D. For further details concerning acute lethality testing refer to Environment Canada (2002) and USEPA (2002). For further details concerning sub-lethal testing refer to Environment Canada (2012)

4.3.6 IN-SITU WATER QUALITY

Measurement of field parameters (e.g. temperature, pH, conductivity, redox potential, or dissolved oxygen, etc.), where warranted, will be carried out for each sample at the time of sampling. The required set of field parameters will vary according to sample type and monitoring objectives. The exact methods used for monitoring field parameters will depend upon the type of monitoring probes being used. Field staff will read and be familiar with the instruction manual for the equipment being used on site, and follow manufacturer's instructions for specifics on proper calibration, use, storage, and maintenance.

Field staff will rinse the monitoring probe three times with the water to be monitored before immersing the probe in the water. Generally, the user will ensure that the probe being used has had sufficient time to equilibrate in the water before the reading is taken. This is generally regarded as the point at which the reading has stabilized.

Field parameter data will be recorded in notebooks, or preferably in a custom form designed for this purpose. A copy of the data should be retained on site.

4.3.6.1 MONITORING PROBE CALIBRATION

Monitoring probes will be stored and calibrated in accordance with manufacturers' instructions. All probes will be calibrated regularly per sampling program requirements and a written record of the calibration results will be maintained on site. Field staff will ensure that calibration solutions are of the correct specification and that they have not passed their expiry date (if applicable). Monitoring probes will be stored as per manufacturers' recommendations.

5 SEDIMENT SAMPLE COLLECTION

For a complete list of the required sample analyses at pre-established monitoring station, please refer to Baffinland's Type A Water Licence and the Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039). Every effort will be made to get samples analysed within the preferred holding time window conforming to the specified protocols for sediment sampling. A summary of recommended sediment sample containers, sample volumes, and maximum sample holding times is presented in Table 9.1. Field observations and parameters if warranted should be recorded during the collection of sediment samples.

5.1 SEDIMENT MONITORING LOCATIONS

The QA/QC Plan addresses the collection of sediment samples related to monitoring programs being carried out in support of Baffinland's Mary River Project, namely:

1. Collection of environmental sediment samples from area lakes, streams and rivers.
2. Collection of sediment samples from fuel berms and dispensing facilities.
3. Collection of sediment samples from landfarm facilities.
4. Collection of sediment samples from remediation and reclamation projects.
5. Collection of sediment samples evaluating spills and releases.

5.2 SEDIMENT SAMPLING METHODS AND EQUIPMENT

Sediment samples specified under Baffinland's Type A Water Licence and Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039) are characterised by the following procedures.

5.2.1 GENERAL SAMPLING PROCEDURES

Generally, sampling procedures will consist of the following:

1. Sampler will wear a fresh pair of disposable nitrile gloves for each sampling event.
2. A fresh sample bottle(s) will be used at each monitoring station. Sample bottles will not be re-used.
3. Sample details e.g. date, sample ID and analysis will be clearly marked on the sample jar in permanent ink.
4. All samples will be sealed by ensuring their lids are tightly secured before placing the bottles into the coolers.
5. All samples will be placed in an iced cooler as soon as possible after collection.

5.2.2 RIVER AND GRAB SAMPLING

The collection of river and grab samples will follow the general procedures stated in 5.2.1 and will entail the following additional QA/QC considerations:

1. Sampling station locations will be dependent upon the monitoring program objectives and the sample location.
2. A clean spatula or spoon will be utilized to obtain a representative sample of the sediment for analyses.
3. If composite samples are required by the monitoring program, a sterile container will be utilised to deposit and homogenize the subsamples, until the composite sample is fully mixed. The composite sample will then be transferred to the identified sample jars by alternating aliquots.
4. The quantity and holding time of samples obtained will depend on the prescribed analysis.

5.2.3 LAKE SAMPLING

For monitoring of sediment character and quality in lakes, a depth sampler will be used. The preferred sample apparatus for lake sediment samples are gravity percussion corers, since they allow for retrieval and analysis of sediment profiles. A *Petite Ponar* can also be used but will not provide sediment profiles. Generally, forms of gravity percussion corers consist of a clear polycarbonate sample core tube attached to a weighted upper head assembly and a seal mechanism. The top two centimeters of sediment from the core samples will be retained for laboratory analysis unless sampling objectives state otherwise.

Sediment lake sampling procedures will follow the general procedures stated in Section 5.2.1 and the following additional QA/QC considerations for a gravity percussion corer:

1. Sampling station locations will be dependent upon the monitoring program objectives and the lake dimensions. When sampling from a watercraft all efforts will be made to anchor the boat stationary. Map coordinates for all lake sampling station locations will be recorded using a handheld GPS unit.

2. The corer will be positioned perpendicular to the water surface prior to release. The penetration depth of the core tube is affected by the depth of water, angle of corer deployment and substrate type.
3. Once the corer is embedded in the substrate, the stainless steel messenger will be sent down the corer rope to release the ball-type seal. This seal creates a vacuum in the core tube, retaining the sampled sediment.
4. Upon retrieval, the bottom of the core tube will be plugged using an extruding plug prior to breaking the air-water interface. This procedure will prevent sample loss.
5. An extruding apparatus will be used to force the extruding plug through the core tube moving the sediment sample to the end of tube allowing the top two centimetres to be scooped out and placed in a clean stainless steel bowl for sample homogenisation.
6. Multiple core samples (generally three or more) are required per sample station to obtain the required sample volume. The multiple core samples are homogenized in the stainless steel bowl, removing any excess water or debris.
7. The sample containers will be filled by alternating aliquots between each of the containers.
8. After the top two centimeters are retained, the remaining, unused sediments within the core tube will be placed into a bucket and only released once all core sampling is complete at that particular station.
9. Depending upon the lake area and depth, multiple sampling stations will likely be required to adequately characterize lake sediment quality.

6 BENTHIC INVERTEBRATES SAMPLE COLLECTION

For a complete list of required analyses at pre-established monitoring stations, see Baffinland's Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039). Samples will be submitted to an analytical laboratory for processing and taxonomic identification. Laboratory methods for benthic invertebrate samples will be in accordance with guidance provided by EC, 2012. Field observations and parameters if warranted should be recorded during the collection of benthic invertebrate samples.

6.1 BENTHIC INVERTEBRATE MONITORING LOCATIONS

This QA/QC Plan addresses the collection of benthic invertebrate samples related to monitoring programs being carried out in support of Baffinland's Mary River Project, namely:

- Collection of benthic invertebrate samples from Project area and reference lakes, streams and rivers to determine potential mine related effects on benthic invertebrate communities.

6.2 BENTHIC INVERTEBRATE SAMPLING METHODS AND EQUIPMENT

Benthic Invertebrate samples follow the same general procedures outlined in Section 5.2.1. Benthic invertebrates can be collected from either depositional (lake) or erosional (stream) sample locations. A

Petite Ponar is utilised when sampling depositional environments while a *Surber sampler* is utilised when sampling erosional environments. For a complete list of depositional and erosional sample methods see Baffinland's Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039). Benthic invertebrate samples will be carefully sieved through 500 µm mesh. All materials, including invertebrates, retained by the mesh will be transferred to labelled plastic jars and fixed with 10% buffered formalin. Fixed and labelled samples will be shipped to an analytical laboratory for processing and archiving.

7 QA/QC

For monitoring of QA/QC during sample collection and shipping, a set of QA/QC samples will be routinely submitted for analysis from prescribed sampling programs. Sampling programs will each have separate QA/QC samples submitted with the regular water samples. Descriptions of the QA/QC samples that will be used are presented on Table 7.1. Ten percent of all samples will consist of field blanks, travel blanks and field duplicates. For example, a monitoring program with 30 samples would consist of 27 monitoring samples and 3 QA/QC samples. Equipment blanks, if required, are performed on an as needed basis to ensure sampling equipment is properly maintained and free of contaminants, and do not count towards the ten percent of QA/QC samples.

7.1 SAMPLING PROGRAMS WITH MULTIPLE SAMPLING STATIONS

For sampling programs with multiple sampling locations (SNP, AEMP) QA/QC samples will be performed randomly to avoid bias, and care will be taken to ensure that the same stations are not sampled repeatedly for QA/QC samples.

7.2 SAMPLING PROGRAMS WITH LIMITED SAMPLING STATIONS

Sampling programs with limited sampling stations (e.g. MMER) will require at least one QA/QC sample per sampling round. A field duplicate, field blank or travel blank must be taken during each sampling session. This may result in over sampling for QA/QC, but will ensure there is sufficient data to identify any anomalies.

7.3 QA/QC ANALYSIS

In the interest of transparency, the analytical laboratories will also be instructed to report the results of their own in-house QA/QC testing (e.g. results of random replicate analyses of submitted samples).

The results of QA/QC analyses will be routinely reviewed by Baffinland or their designate, and any anomalous results will be promptly investigated with the assistance of the analytical laboratory. Once the reason for the anomalous results is identified, Baffinland will ensure that operating procedures of field staff and/or the analytical laboratory will be altered in order to address the issue. Compliance monitoring and data management for water license sampling will be conducted by Baffinland, with the assistance of a designate as required.

TABLE 7-1: Purpose, Description and Frequency of QA/QC Samples

QA/QC Plan	Purpose	Description	Frequency	Prepared By
Field blank	Identification of potential contaminants arising from sample collection. The field blank bottle is prefilled with laboratory deionized water and is handled in the same way as regular sample bottles (i.e., opened and closed during the sample collection). The bottle is submitted as a routine sample.	Bottle contains prefilled deionized water. Bottle is handled the same as one would handle the samples.	Ten percent of all samples collected will be QA/QC.	Analytical laboratory
Travel blank	Identification of potential contaminants arising from sample storage, shipping and laboratory handling. The travel blank accompanies the samples to the laboratory but is not taken out into the field, or opened.	Sealed bottle containing deionized water provided by analytical laboratory.	Ten percent of all samples collected will be QA/QC.	Analytical laboratory
Field duplicate	Assesses sample variability and precision of laboratory analytical methods. Collected from a randomly selected location, split from a homogenized sample and analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory.	Duplicate sample selected at random. A large sterile bottle is used to collect the water. Water is then poured equally into two sets of pre-labelled bottles.	Ten percent of all samples collected will be QA/QC.	Field Staff
Equipment blank	Assesses cross contamination from field water sampling equipment (e.g. Kemmerer). Rinse deionized water through water sampling equipment and transfer to sample bottles.	Bottle contains deionized water that has been rinsed through the sampling equipment.	Collected prior and after completion of sampling program (if required/ as needed). Not included in the ten percent calculation of other QA/QC samples.	Field Staff

8 SAMPLE MANAGEMENT

8.1 SAMPLE LABELING

Accurate sample labelling is essential for subsequent interpretation of field data. Ensure that labels are legible and written with permanent ink (pen, marker, etc.). For a complete list of the predetermined sample labels at monitoring station, please refer to Baffinland's Type A Water Licence and the Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039).

A consistent format for identifying samples must be followed if a predetermined sample label does not exist in order to facilitate accurate sample tracking and to ensure sample labels are interpreted in the same manner by all personnel involved in the program.

Samples must be uniquely identified with the following information:

- Sample ID
- Collection date and time
- Project identifier
- Company name

QA/QC samples will be labeled by the following conventions:

- Field Duplicate: 01 following the sample label
- Field Blank: 02 following the sample label
- Travel Blank: 03 following the sample label
- Equipment Blank: 04 following the sample label

8.2 SAMPLE STORAGE AND HANDLING

Physical, chemical and biochemical reactions may take place in the sample container between the time of sample collection and laboratory analysis. Samples will be placed in iced coolers and shipped to the analytical laboratory as soon as possible after collection, consulting stipulated analytical holding times, to minimize these changes. Care will be taken to ensure that bottles are stored upright and are packed securely within the cooler; glass bottles should be wrapped in bubble wrap. Preferably, leak-proof ice packs will be used for cooling the samples. If loose ice is used, ice should be securely sealed in plastic bags to prevent leakage of melt water.

Biological samples (e.g. benthic invertebrates) preserved using formalin or Lugol's solution can be held at room temperature until submission to the analytical laboratory.

8.3 SAMPLE SUBMISSION AND CHAIN OF CUSTODY

A chain of custody (COC) form will accompany all samples being submitted to ensure that the required analyses are completed, and to confirm receipt of samples by the laboratory (see example form presented in Appendix B). Prior to shipment, samples should be carefully prepared for shipping and sample bottles listed on the COC must be reconciled with what has physically been placed in the shipping container. The collection of samples that are time sensitive needs to coincide with shipping schedules, travel time to the laboratory, and laboratory business hours. A record of all COCs submitted for analysis must be kept on site. Information on the COC form will include:

1. Project name and project assignment number.

2. Address of analytical laboratory, name of contact person and contact details.
3. Contact details and name of sampler.
4. Date and time of sampling.
5. Whether the sample has been filtered, or whether laboratory filtration is required.
6. List of sample I.D.’s, sample type (e.g. lake water, sewage effluent, etc.), number of sample bottles per sample and analysis requested.
7. Urgency of analysis (e.g. rush or normal). For rush samples the analytical laboratory should be notified ahead of time.
8. Whether sample contains preservative and if so, what preservative and when it was added.
9. Submission date and time.
10. Comments on any unusual conditions and other important information.

9 LABORATORY ANALYSIS

9.1 LABORATORY ACCREDITATION

Laboratory analysis of samples is performed by an on-site accredited analytical laboratory and an off-site accredited analytical laboratory. The on-site laboratory is operated by ALS Canada LTD. and is located at the Mine Site. A select set of basic analytical parameters (e.g. pH, TSS, turbidity etc.), are performed by the on-site laboratory. The off-site laboratory, ALS Environmental, located in Waterloo, ON, run by ALS Canada Ltd. performs the majority of analyse required. Toxicity testing is performed by Aquatox Testing & Consulting Inc, located in Guelph, ON. Details of ALS analytical laboratory licencing and accreditation are presented in Appendices C.

9.2 ANALYTICAL DETECTION LIMITS

ALS Limits of Reporting (LORs) are established using rigorous experimental and statistical procedures that begin with the determination of the Method Detection Limit (MDL) at 99%confidence. When detected at or above the MDL, ALS test results are considered to be qualitatively accurate, and a parameter can be reported with 99% confidence as being present in the sample.

It should be noted that on occasion, a loss of analytical sensitivity can be encountered due to excessively high concentrations of parameters within a sample or lack of provided sample matrix. If this is encountered, Baffinland or their designate will work with the analytical laboratory to try and resolve the problem and new samples will be taken if required. The detection limits on ALS analytical reports contains the LOR. The LOR may be the MDL as calculated, or a higher value. Required analytical laboratory detection limits are provided in Appendix D.

9.3 LABORATORY ANALYTICAL METHODS

Analytical methods used by the analytical laboratories for water analyses generally conform to the standard methods outlined in *Standard Methods for the Examination of Water and Wastewater* (APHA et al, 1989). Standard analytical methods for available analyses through ALS Environmental are provided in Appendix D.

9.4 ANALYTICAL LABORATORY QA/QC PROCEDURES

ALS Environmental adheres to a designated QA/QC Management System which includes documentation and document control, staff training and internal audits. The practices exceed accreditation requirements for high confidence in data reliability utilising but not limited to:

- Use of calibration verification standards and drift control standards.
- Use of surrogate standards and internal standards.
- Replicate analyses and blanks on submitted samples.
- Use of standard reference materials (SRM's) and matrix spikes.
- Standards Data Quality objectives are established for each QC sample, based on a combination of reference method objectives, customer requirements and historical test method performance. Where applicable, prescriptive elements of reference methods take precedence over internal

  Further details on the analytical laboratories in-house QA/QC protocols are presented in Appendix E.

