



**BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT**

**SURFACE WATER SAMPLING PROGRAM
QUALITY ASSURANCE AND QUALITY CONTROL PLAN
(REF. NO. NB102-00181/10-7)**

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

SURFACE WATER SAMPLING PROGRAM

QUALITY ASSURANCE AND QUALITY CONTROL PLAN

(REF. NO. NB102-00181/10-7)

EXECUTIVE SUMMARY

This Quality Assurance and Quality Control (QA/QC) Plan has been prepared to fulfill the requirement of Part I, Item 9 of License No. 2BB-MRY0710 issued by the Nunavut Water Board to Baffinland Iron Mines Corporation (Baffinland) on July 27, 2007. In accordance with the stipulations of the Water License, this Surface Water Quality Sampling Program QA/QC Plan was prepared following the general recommendations presented in *Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan* (INAC, 1996).

The QA/QC best practices outlined in this document are designed to provide guidance to field staff and analytical laboratories in order to maintain a high level of confidence in the water quality data generated from the Mary River Project. This QA/QC plan addresses water samples collected from lakes, streams and rivers, treated wastewater effluent, drinking water and site drainage.

Best practice methods for water sample collection will focus on: i) avoiding sample contamination during collection, ii) ensuring that correct sample preservatives are used, and iii) if feasible, samples for analysis of dissolved parameters will be filtered in the field (alternatively, filtration at the analytical laboratory will be used). Due to the logistics of getting water samples to the analytical laboratory, for time sensitive parameters a range of holding times are presented (preferred and maximum). Vertical profile sampling in lakes and rivers will be carried out after the stratified temperature profile has been established using an appropriate sampler (e.g. a 'Van Dorn', 'Kemmerer', etc.) suitable for collection of samples for ultra low metals analyses.

Ten percent of all water samples will consist of field QA/QC samples, which will include field blanks, trip blanks and field replicates. These QA/QC data, along with the results of in-house laboratory QA/QC testing, will be reviewed on a regular basis.

Field staff will be responsible for monitoring a range of field parameters, including pH, conductivity, redox potential, dissolved oxygen, etc. Field staff will be responsible for monitoring probe maintenance and for ensuring that monitoring probes are regularly calibrated and stored as per manufacturers' instructions.

All water samples will be submitted to the analytical laboratory along with chain of custody documentation listing sampling date, sampler name, project ID, requested analyses, total number of bottles per sample, information on whether the sample has been filtered, and urgency of requested analyses.

Water sample analyses are currently being carried out by two accredited analytical laboratories: i) Accutest located in Nepean, Ontario, and ii) ALS laboratory Group located in Vancouver, BC. Analytical methods used by the analytical laboratories generally conform to the standard methods outlined in *Standard Methods for the Examination of Water and Wastewater* (APHA et al, 1989). Details of alternative methods used by the laboratories are provided. Baffinland will advise the Nunavut Water Board in advance of any changes in the laboratories chosen to provide this support service.

Accutest and ALS carry out their own routine in-house QA/QC checks, which include: i) use of calibration check standards and drift control standards, ii) use of surrogate standards and internal standards, iii) replicate analyses on submitted samples, and iv) use of standard reference materials (SRM's) and matrix spikes.

All water quality data collected from the various environmental programs will be stored electronically in a spreadsheet database or other suitable electronic format. A suitably qualified person will act as Water Quality Database Manager ('WQDM'). The WQDM will be responsible for all aspects of database management including review of new results received from the laboratories and QA/QC checks on data entered into the database.

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.

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

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(REF. NO. NB102-00181/10-7)

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SURFACE WATER SAMPLING PROGRAM
QUALITY ASSURANCE AND QUALITY CONTROL PLAN
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SECTION 1.0 - INTRODUCTION

1.1 **INTRODUCTION**

This Quality Assurance and Quality Control (QA/QC) Plan has been prepared to fulfill the requirement of Part I, Item 9 of License No. 2BB-MRY0710 issued by the Nunavut Water Board to Baffinland Iron Mines Corporation (Baffinland) on July 27, 2007.