9.5 SUMMARY OF ANALYTICAL PROCEDURES

TABLE 9-1: Summary of Analytes, Water and Soil Sample Volumes, Preservatives and Sample Storage Time for ALS Environmental

Inorganics	**Analysis [1]**	**Water Container**	**Water Preservation**	**Additional Notes**	**Soil Container**	**Water / Soil Hold Time**
ROUTINE INORGANICS AND PHYSICALS	Acidity and Alkalinity	0.5-1 L Plastic			125-250 mL Jar or Bag	14 Days / NA
	Anions (Br, Cl, SO4, F) and Electrical Conductivity	0.5-1 L Plastic			125-250 mL Jar or Bag	28 Days [7]/ Unlimited
	Bromate[19], Chlorate and Chlorite	125 mL Plastic	EDA (Ethylenediamine)		NA	28 Days (Chlorite 14 Days) / NA
	BOD, Colour and Turbidity	0.5-1 L Plastic			NA	2-4 Days [8] / NA
	COD and Phenols (4AAP)	125-250 mL Glass	1:1 Sulfuric Acid (H_2SO_4)		NA	28 Days / NA
	Cyanide, Total ,Weak Acid Dissociable,Free	145 mL Plastic	6N NaOH		125-250 mL Jar or Bag	14 Days / 14 Days
	Dissolved Oxygen	300 mL BOD bottle	1 each; $MnSO_4$ & alkaline iodide azide pillows		NA	8 Hours[20] / NA
	Dissolved or Total Inorganic Carbon (DIC or TIC)	125-250 mL Glass	.	Field Filter for Dissolved	125-250 mL Jar or Bag	14 Days / 28 Days
	Dissolved or Total Organic Carbon (DOC or TOC)	125-250 mL Glass	1:1 Sulfuric Acid (H_2SO_4)	Field Filter for Dissolved	125-250 mL Jar or Bag	28 Days / 28 Days
	Flashpoint	2 x 100-250 mL Amber Glass		Zero Headspace	125-250 mL Jar	7 Days / 7 Days
	pH	0.5-1 L Plastic			125-250 mL Jar or Bag	0.25 Hours / 30 Days [9]
	Solids (TS, TSS, TDS)	0.5-1 L Plastic			NA	7 Days / NA
	Sulfide	125 - 150 mL Plastic	Zinc Acetate & 6N NaOH		125-250 mL Jar or Bag	7 Days / 7 Days
	Sulfite	125 mL Plastic			NA	0.25 Hours / NA
NUTRIENTS	Ammonia Nitrogen	250 mL Glass or Plastic	1:1 Sulfuric Acid (H_2SO_4)		125-250 mL Jar or Bag	28 Days / 72 Hours
	Nitrate or Nitrite Nitrogen (and Ammonia unpreserved)	0.5-1 L Plastic			NA	2-7 Days [10] / 72 Hours
	Nitrogen, Kjeldahl, Organic, Total or Dissolved	250 mL Glass or Plastic	1:1 Sulfuric Acid (H_2SO_4)	Field Filter for Dissolved	NA	28 Days / NA
	Nutrients, Available (N,P,K,S)	NA			125-250 mL Jar or Bag	NA / 3 Days [11]
	Phosphorus, Reactive (orthophosphate)	0.5-1 L Plastic			NA	2-7 Days [12] / NA
	Phosphorus, Total Dissolved	250 mL Glass or Plastic	1:1 Sulfuric Acid (H_2SO_4)	Field Filter for Dissolved	NA	28 Days / NA
	Phosphorus, Total	250 mL Glass or Plastic	1:1 Sulfuric Acid (H_2SO_4)		NA	28 Days / NA
METALS	Chromium VI (Hexavalent)	125 mL Plastic	50 % NaOH (BC MoE) or 6N NaOH + Ammonium Buffer (OMoE)		125-250 mL Jar or Bag	28 Days / 30 Days
	Mercury, Methyl	250 mL FLPE	1:1 Hydrochloric Acid (HCl)[21]	Field Filter for Dissolved	125-250 mL Jar or Bag	6 Months / 28 Days
	Mercury, Total or Dissolved	40 mL Glass Vial	1:1 Hydrochloric Acid (HCl)	Field Filter for Dissolved	125-250 mL Jar or Bag	28 Days / 28 Days
	Metals, Total or Dissolved	125-250 mL Plastic	1:3 Nitric Acid (HNO_3) to pH<2	Field Filter for Dissolved	125-250 mL Jar or Bag	6 Months / 6 Months
Organics						
HYDRO-CARBONS	F1, Volatile Organic Compounds (VOCs), THMs, 1,4-Dioxane, Volatile Petroleum Hydrocarbons (VPH)	2 or 3 x 40 mL Glass Vials [2]	Sodium Bisulfate [4]	Zero Headspace	Field Methanol Kit [6]	14 Days / 40 Days [13]
		2 or 3 x 40 mL Glass Vials [2]	Sodium Bisulfate [4]	Zero Headspace	Hermetic Sampler kit [6]	14 Days / 48 Hours
	CCME CWS F1, BTEX	2 or 3 x 40 mL Glass Vials [2]	Sodium Bisulfate [4]	Zero Headspace	125 - 500 mL Jar	14 Days / 7 Days
	CCME CWS F2-F4	2 x 60 mL Amber Glass Vials [3]	Sodium Bisulfate		125 - 500 mL Jar	14 Days [14]/ 14 Days
	EPH or LEPH/HEPH	2 x 250 mL Amber Glass with Septa Cap	Sodium Bisulfate		125 - 500 mL Jar	14 Days / 14 Days
	Polycyclic Aromatic Hydrocarbons (PAHs)	2 x 0.25 - 1 L Amber Glass [5]	Sodium Bisulfate		125 - 500 mL Jar	14 Days / 14 Days
	Oil & Grease or Mineral Oil & Grease	2 x 0.25 - 1 L Glass	1:1 HCl or H_2SO_4		125 - 500 mL Jar	28 Days / 28 Days
TRACE ORGANICS	Alcohols	2 x 40 mL Glass Vials		Zero Headspace	125 - 500 mL Jar	7 Days / 7 Days
	Alkanolamines (MEA, DEA, DIPA)	250 mL Amber Glass			125 - 500 mL Jar	7 Days / 14 Days
	AOX	40 - 250 mL Amber Glass	1:3 Nitric Acid (HNO_3) to pH<2		125 - 500 mL Jar	6 months [15] / 28 Days
	C1 - C5 Gases	3 x 40 mL Blue Septa Vials	Sodium Bisulfate [4]	Zero Headspace	NA	14 Days / NA
	Dioxins and Furans, PBDE and PBB	2 x 1 L Amber Glass			125 - 500 mL Jar	Unlimited / Unlimited
	Formaldehyde/Aldehydes	2 x 40 mL Amber Glass Vials [2]	Ammonium Chloride+Copper Sulfate	Zero Headspace	125 - 500 mL Jar	7 Days / 5 Days
	Glycols	2 x 40 mL Amber Glass Vials			125 - 500 mL Jar	7 Days / 14 Days
	Hormones and Steroids	1 L Plastic			NA	28 Days / NA
	Naphthenic Acids	2 x 250 mL Amber Glass			125 - 500 mL Jar	14 Days / 14 Days
	Nitroaromatics and Nitrosamines (Explosives)	1 L Amber Glass			125 - 500 mL Jar	7 Days / 14 Days
	Nonylphenol & Ethoxylates, Bisphenol A (BPA)	1 L Amber Glass			125 - 500 mL Jar	28 Days / 14 Days
	PCB	2 x 0.25 - 1 L Amber Glass			125 - 500 mL Jar	Unlimited / Unlimited [16]

	Perfluorinated Chemicals (PFCs), PFOS, PFOA	1 L Plastic (PTFE free)			125-250 mL Jar or Bag	14 Days / 14 Days
	Phenolics, Chlorinated and Non-Chlorinated	2 x 0.5 - 1 L Amber Glass	Ascorbic Acid & Sodium Bisulfate [4]		125 - 500 mL Jar	14 Days / 14 Days
	Priority Pollutants (EPA 625 list) or SVOCs	2 x 1 L Amber Glass			125 - 500 mL Jar	7 Days / 14 Days [17]
	Resin Acids & Fatty Acids	2 x 0.5 - 1 L Amber Glass	Ascorbic Acid & NaOH		125 mL Jar	14 Days / 14 Days
	Sulfolane	2 x 0.5 - 1 L Amber Glass	Sodium Bisulfate [4]		125 mL Jar	14 Days / 14 Days
PESTICIDE RESIDUES	Carbamate Pesticides	1 L Amber Glass	Use Sodium Thiosulfate if chlorinated		125 - 500 mL Jar	7 Days / 14 Days
	Glyphosate / AMPA	1 L Plastic	Use Sodium Thiosulfate if chlorinated		125 - 500 mL Jar	14 Days / 14 Days
	Herbicides, Acidic	2 x 1 L Amber Glass	Sodium Bisulfate [4]		125 - 500 mL Jar	14 Days / 14 Days
	Organochlorine or Organophosphate Pesticides	2 x 1 L Amber Glass			125 - 500 mL Jar	7 Days / 14 Days
	Soil Sterilant Scan	1 L Amber Glass			250 g Poly Bag	7 Days / 14 Days
Micro						
MICRO-BIOLOGICAL	Coliforms-Fecal, Total, E-coli & HPC	100 - 300 mL Sterilized Plastic	Sodium Thiosulfate		500 mL Sterilized Jar	24-48 Hours [18] (24 - HPC) / NA
	Microtox	1 L Amber Glass			125-250 mL Jar or Bag	3 Days / 3 Days

1. Additional analyses with the same container type and preservation may be possible - consult the lab for details.

2. The number of 40 mL glass vials required (2 or 3) for BTEX & VOC varies by lab based on instrumentation. Consult the lab for details.

3. Please fill to the top of the marked line on the 60 mL Amber Glass Vials.

4. Use Sodium Thiosulfate instead of Sodium Bisulfate if sample is chlorinated.

5. OMoE has no preservation requirement for PAHs. 2 X 250 mL Amber Glass required for BC MoE and OMoE. For AB and SK and for Alkylated PAHs, ALS requires 2 x 1 L Amber Glass.

6. Soil sampling options depend on soil location and condition of soil. Field Methanol Kit consists of one 5g TerraCore® sampler or similar sampling device, two pre-weighed 40 mL glass vials with methanol preservative and a 125mL soil jar for moisture. Hermetic sampler kit consists of a T-handle, two 5g hermetic samplers and a 125mL soil jar for moisture. One additional parameter, such as metals or hydrocarbons can also be obtained from the 125mL soil jar.

7. 4 Days hold time for Electrical Conductivity only as per Ontario MISA.

8. 3 Days hold time for British Columbia as per BC Ministry of Environment (BC MoE), 4 Days hold time as per OMoE.

9. pH in water should be taken in the field as per BC MoE, 4 Days hold time for Ontario MISA and 28 Days hold time for OMoE. 30 Days hold time as received for pH in soil as per OMoE. One year hold time once soil is dried.

10. 3 Days hold time as per BC MoE, 5 Days hold time as per Ontario MISA and 7 Days hold time as per OMoE.

11. 3 Days hold time until received. Unlimited hold time once soil is dried.

12. 3 Days hold time as per BC MoE and 7 Days hold time as per OMoE.

13. 40 Days hold time as per BC MoE and 14 Days hold time as per OMoE. Recovered methanol extract from laboratory has a 40 Days hold time as per OMoE.

14. 40 Days hold time as per OMoE.

15 14 Days hold time as per Ontario MISA.

16. 14 Days hold time as per OMoE. Consult lab for container size if limited sample volume is available.

17. 14 Days hold time for water and 60 Days hold time for soil as per OMoE. Ontario labs require 2 x 250 mL Amber Glass + 500 mL Amber Glass.

18. 30 Hours hold time as per BC Drinking Water Regulation and 48 Hours as per OMoE.

19. Bromate alone does not require preservative.

20. 15 Minutes hold time as per OMoE - Field measurement by meter is recommended.

21. Use 1:1 Sulfuric Acid (H_2SO_4) for preservation of marine or brackish samples.

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10 DATA MANAGEMENT AND REPORTING

10.1 DATA MANAGEMENT

All sample data collected by Baffinland or designate consultants from the various environmental programs required on Project sites will be stored electronically in a spreadsheet database (Microsoft Excel) or using alternative software designed specifically for environmental data management.

QA/QC measures relating to data validation will include the following**:**

1. Designation of a suitable person to act as the Database Manager (DM).
2. Upon receipt, laboratory analytical data will be reviewed by the DM to check for completeness, typos, outlying values, etc. The analytical laboratory will be immediately notified of any anomalous results.
3. At a suitable frequency (e.g. once per month) the spreadsheet database should be updated by the DM using: i) results provided in electronic format by the analytical laboratories, and ii) copies of the field parameter monitoring records forwarded from site
4. The DM will be responsible for ensuring that a third party (e.g. another staff member) carries out a QA/QC check on a minimum of ten percent of newly entered data.

10.2 REPORTING

All documents prepared by Baffinland or their designate for submission to the regulators will be reviewed by senior staff and Baffinland prior to issue, as per the company's standard practice and quality management system.

11 REFERENCES

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3. Environment Canada (EC). 2001 Guidance Document for the Sampling and Analysis of Metal Mining Effluent. http://publications.gc.ca/collections/Collection/En49-24-1-39E.pdf
4. Environment Canada (EC). 2012. Metal mining technical guidance for Environmental Effects Monitoring. ISBN 978-1-100-20496-3.
5. Environment Canada, 2002. Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring. http://www.ec.gc.ca/eem/English/MetalMining/Guidance/default.cfm.
6. INAC, 1996. Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "A" Licenses in Meeting SNP Requirements and for Submission of a QA/QC Plan. Prepared by Department of Indian and Northern Affairs Canada Water Resources Division and the Northwest Territories Water Board, July 1996.
7. Nunavut Water Board, 2013. Baffinland Iron Mines Corp. – Class A Water License No: 2AM-MRY1325. Issued by the Nunavut Water Board, 2013.
8. USEPA, 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms; 5th Ed., USEPA, ref. No. EPA-821-R-02-012.

Appendix A

Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan (INAC, 1996).

QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

GUIDELINES

FOR USE BY CLASS “A” LICENSEES IN MEETING SNP REQUIREMENTS

AND FOR SUBMISSION OF A QA/QC PLAN

JULY 1996

DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS CANADA
WATER RESOURCES DIVISION
AND THE
NORTHWEST TERRITORIES WATER BOARD

Table of Contents

Appendixes

1.0 Introduction and Definitions

In order to assist Licensees in completing their Quality Assurance and Quality Control (QA/QC) Plan, the following guidelines are provided, which indicates the minimum information that should be included.

These Guidelines are divided into three sections:

1) Field Sampling
2) Lab Analysis
3) Reporting Requirements

It is recognized that there may be different interpretations as to what is covered by "Quality Assurance/Control" due to the fact that certain Licensees have their own laboratories, while others only use commercial laboratories. For licence purposes, "Quality Assurance" and "Quality Control" refer to the following:

Quality Assurance: is the system of activities designed to better ensure that quality control is done effectively; while

Quality Control: is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy and reliability.

2.0 Field Sampling

2.1 Sample Collection

2.1.1 <u>Location</u>

A QA/QC plan must identify the locations of all sampling stations and the markers used to identify the stations. If the Surveillance Network Program (SNP) of the Water Licence does not specify sampling locations, locations should be chosen with help from an Inspector.

Buoys and landmarks identify sampling stations in tailings ponds and lakes, while sign post positioning usually marks stream sample stations. Stations should be used repeatedly, with the same personnel and techniques to reduce operational error. The use of Global Positioning System (GPS) to identify Latitude and Longitude for sampling stations is recommended.

2.1.2 Sampling Equipment

The Plan must include a detailed section on the equipment used for sampling, the rationale behind the choices of equipment, and descriptions of how the equipment is maintained and calibrated. Equipment and bottles should be selected so that they do not contaminate or otherwise alter the concentrations of parameters of interest.

Sampling devices, sample bottles and filtration devices should be constructed of non-metallic material. Most samples are now collected in containers constructed of high density polyethylene plastic. However, there are some exceptions, when testing for oil and grease or phenols glass containers are to be used. When conducting a fish bioassay, plastic drums are used while hydrocarbon based containers are not to be used for the collection of organic samples.

This section should also identify whether new or used bottles are used for each sample analysis. New bottles are preferred, but sample containers may be used repeatedly with proper handling measures.

If old bottles are used, a detailed description should be included, noting how they are maintained, stored and cleaned. Usually, this will closely resemble the product manufacturer's instructions. An example of how bottles should be cleaned is outlined below:

- Rinse well with hot tap water for one minute or more.
- Empty bottle and add 30% HNO_3 to approximately 1/3 container capacity. Shake well for three to four minutes.
- Rinse vigorously with hot tap water for two minutes.
- Rinse thoroughly three times with tap water and three times with distilled water.
- Store with 0.2% HNO_3 for a minimum of one week.
- Rinse again with distilled water at least three times.

Bottles that are to be used for bacteria testing should be acid washed or autoclaved if possible.

Note: Additional information on bottle washing is also available from Water Resources Division.

2.1.3 Sampling Methods

This Section will include details on methods for sample collection and the equipment that is to be used for each station.

In lakes and ponds, regular sample bottles are used the majority of the time, but Van Dorn samples are often utilized. The sample or the sample bottle is usually lowered to mid depth and washed three times before collecting the sample on the fourth submersion. Approximately 2% of the sample container capacity should remain to provide for mixing, preservative addition and thermal expansion.

Stream water sampling is usually done by plunging a sample bottle toward the current and allowing it to fill. Once again, the bottle should be rinsed three times before filling and room should be left for preservative addition and mixing.