Part I, Item 9 of the Water License states:

The Licensee shall submit a Quality Assurance/Quality Control Plan, prepared in accordance with the INAC document "Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "B" Licensees in Collecting Representative Water Samples in the Field, 1996" to an Analyst for approval within ninety (90) days of the issuance of the license (amendment). The plan shall include analysis of field blanks and certified reference material, and replicate sampling in order to assess accuracy, precision and field contamination.

In accordance with the stipulations of the Water License, this Surface Water Quality Sampling Program QA/QC Plan has been prepared following the general recommendations presented in *Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan* (INAC, 1996).

1.2 **QA/QC PLAN OBJECTIVES**

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 document are designed to provide guidance to field staff and analytical laboratories in order to maintain a high level of confidence in the water quality data generated from the Mary River Project.

SECTION 2.0 - SAMPLE COLLECTION

2.1 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 Mary River and Milne Inlet
3. Collection of drinking water samples from camp potable water sources
4. Collection of surface water discharges from future ore stockpiles and waste rock dumps
5. Collection of surface water discharges from future bulk sample open pits
6. Measurement of water sample field parameters (e.g. pH, conductivity etc.)

Exact locations and sampling frequency for designated monitoring stations are presented in the Site Water Management Plan (Knight Piésold, 2007).

2.2 SAMPLING METHODS AND EQUIPMENT

A summary of recommended water sample containers, sample volumes, required analytical laboratory, method detection limits (MDL), sample preservatives and maximum sample hold times is presented in Table 2.1. Laboratory parameters such as pH, BOD, nitrite, nitrate, orthophosphate, fecal coliforms, chlorophyll and phenophytin typically have maximum sample storage times varying from 4 to 48 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. During the preparation of this document the analytical laboratories were consulted with respect to maximum sample holding times. As a result, Table 2.1 presents a preferred and a maximum holding time for time sensitive parameters. Every effort will be made to get samples analysed within the preferred holding time window. If this is not possible, then the maximum holding time will apply.

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

For a complete list of the required sample analyses at each monitoring station, please refer to the Site Water Management Plan (Knight Piésold, 2007).

2.2.1 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. 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 (or

- alternatively, sample bottles will be supplied by the analytical laboratory with preservatives already added).
3. A fresh sample bottle(s) will be used at each monitoring station. Sample bottles will *not* be re-used.
 4. 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, fuel contaminated drainage and receiving waters). Sample jugs will be replaced on a regular basis before they become stained.
 5. Prior to collecting the sample, the sampling jug will be rinsed in the source water three times. Rinse water will be disposed of so that it does not contaminate the source water where the sample will be collected.
 6. Care will be taken to avoid disturbance of sediments and inclusion of disturbed suspended solids in the sample
 7. For samples *not requiring preservatives*, the sample bottle will be rinsed three times with source water before filling the bottle to the top
 8. For samples *requiring preservatives*, the sample bottle will be filled to the top (or to the indicator line marked on the bottle) and securely sealed. Note that for some volatile contaminants (e.g. BTEX), the sample bottle must be filled with zero headspace.
 9. Sample details e.g. date, sample ID and analysis will be clearly marked on the bottle in indelible ink
 10. 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 filters must be used at each monitoring station. Alternatively, sample filtration can be carried out by the analytical laboratory.
 11. All samples will be placed in an iced cooler as soon as possible after collection

2.2.2 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. Map coordinates for all lake sampling station locations will be recorded using a GPS unit.
2. The vertical stratification profile will be determined using a temperature probe equipped with a long cord with metre intervals marked on it.
3. The vertical temperature profile will be established by slowly lowering the temperature probe and recording the temperature change with depth.
4. 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.
5. The depth sampler will be held at this depth for a few minutes to allow flushing of water inside it.
6. 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.
7. 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).
8. Depending upon the lake area and depth, multiple sampling stations will likely be required to adequately characterize lake water quality.

2.2.3 River Sampling

Depending upon the size of the water body, river sampling methods are the same as those presented in Sections 2.2.1 and 2.2.2. 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.

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.

2.2.4 Sampling for Toxicity Testing

Sampling for sub-lethal toxicity testing is a condition of Environmental Effects Monitoring (EEM). Typically, a 4L effluent sample is sufficient. 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.; and
- Preferred test organism.

For further details concerning acute lethality testing refer to Environment Canada (2002) and USEPA (2002).

2.3 QA/QC SAMPLES

For monitoring of QA/QC during sample collection and shipping, a set of QA/QC samples will be routinely submitted for analysis, as summarised in Table 2.2. Ten percent of all samples will comprise QA/QC samples, which will consist of duplicate samples, field blanks and trip blanks.

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 rectify the problem. Compliance monitoring and data management for water license sampling will be conducted by Baffinland, with the assistance of a designate as required.

2.4 MEASUREMENT OF FIELD PARAMETERS

Measurement of field parameters (e.g. temperature, pH, conductivity, redox potential, dissolved oxygen, etc.) 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. For a complete list of required parameters please refer to the Site Water Management Plan (Knight Piésold, 2007). 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.

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 (see example in Appendix A). A copy of the data should be retained on site.

2.4.1 Monitoring Probe Calibration

Monitoring probes will be stored and calibrated in accordance with manufacturers' instructions. All probes will be calibrated before each sampling event 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.

SECTION 3.0 - SAMPLE MANAGEMENT

3.1 SAMPLE SHIPPING AND CHAIN OF CUSTODY

Samples will be placed in iced coolers and shipped to the analytical laboratory as soon as possible after collection. Care will be taken to ensure that bottles are stored upright and are packed securely within the cooler. Preferably, leak-proof ice packs will be used for cooling the samples. If loose ice is used then this should be securely sealed in plastic bags to prevent leakage of melt water.

A chain of custody (COC) form will accompany the samples (see example presented in Appendix A). At a minimum, the COC form will list:

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.

SECTION 4.0 - LABORATORY ANALYSIS

4.1 LABORATORY ACCREDITATION

Currently, laboratory analysis of water samples is being carried out by two accredited analytical laboratories. Accutest located in Nepean, Ontario has been carrying out the majority of sample analyses due to its geographical proximity to site (with respect to sample holding times). ALS Laboratory Group, located in Vancouver, BC has been used when ultra low level metals analysis has been required. From Fall, 2007 onwards, all metals analyses are being carried out by ALS. Details on analytical laboratory accreditation for Accutest and ALS are presented in Appendix B. Baffinland will advise the Nunavut Water Board in advance of any changes in the laboratories chosen to provide this support service.

4.2 ANALYTICAL DETECTION LIMITS

Required analytical laboratory method detection limits for a range of parameters are listed in Table 2.1. 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. If this is encountered, Baffinland or their designate will work with the analytical laboratory to try and resolve the problem.

4.3 LABORATORY ANALYTICAL METHODS

Analytical methods used by the analytical laboratories generally conform to the standard methods outlined in *Standard Methods for the Examination of Water and Wastewater* (APHA et al, 1989). For some parameters alternative standard analytical methods are used, as listed in Appendix C.

4.4 ANALYTICAL LABORATORY QA/QC PROCEDURES

Both Accutest and ALS carry out their own routine in-house QA/QC checks, which include:

- Use of calibration check standards and drift control standards
- Use of surrogate standards and internal standards
- Replicate analyses on submitted samples
- Use of standard reference materials (SRM's) and matrix spikes

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

SECTION 5.0 - DATA MANAGEMENT AND REPORTING

5.1 DATA MANAGEMENT

All water quality data collected by Baffinland or designate from the various environmental programs will be stored electronically in a spreadsheet database (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 Water Quality Database Manager (WQDM).
2. Upon receipt, laboratory analytical data will be reviewed by the WQDM 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 WQDM 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 WQDM 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. A dated and signed record of these data QA/QC checks should be maintained on file.

5.2 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.

SECTION 6.0 - REFERENCES

1. APHA *et al*, 1989. Standard Methods for the Examination of Water and Wastewater; APHA, AWWA and WPCF, 17th ed.
2. Environment Canada, 2002. Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring. <http://www.ec.gc.ca/eem/English/MetalMining/Guidance/default.cfm>.
3. INAC, 1996. Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "B" Licenses in Collecting Representative Water Samples and the Field 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.
4. Knight Piésold, 2007. Baffinland Iron Mines Corporation - Mary River Project - Site Water Management Plan, Ref. No. NB102-00181/10-5, Rev. 0. North Bay: Knight Piésold, 2007.
5. 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.