A glass bottle should be used when sampling for oil and grease with the sample being collected during the first submersion and not rinsed three times first.

This section should also describe how often field blanks and replicate samples will be collected. Field blanks are samples of distilled/deionized water that are to be treated in exactly the same manner as the other samples. Blanks should therefore be taken to the field and handled and preserved as part of the sample program. They indicate when a sample may be contaminated and are indicative of general sample integrity. Replicate samples (duplicates and triplicates) are two or three samples collected from the same station at the same time. They help to ensure sample precision at the laboratory.

2.2 Sample Handling

2.2.1 Preservation

After collection, most samples must be preserved in order to prevent chemical or biochemical changes to the sample. The QA/QC plan must describe how samples from each station are to be preserved.

Preservation is generally done by the addition of certain chemicals into the bottle immediately after the sample is collected. **Table 1** is a general guide to preservatives and their appropriate concentrations. The QA/QC plan should contain more detailed information on the concentrations and amount of preservatives that will be used.

2.2.2 Sample Identification

The plan should include a description of the system used to identify samples. The system must provide positive sample identification and ensure that the identification is maintained. It is advisable to keep a logbook of samples that have already been delivered.

The identification can be maintained by marking the bottle itself or a label, with a water resistant, non-smear felt pen. The information should be clear to persons uninvolved in the sampling and may include such details as company name, sample area, SNP number, time and date.

2.2.3 Transportation

The section on transportation will describe how sample integrity will be ensured from the time of collection to completion of delivery. Delivery to the lab should be done as soon as possible after the samples have been collected.

Usually, samples are sealed and stored upright in a box with other samples to provide a snug, immobile storage space during transfer. Any samples that require refrigeration for preservation should be kept cool during transport.

3.0 Lab Analysis

Because certain Class "A" Licensees have their own analytical laboratory and others rely on commercial laboratories, this section of the Guidelines is divided accordingly.

3.1 Outside Laboratories

3.1.1 Lab Accreditation

The Licensee will identify in the plan the name of the commercial laboratory that will be conducting the analyses. A letter must be provided from the commercial lab indicating that they are accredited to conduct analyses on each of the required sampling parameters. Ideally, the lab should be accredited by the Canadian Associated for Environmental Analytical Laboratories (C.A.E.A.L.) and should provide a certificate stating parameters for which they are accredited.

3.1.2 Detection Limits

Detection limits for the commercial lab should be identified for all parameters and should be reported when any SNP data is submitted.

3.1.3 Methodology

Descriptions should be included for any methods of analysis used that are not outlined in "Standard Methods for the Examination of Water and Wastewater".

3.2 In House Laboratories

3.2.1 Identification of Analytical Laboratory/Detection Limits

Licensees using in-house labs shall identify their detection limits for all parameters and report them when any SNP data is submitted. The Licensee shall also identify the commercial lab they use to check for quality control.

3.2.2 For Overall Analytical Methods, Precision and Accuracy

The plan must describe how the Licensee will ensure precision and accuracy in their analytical methods. This includes what action will be taken if any sample results are found to be outside the appropriate ranges.

All analyses should be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" or by other approved methods. In addition, the lab should analyze standard reference material for each parameter measured. For each parameter (group) to be measured, a complete description of the sampling procedure must be documented and adhered to.

If any sample results are outside the appropriate QA/QC ranges, attempts should be made to correct the problem and the sample shall be immediately re-analyzed. If any analysis indicates a violation of a licence condition, an Inspector shall be notified of the violation, any corrective action taken, and the results of retests.

3.2.3 Accuracy Requirements

The plan should document how the Licensee will go about ensuring accuracy in the laboratory. Accuracy is the measurement of how closely a value approximates a standard, or true value. The Licensee should identify the frequency at which certified or reference standards will be analyzed during each sampling period.

3.2.4 Precision Requirements

Precision is a measure of the closeness or repeatability of a set of values. This section will describe how and when replicate samples are taken to ensure lab precision. It is recommended that the Licensee take triplicates at one SNP station during each sampling period. If daily sampling is required at only one station, a duplicate sample should be taken each time, with a triplicate sample taken one a week.

3.2.5 Methodology

Descriptions should be included of any methods of analysis that are not taken from "Standard Methods for the Examination of Waste and Wastewater." Standard methods should be referenced.

4.0 Reporting Requirements

4.1 General Submission

The QA/QC plan will contain a section outlining what information will be reported in the monthly SNP reports. Any control charts or graphs which display the precision and accuracy of the methods used to analyze the samples should be submitted with the report. This includes warning and control limits used to determine acceptability of the data.

4.2 Outside Laboratories

The Licensee shall outline the number of replicate samples that will be collected and submitted with each SNP report. It is recommended that one set of duplicates or triplicates from an assigned SNP site, as well as the results from field blanks, be submitted with each required SNP report. This would serve as an internal/external check for the Licensee and the commercial lab.

4.3 In-House Laboratories

The Licensee shall outline the number of results from replicate samples that will be included with each required SNP report. It is recommended that two duplicate sets be collected per month at an assigned SNP site, with one set being sent to a commercial lab while the other is to be analyzed by the Licensee's lab. Analytical results from both labs should be submitted with each required SNP report. This would serve as an external check for the lab. Any results from a commercial lab should be presented on the lab's letterhead.

FOR FURTHER INFORMATION, CONTACT THE WATER RESOURCES DIVISION AT:

Box 1500
Yellowknife, NWT
X1A 2R3
(867) 669-2654 Phone
(867) 669-2716 Fax

Appendix 1
Table 1: General Summary of Special Sampling or Handling Techniques

Determination	Container	Minimum Sample Size (ml)	Preservation	Maximum Storage Recommended
BOD	Sterile polyethylene	1000	Refrigerate 4°C	24 hours
Conductivity	Polyethylene	500	Refrigerate 4°C	28 days
Total Cyanide	Polyethylene	500	Add NaOH to raise pH>12 refrigerate in dark	24 hours
Hardness	Polyethylene	100	Add Conc. HNO_3 to lower pH<2 OR (*) unpreserved	6 months
Metals, General	Polyethylene	250	For dissolved metals filter immediately, add Conc. $HN0_3$ to pH<2	6 months
Mercury	Glass (rinsed with 1 + 1 HNO_3)	500	Add Conc. HNO_3 or pH<2 or H_2SO_4 + 1 ml of 5% $K_2Cr_2O_7$, refrigerate 4°C	28 days
Nitrogen:				
Ammonia	Polyethylene	500	Analyze as soon as possible or add H_2S0_4 to pH<2, refrigerate OR (*) unpreserved	7 days
Nitrate	Polyethylene	100	Analyze as soon as possible or refrigerate	48 hours
Oil and Grease	Glass or wide-mouth calibrated	1000	Add H_2S0_4 to pH<2, refrigerate	28 days
pH	Polyethylene	--	Analyze immediately	2 hours
Suspended Solids	Polyethylene	--	Refrigerate	7 days
Temperature	Polyethylene	--	Analyze immediately	0
Turbidity	Polyethylene	--	Analyze same day; store in dark up to 24 hours, refrigerate	24 hours
Bacteria	Polyethylene (sterilized)	--	None: Keep cool	6 - 48 hours

(*) Unpreserved = check with lab that will be analyzing the samples

Appendix 2

References:

Gilbert, Andrew (1993). "Echo Bay Mines Ltd. Environmental Laboratory Quality Assurance Plan".

Soniassy, R. (1980). "A Guide for the Collection of Water and Effluent Samples"; pp 1-16; INAC

"Standard Methods for the Examination of Water and Wastewater" (1989); AHPA, AWWA and WPCF, 17th edition.

Water Resources Division, Indian and Northern Affairs Canada (1990). "Generic Quality Assurance (QA) Plan Guidelines for Use by the Licensees in Meeting SNP Requirements for Submission of a QA Plan"; INAC.

Appendix B

COC Example Forms

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Page of

Report To	Contact and company name below will appear on the final report	**Report Format / Distribution**	
Company:		Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)	
Contact:		Quality Control (QC) Report with Report ☐ YES ☐ NO	
Phone:		☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	
Street:		Email 1 or Fax	
City/Province:		Email 2	
Postal Code:		Email 3	
Invoice To	Same as Report To ☐ YES ☐ NO	**Invoice Distribution**	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	
Company:		Email 1 or Fax	
Contact:		Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		**ALS Contact:**	**Sampler:**

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4] ☐		**1 Business day [E1]** ☐	
3 day [P3] ☐		**Same Day, Weekend or Statutory holiday [E0]** ☐	
2 day [P2] ☐			

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	**Sample Identification and/or Coordinates** (This description will appear on the report)	**Date** (dd-mmm-yy)	**Time** (hh:mm)	**Sample Type**														Number of Containers

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?

☐ YES ☐ NO

Are samples for human drinking water use?

☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐		SIF Observations	Yes ☐	No ☐
Ice Packs ☐	Ice Cubes ☐		Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INIITIAL COOLER TEMPERATURES ºC			FINAL COOLER TEMPERATURES ºC		

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

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

OCTOBER 2015 FRONT

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

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

Appendix C

Analytical Laboratory Accreditation and Licencing

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).

CALA

Accreditation No.: A3149
Issued On: July 29, 2016
Accreditation Date: January 3, 2005
Expiry Date: January 27, 2019

ilac-MRA CALA

President & CEO

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request; reproduction must follow policy in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca.

Ministry of the Environment and Climate Change

Safe Drinking Water Branch
Laboratory Licensing and
Compliance Program

125 Resources Rd.
Etobicoke ON M9P 3V6
Tel: (416) 235 - 6370
Fax: (416) 235 - 6519

Ministère de l'Environnement et de l'Action en matière de changement climatique

Direction du contrôle de la qualité de l'eau potable
Programme de délivrance des permis et
de conformité des laboratoires

125, Chemin Resources
Etobicoke ON M9P 3V6
Tél: (416) 235 - 6370
Téléc: (416) 235 - 6519

Ontario

Drinking-Water Testing Licence

Under the Drinking-Water Testing Services Regulation, O. Reg. 248/03 and the Safe Drinking Water Act, 2002

Licence #: 2290
This supercedes licence issued: Sep 06, 2016
Licensee: ALS Canada Ltd.

Located at:
60 Northland Rd. Unit #1
Waterloo ON N2V 2B8
Canada

The licensee is authorized to conduct the following drinking-water tests at the laboratory:

Class: Inorganic

Test	Lab Method Code	Technique - Sub-Technique	Appendix #
4AAP-phenolics	WT-TM-1027	Colourimetry	C009
Alkalinity	WT-TM-1012	Titrimetry-Manual	C070
Alkalinity	WT-TM-1032	Colourimetry	C094
Aluminum	NA-TM-1002	ICP-MS (Total-non-digested)	C005
Aluminum	NA-TM-1002	ICP-MS(Total-digested)	C032
Ammonia	WT-TM-1013	Colourimetry	C095
Antimony	NA-TM-1002	ICP-MS(Total-digested)	C032
Antimony	NA-TM-1002	ICP-MS (Total-non-digested)	C005
Arsenic	NA-TM-1002	ICP-MS(Total-digested)	C032

Class: Inorganic		**Technique - Sub-Technique:**	
Arsenic	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Barium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Barium	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Beryllium	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Beryllium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Bismuth	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Bismuth	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Boron	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Boron	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Bromate	**Lab Method Code:** WT-TM-1503	LC-MS-MS	**Appendix #:** C114
Bromide	**Lab Method Code:** NA-TM-1001	IC	**Appendix #:** C003
Cadmium	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Cadmium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Calcium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032

Class: Inorganic | **Technique - Sub-Technique:**

Calcium — ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C005

Carbon; dissolved organic — Combustion
Lab Method Code: WT-TM-1024 — **Appendix #:** C047

Carbon; total organic — Combustion
Lab Method Code: WT-TM-1024 — **Appendix #:** C047

Chloride — IC
Lab Method Code: NA-TM-1001 — **Appendix #:** C003

Chlorine; residual — Colourimetry
Lab Method Code: WT-TM-1021 — **Appendix #:** C074

Chlorine; total — Colourimetry
Lab Method Code: WT-TM-1021 — **Appendix #:** C074

Chromium — ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C005

Chromium — ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C032

Chromium VI — IC-UV/VIS
Lab Method Code: WT-TM-1035 — **Appendix #:** C157

Cobalt — ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C032

Cobalt — ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C005

Copper — ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C005

Copper — ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 — **Appendix #:** C032

Cyanate — ISE
Lab Method Code: WT-TM-1036 — **Appendix #:** C161

Class: Inorganic **Technique - Sub-Technique:**

Cyanide; free Colourimetry-WAD-CFA
Lab Method Code: NA-TM-1003 **Appendix #:** C004

Cyanide; free Colourimetry-CFA
Lab Method Code: NA-TM-1003 **Appendix #:** C004

Cyanide; total Colourimetry-SAD-CFA
Lab Method Code: NA-TM-1003 **Appendix #:** C004

Fluoride IC
Lab Method Code: NA-TM-1001 **Appendix #:** C003

Iron ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Iron ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Lead ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Lead ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Lithium ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Lithium ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Magnesium ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Magnesium ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Manganese ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Manganese ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Class: Inorganic **Technique - Sub-Technique:**

Mercury Spectrophotometric-CVAAS
Lab Method Code: NA-TM-1005; NA-TP-2012 **Appendix #:** C049

Molybdenum ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Molybdenum ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Nickel ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Nickel ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Nitrate (as nitrogen) IC
Lab Method Code: NA-TM-1001 **Appendix #:** C003

Nitrilotriacetic acid Colourimetry
Lab Method Code: WT-TM-1007 **Appendix #:** C036

Nitrite (as nitrogen) IC
Lab Method Code: NA-TM-1001 **Appendix #:** C003

Nitrogen; ammonia+ammonium Colourimetry
Lab Method Code: WT-TM-1013 **Appendix #:** C095

Nitrogen; nitrate+nitrite Calculation-IC
Lab Method Code: NA-TM-1001 **Appendix #:** N/A

Nitrogen; total Kjeldahl Colourimetry-Digestion-Aquakem
Lab Method Code: WT-TM-1041 **Appendix #:** C099

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o-Phosphate Colourimetry-Total (non-filtered)(non-digested)
Lab Method Code: WT-TM-1025 **Appendix #:** C098

Organic nitrogen Calculation-Colourimetry-Digestion-Aquakem
Lab Method Code: WT-TM-1041 **Appendix #:** N/A

Perchlorate LC-MS-MS
Lab Method Code: WT-TM-1505 **Appendix #:** C168

Class: Inorganic **Technique - Sub-Technique:**

Phosphorus	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Phosphorus	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Phosphorus; total	**Lab Method Code:** WT-TM-1025	Colourimetry-Total (non-filtered) (digested)	**Appendix #:** C011
Potassium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Potassium	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Selenium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Selenium	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Silicon	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Silicon	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Silver	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Silver	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Sodium	**Lab Method Code:** NA-TM-1002	ICP-MS(Total-digested)	**Appendix #:** C032
Sodium	**Lab Method Code:** NA-TM-1002	ICP-MS (Total-non-digested)	**Appendix #:** C005
Solids; volatile suspended	**Lab Method Code:** WT-TM-1011	Gravimetry	**Appendix #:** C010

Class: Inorganic	**Technique - Sub-Technique:**
Strontium	ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C005
Strontium	ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C032
Sulphate	IC
Lab Method Code: NA-TM-1001	**Appendix #:** C003
Sulphide	Colourimetry
Lab Method Code: WT-TM-1003	**Appendix #:** C012
Sulphur	ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C005
Sulphur	ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C032
Thallium	ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C005
Thallium	ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C032
Tin	ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C005
Tin	ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C032
Titanium	ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C005
Titanium	ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C032
Tungsten	ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C032
Tungsten	ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002	**Appendix #:** C005

Class: Inorganic **Technique - Sub-Technique:**

Uranium ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Uranium ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Vanadium ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Vanadium ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Zinc ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Zinc ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Zirconium ICP-MS (Total-non-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C005

Zirconium ICP-MS(Total-digested)
Lab Method Code: NA-TM-1002 **Appendix #:** C032

Class: Microbiological **Technique - Sub-Technique:**

E. coli MPN--24 hrs, Quanti-Tray
Lab Method Code: NATM1300 **Appendix #:** C183

E. coli MF-mFC-BCIG
Lab Method Code: WT-TM-1200 **Appendix #:** C052

E. coli MPN--18 hrs, Quanti-Tray
Lab Method Code: NATM1300 **Appendix #:** C183

Fecal coliforms MPN--18 hrs, Quanti-Tray
Lab Method Code: NATM1300 **Appendix #:** C185