SECTION 7.0 - CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.

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TABLE 2.1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

SURFACE WATER SAMPLING PROGRAM - QUALITY ASSURANCE AND QUALITY CONTROL PLAN

SUMMARY OF RECOMMENDED WATER SAMPLE VOLUMES, LOD's, PRESERVATIVES AND SAMPLE STORAGE TIMES

Parameter	Method Detection Limit	Required Sample Bottle	Sample Preservative	Maximum Sample Storage Time	
				Preferred	Maximum
General Chemistry					
Total metals	See Note 6	250mL plastic	0.5mL conc. nitric acid	6 months	-
Dissolved metals	See Note 6	250mL plastic	cool 4°C ⁽¹⁾	7 days	-
Anions	See Note 6	1L plastic	cool 4°C	7 days	-
TSS ⁽⁴⁾	3 mg/L	1L plastic	cool 4°C	7 days	-
pH	0.01 pH unit	250mL plastic	cool 4°C	4 hours	14 days
Conductivity	0.2µS/cm	250mL plastic	cool 4°C	28 days	-
Total hardness	0.5mg/L	250mL plastic	cool 4°C	6 months	-
Total acidity / alkalinity	0.5mg/L	500mL plastic	cool 4°C	14 days	-
Nutrients					
BOD ₅	5mg/L	1L plastic	cool 4°C	4 hours	7 days
Total ammonia	0.005mg/L	250mL plastic	2mL sulphuric acid, cool 4°C	28 days	-
Nitrate	0.005mg/L	500mL plastic	cool 4°C	48 hours	7 days
Nitrite	0.002mg/L	500mL plastic	cool 4°C	48 hours	7 days
Orthophosphate	0.002mg/L	250mL plastic	cool 4°C	48 hours	7 days
TOC ⁽⁵⁾	0.01mg/L	125 ml, glas, amber	2ml HCl acid	28 days	-
Biological					
Chlorophyll	0.2mg/m ³	1 L amber glass	cool 4°C	72 hours	3 days ⁽⁶⁾
Phenophytin	0.2mg/m ³	1 L amber glass	cool 4°C	72 hours	3 days ⁽⁶⁾
Sub-lethal Toxicity Testing ⁽⁷⁾	N/A	4L plastic tote	cool 4°C	7 days	
Bacterial					
Fecal coliforms	1MPN	125mL sterile plastic or glass	cool 4°C	6hrs	48hrs
Organics					
TPH ⁽²⁾	1.0 mg/L	500mL brown glass ⁽⁷⁾	2mL sulphuric acid	14 days	-
BTEX ⁽³⁾	0.0005 mg/L	100mL two septum vial ⁽⁷⁾	2mL sulphuric acid, cool 4°C	14 days	-

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Notes:

1. Sample must be field filtered using a 0.45µm disposable filter and syringe.
2. Total petroleum hydrocarbons.
3. Benzene, toluene, ethyl benzene, xylenes.
4. Total suspended solids.
5. Total organic carbon.
6. For samples with pH >7, the sample may be preserved by filtering through a glass fibre filter and storing the filter and residue in an airtight plastic bag in a freezer for up to 3 weeks.
7. Zero sample headspace.
8. Type of test organism selected will depend upon objectives of testing.

TABLE 2.2

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

SURFACE WATER SAMPLING PROGRAM - QUALITY ASSURANCE AND QUALITY CONTROL PLAN

SUMMARY OF RECOMMENDED FIELD QA/QC WATER SAMPLES

QA/QC Sample	Purpose	Description	Frequency	Prepared By
Field blank	Identification of potential contaminants arising from sample collection, storage, shipping and laboratory handling. The field blank is taken into the field and is then submitted as a routine sample.	100 mL sealed vial containing deionized water	one per sample shipment	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.	100 mL sealed vial containing deionized water	one per sample shipment	Analytical laboratory
Field replicate	Assesses sample variability and precision of laboratory analytical methods	Duplicate sample selected at random. The field replicate sample label should not identify which sampling station it came from.	10 percent of samples	Field staff

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25-Oct-07

Note:

1. Ten percent of all samples will consist of QA/QC samples.

APPENDIX A
EXAMPLE FORMS

- Sample Chain of Custody 1 page
- Record of Water Sample Field Parameter Measurements 1 page

BAFFINLAND MARY RIVER PROJECT

SAMPLE CHAIN OF CUSTODY

FROM:

.....