Fecal coliforms MF-mFC
Lab Method Code: WT-TM-1200 **Appendix #:** C051

HPC MF-HPC
Lab Method Code: WT-TM-1200 **Appendix #:** C030

Class: Microbiological **Technique - Sub-Technique:**

HPC		MPN--44 hrs, Quanti-Tray	
Lab Method Code:	NATM1300	**Appendix #:**	C184
Pseudomonas aeruginosa		MF-mPAC	
Lab Method Code:	WT-TM-1203	**Appendix #:**	C091
Total coliform		MPN--24 hrs, Quanti-Tray	
Lab Method Code:	NATM1300	**Appendix #:**	C183
Total coliform		MF-mEndo	
Lab Method Code:	WT-TM-1200	**Appendix #:**	C002
Total coliform		MPN--18 hrs, Quanti-Tray	
Lab Method Code:	NATM1300	**Appendix #:**	C183
Total coliform background		MF-mEndo	
Lab Method Code:	WT-TM-1200	**Appendix #:**	C002

Class: Organic **Technique - Sub-Technique:**

1,1,1,2-tetrachloroethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
1,1,1-trichloroethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
1,1,2,2-tetrachloroethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
1,1,2-trichloroethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
1,1-dichloroethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
1,1-dichloroethene		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
1,2,4-trichlorobenzene		GC-MS	
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
1,2-dibromoethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113

Class: Organic	**Technique - Sub-Technique:**	**Lab Method Code:**	**Appendix #:**
1,2-dichlorobenzene	GC-MS/FID	WT-TM-1406	C113
1,2-dichloroethane	GC-MS/FID	WT-TM-1406	C113
1,2-dichloropropane	GC-MS/FID	WT-TM-1406	C113
1,2-propanediol	GC-FID	WT-TM-1601	C090
1,3-dichlorobenzene	GC-MS	WT-TM-1101/WT-TM-1300	C015
1,3-dichlorobenzene	GC-MS/FID	WT-TM-1406	C113
1,3-propanediol	GC-FID	WT-TM-1601	C090
1,4-dichlorobenzene	GC-MS/FID	WT-TM-1406	C113
1,4-dioxane	HSGC-MS/FID	WT-TM-1406	C172
1-chloronaphthalene	GC-MS	WT-TM-1101/WT-TM-1300	C015
1-methylnaphthalene	GC-MS	WT-TM-1101/WT-TM-1300	C015
2,3,4,5-tetrachlorophenol	GC-MS	WT-TM-1101/WT-TM-1300	C015
2,3,4,6-tetrachlorophenol	GC-MS	WT-TM-1101/WT-TM-1300	C015
2,3,4-trichlorophenol	GC-MS	WT-TM-1101/WT-TM-1300	C015

Class: Organic — **Technique - Sub-Technique:**

2,3,5,6-tetrachlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,3,5-trichlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,4,5-T	GC-MS		
Lab Method Code:	WT-TM-1107/WT-TM-1302	**Appendix #:**	C023
2,4,5-trichlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,4,6-trichlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,4-D	GC-MS		
Lab Method Code:	WT-TM-1107/WT-TM-1302	**Appendix #:**	C023
2,4-dichlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,4-dimethylphenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,4-dinitrophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,4-dinitrotoluene	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,6-dichlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2,6-dinitrotoluene	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2-chloronaphthalene	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015
2-chlorophenol	GC-MS		
Lab Method Code:	WT-TM-1101/WT-TM-1300	**Appendix #:**	C015

Class: Organic

Analyte	Technique - Sub-Technique:	Lab Method Code:	Appendix #:
2-hexanone	GC-MS/FID	WT-TM-1406	C113
2-methyl-4,6-dinitrophenol	GC-MS	WT-TM-1101/WT-TM-1300	C015
2-methylnaphthalene	GC-MS	WT-TM-1101/WT-TM-1300	C015
2-nitrophenol	GC-MS	WT-TM-1101/WT-TM-1300	C015
3,3'-dichlorobenzidine	GC-MS	WT-TM-1101/WT-TM-1300	C015
4-bromophenyl phenyl ether	GC-MS	WT-TM-1101/WT-TM-1300	C015
4-chloro-3-methylphenol	GC-MS	WT-TM-1101/WT-TM-1300	C015
4-chlorophenyl phenyl ether	GC-MS	WT-TM-1101/WT-TM-1300	C015
5-nitroacenaphthene	GC-MS	WT-TM-1101/WT-TM-1300	C015
a-BHC	GC-MS	WT-TM-1102/WT-TM-1302	C019
Acenaphthene	GC-MS	WT-TM-1101/WT-TM-1300	C015
Acenaphthylene	GC-MS	WT-TM-1101/WT-TM-1300	C015
Acetone	GC-MS/FID	WT-TM-1406	C113
a-Chlordane	GC-MS	WT-TM-1102/WT-TM-1302	C019

Class: Organic — **Technique - Sub-Technique:**

Acridine — GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 — **Appendix #:** C015

Alachlor — GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 — **Appendix #:** C023

Aldicarb — LC-MS-MS
Lab Method Code: WT-TM-1502 — **Appendix #:** C135

Aldrin — GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 — **Appendix #:** C019

Aldrin+Dieldrin — Calculation-GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 — **Appendix #:** N/A

Anthracene — GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 — **Appendix #:** C015

Aroclor 1242 — GC-MS
Lab Method Code: WT-TM-1105/WT-TM-1301 — **Appendix #:** C017

Aroclor 1248 — GC-MS
Lab Method Code: WT-TM-1105/WT-TM-1301 — **Appendix #:** C017

Aroclor 1254 — GC-MS
Lab Method Code: WT-TM-1105/WT-TM-1301 — **Appendix #:** C017

Aroclor 1260 — GC-MS
Lab Method Code: WT-TM-1105/WT-TM-1301 — **Appendix #:** C017

Atrazine — GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 — **Appendix #:** C023

Atrazine + N-dealkylated metabolites — Calculation-GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 — **Appendix #:** N/A

Azinphos-methyl — GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 — **Appendix #:** C023

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b-BHC — GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 — **Appendix #:** C019

Class: Organic	**Technique - Sub-Technique:**		
Bendiocarb	GC-MS	**Lab Method Code:** WT-TM-1107/WT-TM-1302	**Appendix #:** C023
Benzene	GC-MS/FID	**Lab Method Code:** WT-TM-1406	**Appendix #:** C113
Benzo(a)anthracene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Benzo(a)pyrene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Benzo(b)fluoranthene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Benzo(g,h,i)perylene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Benzo(k)fluoranthene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Benzyl butyl phthalate	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Biphenyl	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Bis(2-chloroethoxy)methane	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Bis(2-chloroethyl)ether	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Bis(2-chloroisopropyl)ether	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Bis(2-ethylhexyl)phthalate	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Bisphenol A	LC-MS-MS	**Lab Method Code:** WT-TM-1521	**Appendix #:** C116

Class: Organic **Technique - Sub-Technique:**

Bromochloroacetic acid GC-Derivitatization/ECD
Lab Method Code: WT-TM-1604 **Appendix #:** C163

Bromodichloroacetic acid GC-Derivitatization/ECD
Lab Method Code: WT-TM-1604 **Appendix #:** C163

Bromodichloromethane GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Bromoform GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Bromomethane GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Bromoxynil GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Camphene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Carbaryl GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Carbofuran GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Carbon disulfide GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Carbon tetrachloride GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Chlordane; total Calculation-GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** N/A

Chlorodibromoacetic acid GC-Derivitatization/ECD
Lab Method Code: WT-TM-1604 **Appendix #:** C163

Chloroethane GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Class: Organic **Technique - Sub-Technique:**

Chloroform GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Chloromethane GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Chlorpyrifos GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Chrysene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

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cis-1,2-dichloroethene GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

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cis-1,3-dichloropropene GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Cyanazine GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Dalapon GC-Derivitatization/ECD
Lab Method Code: WT-TM-1604 **Appendix #:** C163

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d-BHC GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

DDT & Metabolites Calculation-GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** N/A

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de-Ethylated atrazine GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Diazinon GC-MS
Lab Method Code: WT-TM-1107/WT-TM-1302 **Appendix #:** C023

Dibenzo(a,h)anthracene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Dibromoacetic acid GC-Derivitatization/ECD
Lab Method Code: WT-TM-1604 **Appendix #:** C163

Class: Organic

	Technique - Sub-Technique:	Lab Method Code:	Appendix #:
Dibromochloromethane	GC-MS/FID	WT-TM-1406	C113
Dicamba	GC-MS	WT-TM-1107/WT-TM-1302	C023
Dichloroacetic acid	GC-Derivitatization/ECD	WT-TM-1604	C163
Dichlorodifluoromethane	GC-MS/FID	WT-TM-1406	C113
Dichloromethane	GC-MS/FID	WT-TM-1406	C113
Diclofop-methyl	GC-MS	WT-TM-1107/WT-TM-1302	C023
Dieldrin	GC-MS	WT-TM-1102/WT-TM-1302	C019
Diethyl phthalate	GC-MS	WT-TM-1101/WT-TM-1300	C015
Diethylene glycol	GC-FID	WT-TM-1601	C090
Dimethoate	GC-MS	WT-TM-1107/WT-TM-1302	C023
Dimethyl phthalate	GC-MS	WT-TM-1101/WT-TM-1300	C015
di-n-butyl phthalate	GC-MS	WT-TM-1101/WT-TM-1300	C015
di-n-octyl phthalate	GC-MS	WT-TM-1101/WT-TM-1300	C015
Dinoseb	GC-MS	WT-TM-1107/WT-TM-1302	C023

Class: Organic **Technique - Sub-Technique:**

Diphenyl ether GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Diphenylamine GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Diquat LC-MS-MS
Lab Method Code: WT-TM-1506 **Appendix #:** C134

Diuron LC-MS-MS
Lab Method Code: WT-TM-1502 **Appendix #:** C135

Endosulphan I GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Endosulphan II GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Endosulphan sulphate GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Endrin GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Endrin aldehyde GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Ethane GC-Headspace
Lab Method Code: WT-TM-1602 **Appendix #:** C062

Ethene GC-Headspace
Lab Method Code: WT-TM-1602 **Appendix #:** C062

Ethylbenzene GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Ethylene glycol GC-FID
Lab Method Code: WT-TM-1601 **Appendix #:** C090

Extractable petroleum hydrocarbons (F2: C10 to C16) GC-FID
Lab Method Code: NA-TM-1110 **Appendix #:** C068

Class: Organic **Technique - Sub-Technique:**

Extractable petroleum hydrocarbons (F3: C16 to C34) GC-FID
Lab Method Code: NA-TM-1110 **Appendix #:** C068

Extractable petroleum hydrocarbons (F4: C34 to C50) GC-FID
Lab Method Code: NA-TM-1110 **Appendix #:** C068

Fluoranthene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Fluorene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Formaldehyde GC-Derivitatization/ECD
Lab Method Code: WT-TM-1603 **Appendix #:** C162

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g-Chlordane GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Glyphosate LC-MS-MS
Lab Method Code: WT-TM-1504 **Appendix #:** C133

Heavy hydrocarbon (F4 Gravimetric) GC-FID
Lab Method Code: WT-TM-1307/WT-TM-1112 **Appendix #:** C069

Heptachlor GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Heptachlor epoxide GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** C019

Heptachlor+Heptachlor Epoxide Calculation-GC-MS
Lab Method Code: WT-TM-1102/WT-TM-1302 **Appendix #:** N/A

Hexachlorobenzene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Hexachlorobutadiene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Hexachlorocyclopentadiene GC-MS
Lab Method Code: WT-TM-1101/WT-TM-1300 **Appendix #:** C015

Class: Organic

	Technique - Sub-Technique:		
Hexachloroethane	GC-MS		
Lab Method Code: WT-TM-1101/WT-TM-1300		**Appendix #:**	C015
Hexane	GC-MS/FID		
Lab Method Code: WT-TM-1406		**Appendix #:**	C113
Indeno(1,2,3-c,d)pyrene	GC-MS		
Lab Method Code: WT-TM-1101/WT-TM-1300		**Appendix #:**	C015
Indole	GC-MS		
Lab Method Code: WT-TM-1101/WT-TM-1300		**Appendix #:**	C015
Isophorone	GC-MS		
Lab Method Code: WT-TM-1101/WT-TM-1300		**Appendix #:**	C015
Lindane; total	GC-MS		
Lab Method Code: WT-TM-1102/WT-TM-1302		**Appendix #:**	C019
m/p-Cresol	GC-MS		
Lab Method Code: WT-TM-1101/WT-TM-1300		**Appendix #:**	C015
m/p-Xylene	GC-MS/FID		
Lab Method Code: WT-TM-1406		**Appendix #:**	C113
Malathion	GC-MS		
Lab Method Code: WT-TM-1107/WT-TM-1302		**Appendix #:**	C023
MCPA	GC-MS-Extraction		
Lab Method Code: WT-TM-1107/WT-TM-1302		**Appendix #:**	C023
Methane	GC-Headspace		
Lab Method Code: WT-TM-1602		**Appendix #:**	C062
Methoxychlor	GC-MS		
Lab Method Code: WT-TM-1102/WT-TM-1302		**Appendix #:**	C019
Methyl ethyl ketone	GC-MS/FID		
Lab Method Code: WT-TM-1406		**Appendix #:**	C113
Methyl isobutyl ketone	GC-MS/FID		
Lab Method Code: WT-TM-1406		**Appendix #:**	C113

Class: Organic

	Technique - Sub-Technique:	Lab Method Code:	Appendix #:
Metolachlor	GC-MS	WT-TM-1107/WT-TM-1302	C023
Metribuzin	GC-MS	WT-TM-1107/WT-TM-1302	C023
Mirex	GC-MS	WT-TM-1102/WT-TM-1302	C019
Monobromoacetic acid	GC-Derivitatization/ECD	WT-TM-1604	C163
Monochloroacetic acid	GC-Derivitatization/ECD	WT-TM-1604	C163
Monochlorobenzene	GC-MS/FID	WT-TM-1406	C113
MTBE	GC-MS/FID	WT-TM-1406	C113
Naphthalene	GC-MS	WT-TM-1101/WT-TM-1300	C015
Nitrobenzene	GC-MS	WT-TM-1101/WT-TM-1300	C015
n-Nitroso-di-n-propylamine	GC-MS	WT-TM-1101/WT-TM-1300	C015
Nonylphenol	LC-MS-MS	WT-TM-1521	C116
Nonylphenol Diethoxylate	LC-MS	WT-TM-1521	C116
Nonylphenol Monoethoxylate	LC-MS	WT-TM-1521	C116
o,p'-DDD	GC-MS	WT-TM-1102/WT-TM-1302	C019

Class: Organic

	Technique - Sub-Technique:	Lab Method Code:	Appendix #:
o,p'-DDE	GC-MS	WT-TM-1102/WT-TM-1302	C019
o,p'-DDT	GC-MS	WT-TM-1102/WT-TM-1302	C019
o-Cresol	GC-MS	WT-TM-1101/WT-TM-1300	C015
Octylphenol	LC-MS	WT-TM-1521	C116
Octylphenol diethoxylate	LC-MS	WT-TM-1521	C116
Octylphenol monoethoxylate	LC-MS	WT-TM-1521	C116
Oxychlordane	GC-MS	WT-TM-1102/WT-TM-1302	C019
o-Xylene	GC-MS/FID	WT-TM-1406	C113
p,p'-DDD	GC-MS	WT-TM-1102/WT-TM-1302	C019
p,p'-DDE	GC-MS	WT-TM-1102/WT-TM-1302	C019
p,p'-DDT	GC-MS	WT-TM-1102/WT-TM-1302	C019
Paraquat	LC-MS-MS	WT-TM-1506	C134
Parathion	GC-MS	WT-TM-1107/WT-TM-1302	C023
p-chloroaniline	GC-MS	WT-TM-1101/WT-TM-1300	C015

Class: Organic	**Technique - Sub-Technique:**		
Pentachlorophenol	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Perylene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Petroleum hydrocarbons (F1: C6 to C10)	GC-MS/FID	**Lab Method Code:** WT-TM-1406	**Appendix #:** C111
Phenanthrene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Phenol	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Phorate	GC-MS	**Lab Method Code:** WT-TM-1107/WT-TM-1302	**Appendix #:** C023
Picloram	GC-MS	**Lab Method Code:** WT-TM-1107/WT-TM-1302	**Appendix #:** C023
p-nitrophenol	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Polychlorinated biphenyls	GC-MS	**Lab Method Code:** WT-TM-1105/WT-TM-1301	**Appendix #:** C017
Prometryn	GC-MS	**Lab Method Code:** WT-TM-1107/WT-TM-1302	**Appendix #:** C023
Pyrene	GC-MS	**Lab Method Code:** WT-TM-1101/WT-TM-1300	**Appendix #:** C015
Simazine	GC-MS	**Lab Method Code:** WT-TM-1107/WT-TM-1302	**Appendix #:** C023
Styrene	GC-MS/FID	**Lab Method Code:** WT-TM-1406	**Appendix #:** C113
Temephos	GC-MS	**Lab Method Code:** WT-TM-1107/WT-TM-1302	**Appendix #:** C023

Class: Organic | **Technique - Sub-Technique:**

Terbufos		GC-MS	
Lab Method Code:	WT-TM-1107/WT-TM-1302	**Appendix #:**	C023
Tetrachloroethylene		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
Tetraethyl Lead		GC-MS	
Lab Method Code:	WT-TM-1308	**Appendix #:**	C159
Toluene		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
Total Haloacetic acids		Calculation-GC-Derivitatization/ECD	
Lab Method Code:	WT-TM-1604	**Appendix #:**	N/A
trans-1,2-dichloroethene		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
trans-1,3-dichloropropene		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
Triallate		GC-MS	
Lab Method Code:	WT-TM-1107/WT-TM-1302	**Appendix #:**	C023
Tribromoacetic acid		GC-Derivitatization/ECD	
Lab Method Code:	WT-TM-1604	**Appendix #:**	C163
Trichloroacetic acid		GC-Derivitatization/ECD	
Lab Method Code:	WT-TM-1604	**Appendix #:**	C163
Trichloroethylene		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
Trichlorofluoromethane		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113
Trifluralin		GC-MS	
Lab Method Code:	WT-TM-1107/WT-TM-1302	**Appendix #:**	C023
Trihalomethanes; total		GC-MS/FID	
Lab Method Code:	WT-TM-1406	**Appendix #:**	C113

Class: Organic **Technique - Sub-Technique:**

Vinyl chloride GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Xylene; total GC-MS/FID
Lab Method Code: WT-TM-1406 **Appendix #:** C113

Class: Physical/Others **Technique - Sub-Technique:**

Apparent colour Colourimetry
Lab Method Code: WT-TM-1014 **Appendix #:** C097

BOD (5 Day) Meter-D.O
Lab Method Code: WT-TM-1002 **Appendix #:** C001

CBOD (5 Day) Meter-D.O
Lab Method Code: WT-TM-1002 **Appendix #:** C001

COD Colourimetry-Reflux
Lab Method Code: WT-TM-1006 **Appendix #:** C035

Conductivity Potentiometry
Lab Method Code: WT-TM-1028 **Appendix #:** C108

Conductivity Potentiometry
Lab Method Code: WT-TM-1010 **Appendix #:** C048

Hardness (as $CaCO_3$) Calculation-ICP-MS
Lab Method Code: NA-TM-1002 **Appendix #:** NA

Oil and Grease; mineral Gravimetry-Extraction
Lab Method Code: WT-TM-1100 **Appendix #:** C033

Oil and Grease; total Gravimetry-Extraction
Lab Method Code: WT-TM-1100 **Appendix #:** C033

pH Potentiometry
Lab Method Code: WT-TM-1001 **Appendix #:** C026

pH Potentiometry
Lab Method Code: WT-TM-1028 **Appendix #:** C106

Solids; total Gravimetry
Lab Method Code: WT-TM-1011 **Appendix #:** C056

Class: Physical/Others **Technique - Sub-Technique:**

Solids; total dissolved Gravimetry
Lab Method Code: NA-TM-1004 **Appendix #:** C056

Solids; total suspended Gravimetry
Lab Method Code: WT-TM-1011 **Appendix #:** C010

Solids; total volatile Gravimetry
Lab Method Code: WT-TM-1011 **Appendix #:** C056

True colour Colourimetry
Lab Method Code: WT-TM-1014 **Appendix #:** C097

Turbidity Nephelometry
Lab Method Code: WT-TM-1004 **Appendix #:** C024

Subject to the following terms and conditions:
Terms and conditions are specified in Appendix 1.

Expiry Date: Sep 30, 2018

October 12, 2016
Date Issued

Director

Licence Number: 2290
Date Issued: October 12, 2016

Appendix 1 - Conditions

Pursuant to the *Safe Drinking Water Act, 2002*, S.O. 2002, c. 32, and the regulations made thereunder, this drinking-water testing services licence is issued subject to the following conditions.

Part I: Definitions

1.1 In this licence, unless the context otherwise requires, words and phrases shall be given the same meaning as those set out in the *Safe Drinking Water Act, 2002*, S.O. 2002, c. 32 and any regulations made in accordance with that Act.

1.2 In this licence

"accreditation body" means any body designated or established pursuant to section 64 of the SDWA;

"director" means a director appointed pursuant to s. 6 of the SDWA for the purposes of Part VII of the SDWA;

"laboratory" means the drinking-water testing laboratory located at 60 Northland Road, Unit #1, Waterloo, ON;

"licence" means this entire drinking water testing licence document, issued in accordance with Part VII of the SDWA, and includes this appendix, any schedules to it, and the application and other supporting documents listed in schedule "A" that are attached to and form part of this licence, except as otherwise specified in the conditions contain herein;

"licensee" means ALS Environmental (Waterloo);

"Ministry" means the Ministry of the Environment & Climate Change;

"protocol" means the document published by and available from the Ministry entitled "Protocol of Accepted Drinking-Water Testing Methods", Version 2.0 dated May 31, 2010.

"provincial officer" means a provincial officer designated pursuant to s. 8 of the SDWA;

"SDWA" means the *Safe Drinking Water Act, 2002*, S.O. 2002, c. 32, as amended.

Part II – Authorized Tests

2.1 Subject to the conditions of this licence, the licensee is authorized to provide a drinking-water testing service at the laboratory.

2.2 The licensee is only authorized to conduct drinking-water tests at the laboratory for the class and for the parameters set out in the licence.

2.3 Subject to conditions 2.4 and 2.5, the licensee shall only conduct drinking water tests at the laboratory for parameters using the methods that were listed in the application, and approved by this licence.

[Where applicable]

2.4 Despite condition 2.3, where the licensee listed a method for a parameter in the application for this licence, but the method is not designated as an acceptable testing method for that parameter in the protocol, the licensee is not authorized to use the method listed in the application for this licence, unless the method is specifically authorized under condition 2.5.

[Where applicable]

2.5 The licensee is specifically authorized to conduct drinking-water tests for the parameters listed below using the corresponding method listed below, despite the method not being designated as an acceptable testing method for that parameter in the protocol:

None

Accreditation

2.6 Except as authorized by condition 2.7, the licensee shall only conduct a drinking-water test if the laboratory is accredited by an accreditation body for the conduct of that test.

Non-accredited Tests [Where applicable]

2.7 In accordance with section 74 of the SDWA, the licensee is authorized to conduct the following tests for which the laboratory is not accredited by an accreditation body, using the method specified.

None

Part III: Operational Requirements

3.1. A copy of this licence shall be made readily available for reference by all persons responsible for all or part of the operation of the drinking-water testing laboratory.

3.2. A copy of this licence shall be made readily available to laboratory clients and for Ministry inspection.

3.3. The Certificate of Drinking Water Testing Licence shall be conspicuously displayed in a location at the laboratory which maximizes the likelihood of a client seeing it upon entry to the laboratory's sample receiving area.

Part IV: General

Compliance

4.1 The licensee shall operate the laboratory in accordance with the SDWA, including the statutory conditions enumerated in 75(3), any applicable regulations made thereunder, and this licence.

4.2 The licensee shall ensure that any person authorized to carry out a drinking-water test or any aspect of a drinking-water test at a laboratory has been informed of the SDWA, all applicable regulations made in accordance with that Act, and this licence and shall take all reasonable measures to ensure any such person complies with the same.

Interpretation

4.3 Where there is a conflict between the provisions of this licence and any other document, the following hierarchy shall be used to determine the provision that takes precedence:

i. the SDWA;
ii. any regulation made under the SDWA;
iii. this licence;
iv. any application or supporting documents listed in Schedule "A".

4.4 The conditions of this licence are severable. If any requirement of this licence, or the application of any requirement of this licence to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this licence shall not be affected thereby.

Other Legal Obligations

4.5 The issuance of, and compliance with the conditions of, this licence does not:

i. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement; or
ii. limit in any way the authority of the ministry to require certain steps be taken or to require the licensee to furnish any further information related to compliance with this licence.

Change of Licensee's Information

4.6 The licensee shall notify the director, in writing, of any of the following changes within 30 days of the change occurring,

i. change of address of the laboratory; or
ii. change of business name, and the notification shall include a copy of the most recent documentation filed under the *Business Names Act*, R.S.O. 1990, c. B17 or *Corporations Information Act*, R.S.O. 1990, c. C.39.

4.7 The licensee shall notify the director, in writing, of any changes to the following personnel identified on the licence application form whenever staffing changes are made

(a) Owner of the Laboratory;
(b) Laboratory Administrator;
(c) Laboratory Operator;
(d) Laboratory Director, and
(e) Laboratory Director Designate

4.8 As per section 73(6) of the SDWA this licence is not transferable without the consent of the Director.

Information

4.9 Any information requested, by the Ministry, concerning the drinking-water testing laboratory and its operation under this licence, including but not limited to any records required to be kept by this licence shall be provided to the Ministry, upon request.

4.10 Records required by or created in accordance with the SDWA, any regulations under the SDWA, or this licence shall be retained for at least 5 years in a location where a provincial officer who is inspecting the laboratory can conveniently view them.

4. 11 The receipt of any information by the Ministry or the failure of the Ministry to prosecute any person or to require any person to take any action, under this licence or under any statute, regulation or other legal requirement, in relation to the information, shall not be construed as an approval, waiver, or justification by the Ministry of any act or omission of any person that contravenes any term or condition of this approval or any statute, regulation or other legal requirement.

Part V: Special Conditions

1 . Pursuant to subsection 10(1), clause (d) of O. Reg. 248/03, the chain of custody procedures submitted by the licensee as part of the application for this licence are approved.

2. When a sample is submitted to the licensee for a drinking-water test for a microbiological parameter, the licensee shall ensure that the test is conducted in a standardized timely manner and that microbiological plates are processed and read without extended overnight refrigerated incubation.

3. The licensee is authorized to report the results of more than one parameter (such as total THMs) as an aggregate result in order to comply with reporting requirements provided that that licensee conducts a separate test for each parameter using a method otherwise authorized by this licence, and the means by which the aggregate is calculated is documented and kept available for inspection by the Ministry.

4. The licensee shall not filter drinking water samples prior to analyses unless dictated by non-routine analytical contingencies.

4.1 The licensee shall collect and handle drinking water samples in accordance with the Ministry's Protocol.

5. Licensed laboratories shall report all adverse water quality results as per the drinking water legislation without any regard to calculated uncertainty estimations.

6. Due to short holding time and the requirement for immediate analyses of residual chlorine, the data from the determination of residual chlorine cannot be used for the purposes of the SDWA, unless holding times are met.

Note to the Licensee Regarding Reviewable Decisions

All or part of this licence may be reviewable in accordance with the provisions of Part X of the SDWA. *In accordance with Section 129(1) of the SDWA, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal.* ***Section 129(2) sets out a procedure upon which the 15 days may be extended by the Tribunal.*** *Section 129(3) of the SDWA provides that the Notice requiring the hearing shall state:*

1. The aspect of the decision, including the portion of the permit, licence, approval, order or notice of administrative penalty in respect of which the hearing is required; and
2. The grounds for review to be relied on by the person at the hearing.

Except with leave of the Tribunal, a person requiring a hearing in relation to a reviewable decision is not entitled to,

(a) a review of an aspect of the decision other than that stated in the notice requiring the hearing; or

(b) a review of the decision other than on the grounds stated in the notice

The Notice should also include:

1. The name of the appellant;
2. The address of the appellant;
3. The Licence number;
4. The date of the Licence;
5. The name of the Director;

The Notice should be signed and dated by the appellant. This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Part VII, Safe Drinking Water Act, 2002
Safe Drinking Water Branch
Ministry of Environment & Climate Change
125 Resources Road
Toronto, Ontario
M9P 3V6

** If the Director believes that a reviewable decision that he or she is about to make in respect of a drinking-water testing licence, if stayed by an appeal, would endanger, or likely endanger, public health, the Director shall include in the decision the reasons for his or her belief and shall also serve a copy of the decision on the Chief Medical Officer of Health. In the case of a reviewable decision in respect of a drinking-water testing licence, if the Chief Medical Officer of Health advises the Tribunal, the licensee and the Director that in his or her opinion the staying of the decision would endanger, or likely endanger, public health, the Tribunal may not stay the operation of a reviewable decision.*

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

Schedule "A"
Application and Supporting Documentation

The following documents are incorporated into and constitute part of this licence:

1. Application received by the Director on 07/23/08, 06/01/09, 06/12/09, 08/26/09, 11/03/11, 03/12/12 05/23/12, 05/29/12, 11/05/12, 01/09/13, 07/30/13, 01/19/15, 08/14/15, 09/03/15, 10/20/15, 11/17/15, 01/04/16, 01/28/16 and 07/26/16.

Appendix D

Laboratory Analytical Methods

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Misc.-Field Tests			
Air volume	HYGIENE METHOD	0	
Waste-Sample Preparation			
Final pH	EPA 1311	0.10	pH units
Initial pH	EPA 1311	0.10	pH units
Water-Physical Tests			
Color, Apparent	APHA 2120	1.0	C.U.
Conductivity	APHA 2510 B	3.0	umhos/cm
Hardness (as CaCO3)	APHA 2340 B	10	mg/L
pH	APHA 4500 H-Electrode	0.10	pH units
Total Dissolved Solids	APHA 2540C	20	mg/L
Total Suspended Solids	APHA 2540 D-Gravimetric	2.0	mg/L
Turbidity	APHA 2130 B	0.10	NTU
Soil-Physical Tests			
% Moisture	Gravimetric: Oven Dried	0.10	%
Soil-Particle Size			
% Clay (<2um)	Forestry Canada (1991) p. 46-53	0.10	%
% Sand (2.0mm - 0.05mm)	Forestry Canada (1991) p. 46-53	0.10	%
% Silt (0.05mm - 2um)	Forestry Canada (1991) p. 46-53	0.10	%
Texture	Forestry Canada (1991) p. 46-53		
Filter-Particulates			
Particulates Analysis	SEE SUBLET LAB'S REPORT		
Dustfall-Particulates			
Fixed Insoluble Dustfall	BCMOE DUSTFALLS	0.10	mg/dm2.day
Total Insoluble Dustfall	BCMOE DUSTFALLS	0.10	mg/dm2.day
Volatile Insoluble Dustfall	BCMOE DUSTFALLS	0.10	mg/dm2.day
Air-Asbestos/Quartz/Other Fibres			
Cristobalite	NIOSH 7500		
Soil-Leachable Anions & Nutrients			
Nitrate-N	EPA 300.0	1.0	ug/g
Nitrite-N	EPA 300.0	1.0	ug/g
Total Kjeldahl Nitrogen	APHA 4500-N	200	mg/kg
Water-Anions and Nutrients			
Alkalinity, Bicarbonate (as CaCO3)	EPA 310.2	10	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Alkalinity, Carbonate (as CaCO3)	EPA 310.2	10	mg/L
Alkalinity, Hydroxide (as CaCO3)	EPA 310.2	10	mg/L
Alkalinity, Total (as CaCO3)	EPA 310.2	10	mg/L
Ammonia, Total (as N)	EPA 350.1	0.050	mg/L
Bromide (Br)	EPA 300.0 (IC)	0.10	mg/L
Chloride	EPA 300.0 (IC)	2.0	mg/L
Chloride (Cl)	EPA 300.0 (IC)	2.0	mg/L
Fluoride	EPA 300.0 (IC)	0.10	mg/L
Nitrate and Nitrite as N	APHA 4110 B	0.10	mg/L
Nitrate-N (NO3-N)	EPA 300.0 (IC)	0.10	mg/L
Nitrite-N	EPA 300.1 (Modified)	0.0010	mg/L
Sulphate	EPA 300.0 (IC)	2.0	mg/L
Sulphate (SO4)	EPA 300.0 (IC)	2.0	mg/L
Total Kjeldahl Nitrogen	APHA 4500-N	0.15	mg/L
Total Phosphorus	APHA 4500-P B E	0.0030	mg/L
Soil-Anions and Nutrients			
Nitrate and Nitrite as N	APHA 4110 B	1.0	ug/g
Water-Cyanides			
Cyanide, Free	ASTM 7237	0.0050	mg/L
Water-Organic / Inorganic Carbon			
Dissolved Organic Carbon	APHA 5310 B-INSTRUMENTAL	1.0	mg/L
Total Organic Carbon	APHA 5310B	1.0	mg/L
Soil-Organic / Inorganic Carbon			
Fraction Organic Carbon	CARTER 21.2	0.0010	g/g
Total Organic Carbon	CARTER 21.2	0.10	%
Water-Bacteriological Tests			
E. Coli	SM 9222D	0	CFU/100 mL
Fecal Coliforms	SM 9222D	0	CFU/100 mL
Total Coliforms	SM 9222B	0	CFU/100 mL
Soil-Metals			
Aluminum (Al)	EPA 200.2/6020A	50	ug/g
Arsenic (As)	EPA 200.2/6020A	0.2	ug/g
Arsenic (As)	EPA 200.2/6020A	1	ug/g
Barium (Ba)	EPA 200.2/6020A	1	ug/g
Cadmium (Cd)	EPA 200.2/6020A	0.5	ug/g
Calcium (Ca)	EPA 200.2/6020A	100	ug/g

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Chromium (Cr)	EPA 200.2/6020A	1	ug/g
Copper (Cu)	EPA 200.2/6020A	1	ug/g
Iron (Fe)	EPA 200.2/6020A	50	ug/g
Lead (Pb)	EPA 200.2/6020A	1	ug/g
Magnesium (Mg)	EPA 200.2/6020A	20	ug/g
Manganese (Mn)	EPA 200.2/6020A	1	ug/g
Mercury (Hg)	SW846 3050B/7471	0.010	ug/g
Sodium (Na)	EPA 200.2/6020A	100	ug/g
Uranium (U)	EPA 200.2/6020A	1	ug/g
Zinc (Zn)	EPA 200.2/6020A	5	ug/g
Dustfall-Metals			
Aluminum (Al)-Total	EPA 6020A	0.0030	mg/dm2.day
Antimony (Sb)-Total	EPA 6020A	0.00010	mg/dm2.day
Arsenic (As)-Total	EPA 6020A	0.00010	mg/dm2.day
Barium (Ba)-Total	EPA 6020A	0.000050	mg/dm2.day
Beryllium (Be)-Total	EPA 6020A	0.00050	mg/dm2.day
Bismuth (Bi)-Total	EPA 6020A	0.00050	mg/dm2.day
Boron (B)-Total	EPA 6020A	0.010	mg/dm2.day
Cadmium (Cd)-Total	EPA 6020A	0.000050	mg/dm2.day
Calcium (Ca)-Total	EPA 6020A	0.020	mg/dm2.day
Chromium (Cr)-Total	EPA 6020A	0.00050	mg/dm2.day
Cobalt (Co)-Total	EPA 6020A	0.00010	mg/dm2.day
Copper (Cu)-Total	EPA 6020A	0.00050	mg/dm2.day
Interval	EPA 245.7	1	days
Interval	EPA 6020A	1	days
Lead (Pb)-Total	EPA 6020A	0.000050	mg/dm2.day
Lithium (Li)-Total	EPA 6020A	0.0050	mg/dm2.day
Magnesium (Mg)-Total	EPA 6020A	0.0050	mg/dm2.day
Manganese (Mn)-Total	EPA 6020A	0.000050	mg/dm2.day
Mercury (Hg)-Total	EPA 245.7	0.000050	mg/dm2.day

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Molybdenum (Mo)-Total	EPA 6020A	0.000050	mg/ dm2.day
Nickel (Ni)-Total	EPA 6020A	0.00050	mg/ dm2.day
Potassium (K)-Total	EPA 6020A	0.050	mg/ dm2.day
Selenium (Se)-Total	EPA 6020A	0.0010	mg/ dm2.day
Silver (Ag)-Total	EPA 6020A	0.000010	mg/ dm2.day
Sodium (Na)-Total	EPA 6020A	0.050	mg/ dm2.day
Strontium (Sr)-Total	EPA 6020A	0.00010	mg/ dm2.day
Thallium (Tl)-Total	EPA 6020A	0.00010	mg/ dm2.day
Tin (Sn)-Total	EPA 6020A	0.00010	mg/ dm2.day
Uranium (U)-Total	EPA 6020A	0.000010	mg/ dm2.day
Vanadium (V)-Total	EPA 6020A	0.0010	mg/ dm2.day
Zinc (Zn)-Total	EPA 6020A	0.0030	mg/ dm2.day

Water-Total Metals

Aluminum (Al)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.003	mg/L
Aluminum (Al)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.01	mg/L
Aluminum (Al)-Total	EPA 200.8	0.01	mg/L
Antimony (Sb)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Arsenic (As)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Arsenic (As)-Total	EPA 200.8	0.001	mg/L
Barium (Ba)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Barium (Ba)-Total	EPA 200.8	0.002	mg/L
Beryllium (Be)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Bismuth (Bi)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Boron (B)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.01	mg/L
Cadmium (Cd)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Cadmium (Cd)-Total	EPA 200.8	0.00009	mg/L
Calcium (Ca)-Total	EPA 200.8	0.5	mg/L
Calcium (Ca)-Total	EPA SW-846 3005A/6010B	0.05	mg/L
Chromium (Cr)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Chromium (Cr)-Total	EPA 200.8	0.0005	mg/L
Cobalt (Co)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Copper (Cu)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Copper (Cu)-Total	EPA 200.8	0.001	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Iron (Fe)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.01	mg/L
Iron (Fe)-Total	EPA 200.8	0.05	mg/L
Lead (Pb)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Lead (Pb)-Total	EPA 200.8	0.0005	mg/L
Lithium (Li)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Magnesium (Mg)-Total	EPA 200.8	0.5	mg/L
Magnesium (Mg)-Total	EPA SW-846 3005A/6010B	0.1	mg/L
Manganese (Mn)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Manganese (Mn)-Total	EPA 200.8	0.001	mg/L
Mercury (Hg)-Total	EPA SW846 7470A	0.000010	mg/L
Molybdenum (Mo)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Nickel (Ni)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Phosphorus (P)-Total	EPA SW-846 3005A/6010B	0.3	mg/L
Potassium (K)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.05	mg/L
Selenium (Se)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Silicon (Si)-Total	EPA SW-846 3005A/6010B	0.05	mg/L
Silver (Ag)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Sodium (Na)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.05	mg/L
Sodium (Na)-Total	EPA 200.8	0.5	mg/L
Strontium (Sr)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0002	mg/L
Thallium (Tl)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Tin (Sn)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Titanium (Ti)-Total	EPA SW-846 3005A/6010B	0.01	mg/L
Uranium (U)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Uranium (U)-Total	EPA 200.8	0.001	mg/L
Vanadium (V)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.001	mg/L
Zinc (Zn)-Total	APHA 3030 B&E / EPA SW-846 6020A	0.003	mg/L
Zinc (Zn)-Total	EPA 200.8	0.003	mg/L
Water-Dissolved Metals			
Aluminum (Al)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.001	mg/L
Antimony (Sb)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Arsenic (As)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Barium (Ba)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Beryllium (Be)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Bismuth (Bi)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Boron (B)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.01	mg/L
Cadmium (Cd)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Calcium (Ca)-Dissolved	EPA 200.8	0.5	mg/L
Chromium (Cr)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Cobalt (Co)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Copper (Cu)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0002	mg/L
Dissolved Metals Filtration Location	EPA 200.8		
Iron (Fe)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.01	mg/L
Lead (Pb)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Lithium (Li)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Magnesium (Mg)-Dissolved	EPA 200.8	0.5	mg/L
Manganese (Mn)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Molybdenum (Mo)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00005	mg/L
Nickel (Ni)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0005	mg/L
Potassium (K)-Dissolved	EPA SW-846 3005A/6020A	0.05	mg/L
Selenium (Se)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Silver (Ag)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Sodium (Na)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.05	mg/L
Strontium (Sr)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0002	mg/L
Thallium (Tl)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Tin (Sn)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.0001	mg/L
Titanium (Ti)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.01	mg/L
Uranium (U)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.00001	mg/L
Vanadium (V)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.001	mg/L
Zinc (Zn)-Dissolved	APHA 3030 B&E / EPA SW-846 6020A	0.001	mg/L
Waste-TCLP Metals			
Arsenic (As)	EPA 200.8	0.001	mg/L
Barium (Ba)	EPA 200.8	0.01	mg/L
Cadmium (Cd)	EPA 200.8	0.0001	mg/L
Chromium (Cr)	EPA 200.8	0.001	mg/L
Lead (Pb)	EPA 200.8	0.001	mg/L
Mercury (Hg)	SW846 7470A	0.00010	mg/L
Water-Aggregate Organics			
BOD	APHA 5210 B	2.0	mg/L
COD	APHA 5220 D	10	mg/L
Oil and Grease, Total	APHA 5520 B	2.0	mg/L
Mineral Oil and Grease	APHA 5520 B	1.0	mg/L
Phenols (4AAP)	EPA 9066	0.0010	mg/L
Soil-Aggregate Organics			
Oil and Grease, Total	APHA 5520 B	500	mg/kg
Water-Volatile Organic Compounds			
1,4-Difluorobenzene	SW846 8260 (HEADSPACE)	1	

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
4-Bromofluorobenzene	SW846 8260 (HEADSPACE)	1	
Benzene	SW846 8260 (HEADSPACE)	0.5	ug/L
Ethyl Benzene	SW846 8260 (HEADSPACE)	0.5	ug/L
Toluene	SW846 8260 (HEADSPACE)	0.5	ug/L
Water-Hydrocarbons			
2-Bromobenzotrifluoride	MOE DECPH-E3421/CCME TIER 1	1	
3,4-Dichlorotoluene	E3421/CCME (HS)	1	
Chrom. to baseline at nC50	MOE DECPH-E3421/CCME TIER 1		
F2-Naphth	CCME CWS-PHC DEC-2000 - PUB# 1310-L	100	ug/L
F3-PAH	CCME CWS-PHC DEC-2000 - PUB# 1310-L	250	ug/L
F2 (C10-C16)	MOE DECPH-E3421/CCME TIER 1	100	ug/L
F3 (C16-C34)	MOE DECPH-E3421/CCME TIER 1	250	ug/L
F4 (C34-C50)	MOE DECPH-E3421/CCME TIER 1	250	ug/L
Total Hydrocarbons (C6-C50)	CCME CWS-PHC DEC-2000 - PUB# 1310-L	250	ug/L
F1 (C6-C10)	E3421/CCME (HS)	100	ug/L
F1-BTEX	CCME CWS-PHC DEC-2000 - PUB# 1310-L	100	ug/L
Soil-Hydrocarbons			
2-Bromobenzotrifluoride	MOE DECPH-E3398/CCME TIER 1	1	
3,4-Dichlorotoluene	E3398/CCME TIER 1-HS	1	
Chrom. to baseline at nC50	MOE DECPH-E3398/CCME TIER 1		
F2-Naphth	CCME CWS-PHC DEC-2000 - PUB# 1310-S	10	ug/g
F3-PAH	CCME CWS-PHC DEC-2000 - PUB# 1310-S	50	ug/g
F2 (C10-C16)	MOE DECPH-E3398/CCME TIER 1	10	ug/g
F3 (C16-C34)	MOE DECPH-E3398/CCME TIER 1	50	ug/g
F4 (C34-C50)	MOE DECPH-E3398/CCME TIER 1	50	ug/g
Total Hydrocarbons (C6-C50)	CCME CWS-PHC DEC-2000 - PUB# 1310-S	50	ug/g
F1 (C6-C10)	E3398/CCME TIER 1-HS	5.0	ug/g
F1-BTEX	CCME CWS-PHC DEC-2000 - PUB# 1310-S	10	ug/g
Water-Organic Parameters			
Chlorophyll a	EPA 445.0 ACET	0.10	ug/L
Phaeophytin a	EPA 445.0 ACET	0.10	ug/L
Misc.-Miscellaneous			
Special Request	SEE SUBLET LAB RESULTS		

Methodology

<table>
<tr><th>Product</th><th>Matrix</th><th>Product Description</th><th>Analytical Method Reference</th></tr>
<tr><td>AIR VOLUME-ED</td><td>Misc.</td><td>Air volume (L)</td><td>HYGIENE METHOD</td></tr>
<tr><td colspan="4">NOTE: When air concentrations of analytes are reported, they are based on air sampling information (air volume, sampling time, sampling flow rate) supplied by the client.</td></tr>
<tr><td>ALK-SPEC-WT</td><td>Water</td><td>Speciated Alkalinity</td><td>EPA 310.2</td></tr>
<tr><td>ALK-WT</td><td>Water</td><td>Alkalinity, Total (as CaCO3)</td><td>EPA 310.2</td></tr>
<tr><td>ANIONS3-WT</td><td>Water</td><td>Cl, F, SO4</td><td>EPA 300.0 (IC)</td></tr>
<tr><td>BOD-WT</td><td>Water</td><td>BOD</td><td>APHA 5210 B</td></tr>
<tr><td colspan="4">Diluted and seeded samples are filled in an airtight bottle and incubated at a specified temperature for 5 days.</td></tr>
<tr><td>BR-WT</td><td>Water</td><td>Bromide</td><td>EPA 300.0 (IC)</td></tr>
<tr><td>BTX-HS-WT</td><td>Soil</td><td>BTEX by Headspace</td><td>SW846 8260 (HEADSPACE)</td></tr>
<tr><td colspan="4">BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.</td></tr>
<tr><td>BTX-HS-WT</td><td>Water</td><td>BTEX by Headspace</td><td>SW846 8260 (HEADSPACE)</td></tr>
<tr><td colspan="4">BTX is determined by analyzing by headspace-GC/MS.</td></tr>
<tr><td>C-DIS-ORG-WT</td><td>Water</td><td>Dissolved Organic Carbon</td><td>APHA 5310 B-INSTRUMENTAL</td></tr>
<tr><td colspan="4">Sample is filtered through a 0.45um filter, sample is then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic cabon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.</td></tr>
<tr><td>CHL/A-ACET-FLUORO-WP</td><td>Water</td><td>Chlorophyll a by fluorometry</td><td>EPA 445.0 ACET</td></tr>
<tr><td colspan="4">This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.</td></tr>
<tr><td>CL-WT</td><td>Water</td><td>Chloride</td><td>EPA 300.0 (IC)</td></tr>
<tr><td>CN-FREE-CFA-WT</td><td>Water</td><td>Free Cyanide in water by CFA</td><td>ASTM 7237</td></tr>
<tr><td colspan="4">This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.</td></tr>
<tr><td>COD-BF</td><td>Water</td><td>Chemical Oxygen Demand</td><td>APHA 5220 D</td></tr>
<tr><td colspan="4">The dichromate ion oxidizes COD material when the sample is digested and after digestion the sample is then analyzed on a spectrophotometer.</td></tr>
<tr><td>COD-WT</td><td>Water</td><td>Chemical Oxygen Demand</td><td>APHA 5220 D</td></tr>
<tr><td colspan="4">The dichromate ion oxidizes COD material when the sample is digested and after digestion the sample is then analyzed on a spectrophotometer.</td></tr>
</table>

Methodology

Product	Matrix	Product Description	Analytical Method Reference
COLOUR-WT	Water	Colour	APHA 2120
Apparent colour is determined by analysis of the decanted sample using the platinum-cobalt colourimetric method.			
DUSTFALLS-INS.DM2-VA	Dustfall	Dustfalls Insoluble (mg/dm2.day)	BCMOE DUSTFALLS
Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.			
EC-BF	Water	Conductivity	APHA 2510 B
Water samples can be measured directly by immersing the conductivity cell into the sample.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5±0.2°C for 24±2h. Method ID: WT-TM-1200			
EC-WT	Water	Conductivity	APHA 2510 B
Water samples can be measured directly by immersing the conductivity cell into the sample.			
ETL-HARDNESS-CALC-WT	Water	Hardness (as CaCO3)	APHA 2340 B
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
F-WT	Water	Fluoride	EPA 300.0 (IC)
F1-F4-CALC-WT	Soil	CCME Total Hydrocarbons	CCME CWS-PHC DEC-2000 - PUB# 1310-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k) fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

Methodology

Product	Matrix	Product Description	Analytical Method Reference
F1-F4-CALC-WT	Water	CCME Total Hydrocarbons	CCME CWS-PHC DEC-2000 - PUB# 1310-L

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k) fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-WT	Soil	F1 (O.Reg.153/04)	E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

F1-HS-WT	Water	F1 (O.Reg.153/04)	E3421/CCME (HS)

Fraction F1 is determined by analyzing by headspace-GC/FID.

F2-F4-WT	Soil	F2-F4 (O.Reg.153/04)	MOE DECPH-E3398/CCME TIER 1

A sub-sample of the solid sample is extracted with a solvent mixture. Following extraction, the sample extract is treated in situ with Silica Gel analyzed by GC/FID.

The F2 fraction is determined by integrating the area in the chromatogram from the apex of nC10 to the apex nC16 and quantitating using external calibration using a standard mix containing nC10, nC16 and nC34. Similarly, the F3 fraction extends from the apex of nC16 to the apex nC34 and the F4 fraction covers the area from the apex nC34 to the apex nC50. If the chromatogram does not return to the baseline by the time nC50 elutes, a gravimetric determination of the F4 is performed.

Methodology

Product	Matrix	Product Description	Analytical Method Reference
F2-F4-WT	Water	F2-F4 (O.Reg.153/04)	MOE DECPH-E3421/CCME TIER 1

The petroleum hydrocarbons are extracted from the aqueous samples using solvent partition. The extracts are treated with silica gel to remove polar contaminants. The final concentrated extract is analyzed by gas chromatography (GC) using flame ionization detection (FID) and a 100% polydimethylsiloxane column.

The F2 fraction is determined by integrating the area in the chromatogram from the apex of nC10 to the apex nC16 and quantitating using external calibration using a standard mix containing nC10, nC16 and nC34. Similarly, the F3 fraction extends from the apex of nC16 to the apex nC34 and the F4 fraction covers the area from the apex nC34 to the apex nC50. If the chromatogram does not return to the baseline by the time nC50 elutes, a gravimetric determination of the F4 is performed.

FILTER-NC-WT	Water	Lab Filtered and Preserved (as required)	
HG-DUST(DM2-CVAFS-VA	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-R511-WT	Soil	Mercury-O.Reg 153/04 (July 2011)	SW846 3050B/7471

Solid sample is digested with a heated, strong, mixed acid solution to convert all forms of mercury to divalent mercury. The divalent mercury is then reduced to elemental mercury, sparged from solution and analyzed by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

HG-T-L-CVAA-WT	Water	Total Mercury in Water by CVAAS (Low)	EPA SW846 7470A

Liquid sample is digested with a heated, strong, mixed acid solution to convert all forms of mercury to divalent mercury. The divalent mercury is then reduced to elemental mercury, sparged from solution and analyzed by CVAAS.

HG-TCLP-WT	Waste	Mercury (CVAA) for O.Reg 347	SW846 7470A
LEACH-TCLP-WT	Waste	Leachate Procedure for Reg 347	EPA 1311
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-D-MS-WT	Water	Dissolved Metals in Water by ICPMS	EPA 200.8

The metal constituents of a non-acidified sample that pass through a membrane filter prior to ICP/MS analysis.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-DIS-MS-VA	Water	Dissolved Metals by ICPMS	EPA SW-846 3005A/6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

Methodology

<table>
<tr><th>Product</th><th>Matrix</th><th>Product Description</th><th>Analytical Method Reference</th></tr>
<tr><td>MET-DUST(DM2)-MS-VA</td><td>Dustfall</td><td>Total Metals in Dustfalls by ICPMS</td><td>EPA 6020A</td></tr>
<tr><td colspan="4">This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).</td></tr>
<tr><td>MET-T-CCMS-VA</td><td>Water</td><td>Total Metals in Water by CRC ICPMS</td><td>APHA 3030 B&E / EPA SW-846 6020A</td></tr>
<tr><td colspan="4">This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).</td></tr>
<tr><td>MET-T-MS-WT</td><td>Water</td><td>Total Metals in Water by ICPMS</td><td>EPA 200.8</td></tr>
<tr><td colspan="4">This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).</td></tr>
<tr><td>MET-TCLP-WT</td><td>Waste</td><td>O.Reg 347 TCLP Leachable Metals</td><td>EPA 200.8</td></tr>
<tr><td>MET-TOT-ICP-VA</td><td>Water</td><td>Total Metals in Water by ICPOES</td><td>EPA SW-846 3005A/6010B</td></tr>
<tr><td colspan="4">This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</td></tr>
<tr><td>MET-UG/G-CCMS-WT</td><td>Soil</td><td>Metal Scan Collision Cell ICPMS</td><td>EPA 200.2/6020A</td></tr>
<tr><td colspan="4">Sample is vigorously digested with nitric and hydrochloric acid. Analysis is conducted by ICP/MS.
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).</td></tr>
<tr><td>MOISTURE-WT</td><td>Soil</td><td>% Moisture</td><td>Gravimetric: Oven Dried</td></tr>
<tr><td>NH3-WT</td><td>Water</td><td>Ammonia, Total as N</td><td>EPA 350.1</td></tr>
<tr><td colspan="4">Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.</td></tr>
<tr><td>NO2-L-IC-WP</td><td>Water</td><td>Nitrite as N by Ion Chromatography</td><td>EPA 300.1 (Modified)</td></tr>
<tr><td colspan="4">Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.</td></tr>
<tr><td>NO2-WT</td><td>Soil</td><td></td><td>EPA 300.0</td></tr>
<tr><td>NO3-WT</td><td>Soil</td><td>Nitrate in Soil</td><td>EPA 300.0</td></tr>
<tr><td>NO3-WT</td><td>Water</td><td>Nitrate-N</td><td>EPA 300.0 (IC)</td></tr>
<tr><td colspan="4">A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.</td></tr>
</table>

Methodology

<table>
<tr><th>Product</th><th>Matrix</th><th>Product Description</th><th>Analytical Method Reference</th></tr>
<tr><td>OGG-SPEC-CALC-WT</td><td>Water</td><td>Speciated Oil and Grease A/V Calculation</td><td>CALCULATION</td></tr>
<tr><td colspan="4">Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.</td></tr>
<tr><td>OGG-SPEC-WT</td><td>Water</td><td>Speciated Oil and Grease-Gravimetric</td><td>APHA 5520 B</td></tr>
<tr><td colspan="4">Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.</td></tr>
<tr><td>OGG-TOT-WT</td><td>Soil</td><td>Oil and Grease, Total</td><td>APHA 5520 B</td></tr>
<tr><td colspan="4">Sample is extracted with an acetone:hexane mixture followed, extract is then evaporated and residue is weighed to determine total oil and grease.</td></tr>
<tr><td>OGG-TOT-WT</td><td>Water</td><td>Oil and Grease, Total</td><td>APHA 5520 B</td></tr>
<tr><td colspan="4">Sample is extracted with hexane, extract is then evaporated and the residue is weighed to determine total oil and grease.</td></tr>
<tr><td>P-TOTAL-LOW-WT</td><td>Water</td><td>Phosphorus, Total, Low Level</td><td>APHA 4500-P B E</td></tr>
<tr><td colspan="4">This analysis is carried by out an discrete colorimetric auto-analyzer using procedures adapted from APHA Method 4500-P "Phosphorus".</td></tr>
<tr><td>PARTICULATE-0.10-SLT</td><td>Filter</td><td>Respirable Dust N0600</td><td>SEE SUBLET LAB'S REPORT</td></tr>
<tr><td>PH-BF</td><td>Water</td><td>pH</td><td>APHA 4500 H-Electrode</td></tr>
<tr><td colspan="4">Water samples are analyzed directly by a calibrated pH meter.
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).</td></tr>
<tr><td>PH-WT</td><td>Water</td><td>pH</td><td>APHA 4500 H-Electrode</td></tr>
<tr><td colspan="4">Water samples are analyzed directly by a calibrated pH meter.
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).</td></tr>
<tr><td>PHENOLS-4AAP-WT</td><td>Water</td><td>Phenol (4AAP)</td><td>EPA 9066</td></tr>
<tr><td colspan="4">An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.</td></tr>
<tr><td>PHEOA-ACET-FLUORO-WP</td><td>Water</td><td>Pheophytin a by fluorometry</td><td>EPA 445.0 ACET</td></tr>
<tr><td colspan="4">This analysis is done using procedures modified from EPA method 445.0. Pheopigments present in the sample are determined collectively as Pheophytin a by a 90% (v/v) acetone extraction followed with analysis by fluorometry using the acidification procedure.</td></tr>
<tr><td>PREP-DUSTFALL-VA</td><td>Dustfall</td><td>Dustfall Sample Preparation</td><td></td></tr>
</table>

Methodology

Product	Matrix	Product Description	Analytical Method Reference
PSA-3-SK	Soil	Particle size - Pipette removal OM & CO3	Forestry Canada (1991) p. 46-53

Dry, < 2 mm soil is treated hydrochloric acid top remove carbonates, then hydrogen peroxide to remove organic matter. The remaining soil is treated with sodium hexametaphosphate to ensure complete dispersion of primary soil particles. The homogenized suspension is allowed to settle in accordance with Stoke's Law so that only clay particles remain in suspension.To determine the clay fraction, an aliquot of the clay suspension is removed, then dried and weighed. The sand fraction is determined by wet sieving the remaining suspension, then drying and weighing the sand retained on the sieve. The silt fraction is determined by calculation where % Silt = 100 - (%Sand+%Clay)

Reference:
Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

SAMPLE-DISPOSAL-WT	Misc.	Sample Handling and Disposal Fee	
SHIPPING-WT	Misc.	Shipping Charge	
SO4-WT	Water	Sulphate	EPA 300.0 (IC)
SOLIDS-TDS-BF	Water	Total Dissolved Solids	APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105±5°C overnight and then 180±10°C for 1hr.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105±5°C overnight and then 180±10°C for 1hr.

SOLIDS-TSS-BF	Water	Suspended solids	APHA 2540 D-Gravimetric

A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 105±5°C for a minimum of four hours or until a constant weight is achieved.

SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric

A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 105±5°C for a minimum of four hours or until a constant weight is achieved.

SPECIAL REQUEST-SLT	Misc.	Special Request Datachem Salt Lake	SEE SUBLET LAB RESULTS
TC-MF-WT	Water	Total Coliforms	SM 9222B

A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35±0.5°C for 24±2h. Method ID: WT-TM-1200

TKN-WT	Soil	Total Kjeldahl Nitrogen	APHA 4500-N

A homogenized soil sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.

Methodology

Product	Matrix	Product Description	Analytical Method Reference
TOC-WT	Soil	TOC & FOC in Solids	CARTER 21.2

TOC-WT | Water | Total Organic Carbon | APHA 5310B

Sample is injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic cabon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.

TURBIDITY-BF | Water | Turbidity | APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

TURBIDITY-WT | Water | Turbidity | APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

XYLENES-SUM-CALC-WT | Soil | Sum of Xylene Isomer Concentrations | CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

XYLENES-SUM-CALC-WT | Water | Sum of Xylene Isomer Concentrations | CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

Appendix E

Analytical Laboratory QA/QC Procedures

ALS Quality Management System Summary

ALS is a global diversified testing services organization with a presence on every continent, offering a broad range of services to leading global companies.

The following report summarizes standard practices routinely employed by the ALS Environmental Division in Canada. Our practices exceed accreditation requirements and have been built to meet the needs of our customers and to give them confidence in the reliability of our test data.

Additional information is available on request from the Quality Department. Customers are invited to audit or tour ALS facilities at their convenience.

Services to Customers

ALS cooperates closely with its customers to ensure their testing needs are understood, and allows them reasonable access to relevant work areas of the laboratories to audit the management system or to witness test work undertaken on their behalf.

All client issues are logged into our tracking system to ensure each issue is addressed completely and appropriately. Local and national oversight and initiatives ensure that identified improvements are incorporated in the Canadian laboratories so that customers receive the same level of service regardless of which location performs the testing.

Documentation and Document Control

Test methods and support procedures are documented in detail to ensure consistency of application, repeatability of test results and traceability of analyses.

Test method requirements include but are not limited to sample handling, sample storage, minimizing interference, sample preparation, reagent and standard specifications, equipment, supplies, calibration requirements, instrumental measurement procedures, quality control requirements, data quality objectives and corrective actions, calculations, reporting requirements, reference information, hazards and their preventive measures.

Administrative support procedures are also documented where needed to ensure quality system procedures and customer services are provided in a controlled, approved manner consistent with ALS policies and client needs.

All procedures are authorized prior to use by the signing authority, ensuring adequate technical and quality oversight.

Distribution of documents is controlled to ensure only the most recent version is available for use. Authorized documents are reviewed periodically by the signing authority to ensure they continue to meet ALS requirements and customer needs.

Test methods and support procedures are available for client viewing on-site.

Internal Audits

Internal audits are scheduled and performed by qualified Quality and Technical staff for all routine analytical procedures and Quality System elements. Such audits ensure that procedures are implemented as intended, that test methods are scientifically defensible and technically sound, and that policies, procedures and records continue to meet the Quality System objectives.

Quality staff may periodically initiate unscheduled audits in response to proficiency testing program results, client feedback, requests from managers or any other circumstance that warrants investigation.

Quality Control (QC)

ALS has established QC procedures for monitoring the validity of tests performed by its laboratories. Individual test methods specify quality control requirements, frequency of use, and Data Quality Objectives (DQOs).

The type of quality control elements used for process monitoring is dependent on the test performed, but typically includes (as appropriate): Calibration Verification Standards, Continuing Calibration Verifications, Instrument Blanks, Method Blanks, Laboratory Control Samples, Reference Materials, Matrix Spikes, Surrogate Spikes, and Internal Standards.

DQOs are established for each QC sample, based on a combination of reference method objectives, customer requirements and historical test method performance. Where applicable, prescriptive elements of reference methods take precedence over internal DQOs.

Test results for selected QC samples are available on test reports. Please contact your Account Manager for more information.

Control Charts

Control charts are used to provide a graphical representation of QC results and test method performance over time. Control charts graphically display DQOs as well as the statistically derived mean and ± 2 and 3 standard deviations ("sigma") around the mean, calculated from recent historical QC results. ALS applies advanced trend monitoring algorithms to identify outliers and non-random data distributions (trends) that may indicate undesirable changes in test method performance. The trend monitoring process has been automated within our LIMS. Upon data entry, each QC result is checked against programmed limits and trends. If a trend is identified, a notification is e-mailed to the analyst and their supervisor, so that it can be investigated and corrected.

Continuous Improvement

ALS is committed to continuously improving its processes and services. The Quality System feeds into a continuous cycle of review, implementation, and monitoring so that improvements are actively sought and adopted where needed.

Data Validation

ALS analytical data proceeds through several reviews prior to the release of final reports. The ALS data validation process includes test result validation, inter-parameter validation and report validation. Test result validation involves an independent peer review of raw and calculated test results. Inter-parameter validation occurs when all department specific parameters for a sample are completed, and involves an overall review of test results within each sample for consistency among any related test parameters. Report validation occurs when all the requested test results for a work order are completed, and involves a review of the final report before it is sent to the customer.

ALS maintains laboratory records in a traceable manner for five years.

Method Validation

Customers rely on ALS to select test methods that are appropriate to meet their needs. Wherever possible, ALS references the latest versions of published standard methods developed by organizations such as American Public Health Association, United States Environmental Protection Agency, NIOSH, Environment Canada, and other international, regional or regulatory organizations, or equipment manufacturers.

Method validations are conducted to confirm that our test methods are fit for their intended use. The validations are as extensive as necessary to meet the needs of the given application. The extent depends on the source of the method. Test methods are revalidated periodically to ensure continued suitability and fitness for purpose.

Method Detection Limits and Limits of Reporting

ALS Limits of Reporting (LORs) are established using rigorous experimental and statistical procedures that begin with the determination of the Method Detection Limit (MDL) at 99% confidence. The MDL takes into account several factors, like long term Method Blanks, low level Sample Duplicates, and low level Spiked Samples. When detected at or above the MDL, ALS test results are considered to be qualitatively accurate, and a parameter can be reported with 99% confidence as being present in the sample.

$$\mathbf{MDL = (s_0 \times t_{n-1}) + |MBlk|}$$

Where:
- s_0 = the standard deviation derived from the analysis of blank or low level samples, whichever gives a higher standard deviation,
- t_{n-1} = the Student's t-distribution with n-1 degrees of freedom for the one-sided 99% confidence interval.
- |MBlk|= the absolute value of the mean method blank.

ALS takes a conservative approach to detection limits. Our goal is to minimize false positives, because we recognize that any false positive results can be damaging for our clients. Where possible, we establish LORs at levels well-above the statistical MDL, and ideally at the LOQ_5. This improves the accuracy and precision of results near the detection limit, and reduces the chance of false positives due to sample-specific issues. At or above the LOQ_5, test results are considered to be quantitatively accurate. A reported parameter at the LOQ_5 is considered to be within 40% of the true value 95% of the time.

$$\mathbf{LOQ_5 = 5s_0 + |MBlk|}$$

Where:
- s_0 = the standard deviation used in the MDL calculation,
- |MBlk| = the absolute value of the mean method blank.

The D. L. column on ALS analytical reports contains the LOR. The LOR may be the MDL as calculated above, or a higher value. ALS does not report LORs that are less than the calculated MDL.

Measurement Uncertainty (MU)

ALS procedures for calculating measurement uncertainty are based on accepted practices of identifying components contributing to uncertainty, compiling data that represents or includes these components, evaluating the data using appropriate statistical calculations, and reporting in a manner that prevents misunderstanding of the result. The Type A method of calculating measurement uncertainty is followed, however additional factors are considered to ensure the best and most complete information is derived from our evaluation of test method performance.

The ALS model describes the dependency of uncertainty on three factors. The first is a constant contribution to uncertainty attributable to s_0, the standard deviation of the method for concentrations that approach zero. The second is a constant relative uncertainty associated with higher parameter concentrations. The third is a constant contribution to uncertainty attributable to the mean long-term method blank value where it is significant. The following is the ALS equation for measurement uncertainty, using an expansion factor of k=2:

Expanded 95% Uncertainty as a Function of Concentration

$$\boxed{U(c) = 2 * [\sqrt{\{ s_0^2 + (\Theta c)^2 \}}] + |MBlk_{LT}|}$$

Where:
- **U(c)** = The expanded uncertainty at concentration c. The range c ± U(c) represents approximately the 95% confidence interval (two standard deviations).
- **c** = Measured concentration of parameter in the sample.
- **s_0** = A constant contribution to standard uncertainty represented by the standard deviation at zero concentration, which is related to the method detection limit.
- **θ** = Combined relative standard uncertainty, excluding MDL and Method Blank contributions. Theta has no units.
- **$|MBlk_{LT}|$** = Absolute value of the mean long-term Method Blank value, where significant (i.e. if > 1/5 s_0). [Note that the Method Blank term is not expanded because it represents a constant bias, not a variance.]

Uncertainty values obtained from this procedure must be regarded as estimates. Primarily, this is because all environmental samples are different, especially with regard to matrix effects and heterogeneity. It is our intent with this procedure to arrive at an estimate of a 95% confidence level uncertainty value that can be assumed to apply to 95% (or more) of the samples that a laboratory receives for a given test. It follows that for samples where undetected matrix effects or interferences occur, or for samples that are atypically heterogeneous, uncertainty estimates may be low.

Another aspect of reporting MU is the reporting of test method bias. Bias occurs in a small number of test methods that cannot recover 100% of a parameter from a sample. In these cases ALS reports bias along with the MU to aid with the interpretation of the test result.

Participation in Interlaboratory Proficiency Testing (PT) Programs

ALS locations participate in an extensive variety of proficiency testing programs. Where available, formal programs operated by outside agencies are used. When not available, ALS utilizes less formal proficiency testing studies. Root cause analysis is initiated and corrective action plans are developed when PT program results indicate a decline in test method performance.

Staff Training

Formal training procedures are in place to ensure all staff are trained in ALS polices and analytical procedures prior to performing analyses. A staff orientation program communicates ALS polices to newly hired staff. Task specific training is performed, and analyst proficiency is demonstrated and documented before staff are authorized to work independently. On-going analyst proficiency is monitored using proficiency testing programs. Records are maintained in training logs issued to staff upon hiring.

As well, ALS Canada promotes continuing education and learning by offering advanced courses covering technical and quality functions.

Employee Agreements

ALS protects its customers' confidential information and proprietary rights. We require all employees to review and sign a Code of Conduct policy that communicates the ALS confidentiality policy. It is ALS practice to never disclose information about a client's analysis to a third party without prior consent of the client, or unless compelled to by law. If we are obligated by law to disclose such information, we will inform the client prior to doing so.

Our employees avoid involvement in activities that would diminish confidence in their competence, impartiality, judgment, or integrity by complying with the ALS Code of Conduct and Data Integrity Policy.

Sample Tracking

Procedures are in place to track samples from receipt at the lab through to final reporting. A data management system (LIMS – Laboratory Information Management System) is used to generate a work order number for each sample submission, and a unique identification number is generated for each sample within the work order. The system is then used to assign specific analyses for the samples, to identify methods to be used, and to assign due dates for the results. The system is used to manage analytical workloads and track the status of all samples in-house. LIMS is a secure system that can only be accessed using login passwords. Controlling the level of access according to staff needs provides additional security.

When requested by the client, legal sample protocols are implemented to ensure chain of custody defensibility in a court of law. Contact the lab for legal sampling and transportation instructions if this service is needed.

Equipment Calibration

Measuring and testing equipment used by ALS laboratories that can have a significant effect on the accuracy or validity of test results is calibrated using established procedures. The procedures ensure traceability through an unbroken chain of calibrations or comparisons to national measurement standards. Where traceability of measurements to SI units is not possible and/or not relevant, traceability is provided by the use of certified reference materials and/or consensus standards.

Management Reviews (MR)

Management conducts a review at least annually to ensure the management system is effective, and continues to be suitable for its operations, and to identify necessary changes or improvements. Senior management is included in the review process for all locations.

ALS Quality Control Protocols

08 May, 2012

Quality control samples are introduced into batches of samples at critical points of sample handling, preparation and analysis to demonstrate the processes are performing as expected. In general, quality control samples are considered either Instrument QC or Method QC.

Instrument QC:

Instrument QC samples demonstrate control for the instrumental portion of a method. Instrument QC requirements must be successfully met before the analysis of Method QC or samples may proceed.

- Verification of initial calibration - criteria varies with each test.
- 2nd source Calibration Verification Standard (CVS) – at minimum, with each initial calibration.
- Continuing Calibration Verification (CCV) – frequency varies by test.
- Instrument Blanks – usage and frequency varies by test.

Method QC:

Method QC samples encompass the entire method and are initiated at the earliest point of the method where appropriate. Refer to the QC Definitions below. One set of Method QC is included for each batch of up to 20 client samples. Each set includes:

- 1 Method Blank.
- 1 Sample Duplicate. *
- 1 Lab Control Sample.
- 1 Reference Material or Matrix Spike. **
- Surrogate Compounds.

* Duplicate analyses are not performed where sub-sampling is not possible – e.g. most tests for organics in water.
** Spikes and Reference Materials are unavailable for Microbiology tests.

Method QC must be successfully analyzed before sample results are approved. Method QC results are normally reported to ALS clients with data reports.

Data Quality Objectives (DQOs):

DQOs are established for each QC sample, based on a combination of reference method objectives, customer requirements and historical test method performance. Where applicable, prescriptive elements of reference methods take precedence over internal DQOs. Current DQOs are available upon request.

Detailed descriptions of how DQOs are evaluated for different types of Quality Control samples are described on the following pages.

Types of Quality Control – Definitions and Evaluation Protocols

Method Blank (MB) - A blank sample prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of Method Blanks provide an estimate of the within batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Except in special cases (as outlined in ALS DQO summary documents) the ALS DQO for Method Blanks is for all results to lie below the Limit of Reporting (LOR).

Laboratory Sample Duplicate (DUP) - A second portion of sample taken from the same container as the sub-sample used for the primary analysis, that is analyzed independently through all steps of the laboratory's sampling and analytical procedures. Duplicate samples are used to assess variance of the total method including sampling and analysis.

Duplicate precision is normally measured as Relative Percent Difference (RPD), where RPD = |(Result2 - Result1) / Mean| * 100. Duplicate samples should normally agree to within the ALS Precision DQO for the test and parameter (expressed as RPD), or within ± 2 x the LOR (for low level results). Refer to the ALS DQOs for Precision for specific limits for any given test.

ALS does not establish DQOs for Field Sample Duplicates. However, it is generally understood and accepted that the variability of Field Sample Duplicates is significantly more than what is observed with Laboratory Sample Duplicates.[1]

Laboratory Control Sample (LCS) - A known matrix spiked with compound(s) representative of the target analytes. An LCS is used to verify the accuracy of the laboratory's performance of the test.

LCS accuracy is calculated as the measured amount divided by the target concentration, and is normally expressed as percent recovery. LCS recoveries should normally lie within the ALS Accuracy DQOs for the test and parameter. For a low level LCS, the result should lie within ± 1 x the LOR of the target concentration. Refer to the ALS Accuracy DQOs for specific limits for any given test.

Reference Material (RM) – A material or substance, one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. An RM is similar to an LCS, but encompasses a representative sample matrix. Similar to an LCS, an RM is used to verify the accuracy of the laboratory's performance of the test, but including the challenges of a complex sample matrix.

RM accuracy is calculated, expressed, and evaluated similarly to LCS accuracy. Refer to ALS Accuracy DQOs for specific limits for any given test.

Matrix Spike (MS) - A sample prepared by adding a known amount of a target analyte to a specified amount of a sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the sample matrix on a method's recovery efficiency.

Matrix Spike results are calculated and expressed as percent recovery, by dividing the measured result (minus any analyte contribution from the unspiked sample) by the target analyte concentration. Matrix Spike results should normally lie within the ALS Accuracy DQOs for Matrix

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[1] Depending on the type of Field Sample Duplicates being evaluated (e.g. Co-located versus Split Sample Duplicates), ALS recommends DQOs for Field Sample Duplicates that are between 1.5 – 2.0 times higher than our Laboratory Sample Duplicate DQOs. Co-located Sample Duplicates generally require higher DQOs than Split Sample Duplicates.

Spikes. Matrix Spike results cannot be calculated or reported in cases where the background concentration of the test parameter in the sample is too high relative to the spike level.

Surrogate Compounds (SURR) – Surrogate Compounds are added to every sample where applicable (organics tests only). They are substances with properties that mimic the analyte of interest, and which are unlikely to be found in environmental samples. They are added at known concentration to samples to establish that the analytical method has been properly performed.

Surrogate results are calculated and expressed as percent recovery, by dividing the measured result against the expected target concentration. Refer to ALS Accuracy DQOs for specific limits for any given test.

Automated Relational Checks

In addition to all our standard Quality Control checks, ALS also employs dozens of "Relational Checks", which are programmed into our Laboratory Information Systems (LIMS) to automatically highlight any situations where the expected relationships between different test parameters are violated, which can often point to errors. Such errors may originate with field sampling, or from laboratory processes, but should always be identified and pro-actively investigated.

Total versus Dissolved Metals ("D > T" Check) – One of the most important and common relational checks we do is a check for situations where Dissolved Metal concentrations significantly exceed Total Metal concentrations. By definition, this situation should not occur. However, there are a few reasons why this can occur:

i) Circumstances where Dissolved Metals slightly exceed Total Metals are expected in a small percentage of samples, simply due to normal random variability. In fact, when all metals in a test sample exist in the dissolved form, we expect that Dissolved Metals measurements will numerically exceed Total Metals measurements exactly half the time (by a small margin), simply due to random chance.

ii) Samples to be analyzed for Dissolved Metals must be filtered, which is normally done in the field. Filtration processes are a common source of low level metals contaminants. Contamination of a sample during filtration is the most common source of significant D > T issues.

iii) Field samples for Dissolved and Total Metals are normally collected independently, so variability of the sampling process is another common cause of D > T issues.

If none of the above causes can explain a situation where Dissolved Metals exceed Total Metals, then another type of error may be indicated, either with the collection of the sample in the field, or with sample containers or preservatives, or with the laboratory testing process.

ALS automatically highlights and investigates all circumstances where a Dissolved Metal result exceeds the Total Metal result by 20% RPD or more, but only if the absolute difference between the two results is greater than the sum of the Limits of Reporting (Detection Limits) of the two results.

The mechanism of this relational check is derived from the ALS Duplicate DQOs for Metals in Water.

All D > T relational checks that violate the rule above are flagged internally, and are investigated by ALS before sample results will be released to our clients. In most cases, results will be re-analyzed to confirm or correct the anomalous relationship. If results are confirmed by re-analysis, the following data qualifier is applied:

DTC: Dissolved concentration exceeds total. Results were confirmed by re-analysis.

Other Important Relational Checks Conducted by ALS

ALS employs dozens of other relational checks to highlight anomalous relationships between test parameters. Some of more common checks include the following:

- *Total Ammonia should not exceed Total Kjeldahl Nitrogen*
- *Weak Acid Dissociable Cyanide should not exceed Total Cyanide*
- *E. coli should not exceed Fecal Coliforms*
- *Nitrate + Nitrite should not exceed Total Nitrogen*
- *Hexavalent Chromium should not exceed Total Chromium*
- *True Colour should not exceed Apparent Colour*
- *Mineral Oil and Grease should not exceed Total Oil and Grease*
- *Reactive Phosphorus should not exceed Total Phosphorus*

ALS
Environmental

Quality Control Report Guide

Matrix is the substance type of the QC sample.

Common matrices are water, soil, and tissue.

The **Reference** column contains:

a) Lab sample number (L#) or work group number (WG#) of samples that were used for duplicates or matrix spikes - this information is for internal tracking purposes.

b) Test results for actual samples that were duplicated for QC purposes.

Result from analyzing the QC sample.

% Recovery is calculated for QC samples with known target values (e.g. Spikes or CRMs).

Actual (absolute) test results are reported for the second aliquot of a duplicate pair and method blanks.

A **Qualifier** is used to communicate important information about the QC sample test results.

Sample parameter qualifiers used in the report are defined near the end of the Quality Control Report.

Also refer to the *Sample Parameter Qualifier Definitions* on the next page.

Units of the QC sample test results.

Test results are reported in % recovery for samples with known target values.

Actual (absolute) concentration units are used for reporting duplicate sample and Method Blank test results.

The calculated **Relative % Difference** between duplicate pairs.

RPD is calculated as follows:
|{(Sample Result - Duplicate Result) / [Mean]}| x 100

Duplicate pairs with test results that are < 5 x LOR are reported in sample concentration units (absolute units) and are accompanied by a J qualifier.

The Control **Limit** for the QC sample (ALS Data Quality Objective (DQO)).

QC samples must fall within Control Limits or appropriate action is taken, such as reanalysis where possible, or the data is qualified.

QC samples with known target values have a range for % recovery (eg) 85-115%.

Duplicates have a ± RPD range (e.g. ± 20 RPD). The RPD is reported as an absolute value (e.g. 20 RPD).

Method Blank control limit is the parameter Detection Limit (DL), also known as the Limit of Reporting (LOR).

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-WP	**Water**							
Batch R2179887								
WG1269694-3 DUP		L997018-4						
Sulfate		60.1	62.0		mg/L	3.1	20	21-APR-11
WG1269674-2 LCS								
Sulfate			100		%		85-115	21-APR-11
WG1269674-1 MB								
ulfate			<0.50		mg/L		0.5	21-APR-11
G1269674-4 MS		L997018-4						
ulfate			N/A	MS-B	%		-	21-APR-11
G1269674-5 CVS								
ulfate			103		%		85-115	21-APR-11
G1269674-6 CRM								
lfate			95		%		80-120	21-APR-11

Test Code:
Sulfate (SO4), analyzed by Ion Chromatography (IC), in ALS Winnipeg (WP).

DUP: Laboratory Sample Duplicate - a second portion of sample taken from the same container as the sub-sample used for the primary analysis. Assesses variance of the total method including lab sub-sampling and analysis.

The results for this duplicate pair are 60.1 and 62.0 mg/L. The RPD is 3.1 and the control limits are ± 20 RPD.

LCS: Laboratory Control Sample – a known matrix spiked with target analytes. Verifies the accuracy of the performance of the test.

The recovery for this LCS is 100%, with control limits of 85 to 115% recovery.

MB: Method Blank – a blank matrix taken through the entire test method. Monitors variability of the blank response and bias of the test method.

The result for this MB is less than 0.50 mg/L. The control limit for the MB is equal to the LOR.

MS: Matrix Spike – a known amount of target analytes are added to a client sample. Measures the effect of the sample matrix on a method's recovery efficiency.

In this example, the recovery of the MS could not be calculated. The qualifier explains why – refer to the *Sample Parameter Qualifier Definitions*.

CVS: Calibration Verification Standard - a second source reference standard containing known concentrations of target analytes. Confirms the accuracy and stability of the calibration standards.

This CVS has a recovery of 103% and control limits of 85 to 115% recovery.

CRM/IRM: Certified or Internal Reference Material – a homogeneous sample whose analyte values have been well characterized.

This CRM has a 95% recovery and control limits of 80 to 120% recovery.

Quality Control Report Guide

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Legend: explains acronyms that may be used in the QC Report.

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Qualifiers: QC sample qualifiers are listed and explained here.

The three examples are common qualifiers. They explain unusual or special circumstances that pertain to the QC sample results.

Quality Control Report Guide

Parameters and sample numbers that had Hold Time exceedances are listed in this table.

Hold Times are tracked from sampling date and time to the date and time when the sample was processed in the lab.

The recommended Hold Times.

See the Notes* section for sources of recommendations.

Hold time exceedance Qualifiers are explained in the *Legend and Qualifiers Definitions* section below.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Transmittance, UV (254 nm)	1	19-APR-11 14:00	25-APR-11 08:16	48	38	hours	EHTL
pH	1	19-APR-11 14:00	10-MAY-11 09:32	0.25	499	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Explanations for the Qualifiers listed above.

See also the additional Notes below.

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L997206 were received on 21-APR-11 07:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.