.....

.....

TO:

.....

.....

.....

F.A.O.

Note:

No.	Sample I.D.	Sampling Date	Sampler	Sample Type	Sample Filtered?	No. of Bottles	Rush?	Analyses																	
								General Chemistry								Nutrients					Biological		Bacterial	Organics	
								Metals	Arsenic	Mercury	Anions	TSS	pH	Conductivity	Total Hardness	Total Alkalinity / Acidity	BOD ₅	Total ammonia	Nitrate	Nitrite	Orthophosphate	TOC	Chlorophyll	Phenophytin	Fecal coliforms
1																									
2																									
3																									
4																									
5																									
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20																									

BAFFINLAND MARY RIVER PROJECT

Record of Water Sample Field Parameter Measurements

No.	Sample I.D.	Sampling Date	Sampler	Field Parameters						Notes
				pH	Temperature (°C)	Conductivity (mS)	Redox (mV)	D.O. (mg/L)		
								mg/L	%	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

APPENDIX B
ANALYTICAL LABORATORY ACCREDITATION

- ALS 2 pages
- Accutest 2 pages

ALS



**National
Quality Manual**

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1.0 SCOPE

This Quality Manual describes the Quality Management System of the ALS Laboratory Group Environmental Division locations in Canada. Where appropriate, it refers to other documents for additional information. Throughout this manual, whenever ALS is used alone, it refers to the Environmental Division of the ALS Laboratory Group in Canada.

2.0 LOCATIONS, ACCREDITATIONS AND RECOGNITIONS

ALS has laboratories across Canada. Addresses and contact information are available by following the links at our web site: www.alsenviro.com.

Labs within our network are accredited or recognized by the following agencies, as appropriate to their fields of testing and geographical sectors.

- Canadian Association for Environmental Analytical Laboratories (CAEAL) – www.caeal.ca
- Standards Council of Canada (SCC) – www.scc.ca
- American Industrial Hygiene Association (AIHA) – IHLAP - www.aiha.org
- American Industrial Hygiene Association (AIHA) – EMLAP – www.aiha.org
- State of Washington Department of Ecology (WADOE) – www.ecy.wa.gov
- United States National Environmental Laboratory Accreditation Program (NELAP) - www.nj.gov/dep/oqa
- British Columbia Provincial Health Officer – EWQA – www.pathology.ubc.ca
- British Columbia Ministry of Environment – EDQA – www.env.gov.bc.ca
- Ontario Ministry of Environment – www.ene.gov.on.ca
- Health Canada Good Manufacturing Practices (GMP) - Establishment License - www.hc-sc.gc.ca

Copies of current certificates and licenses applicable to these programs are available on www.alsenviro.com. Scopes of accreditation and/or program information are available on the web sites linked above.

3.0 TERMS AND DEFINITIONS

The terms and definitions relevant to the national quality management system are described in a nationally controlled file. For instances where local and national documents describe similar terms and definitions, the local document takes precedence.

Refer to:

- Local Master List: DEFINITIONS OF KEY TERMS

ACCUTEST

Methods of Quality Control

The objective of the Quality Assurance Program is to ensure that results provided by the laboratory to our clients or regulatory bodies are accurate and precise, as well as consistent over time. Various techniques; statistical, investigative, preventative, administrative, and corrective will be utilized to maximize the reliability of the data.

The analytical services provided by Accutest Laboratories are based on industry recognized methodologies published by the following:

- AWWA, APHA - "Standard Methods for the Examination of Water and Wastewater", 20th Edition, 1998.
- Ontario Ministry of Agriculture, Food, and Rural Affairs
- Ontario Ministry of the Environment
- ASTM - American Society for Testing Materials
- AOAC "Official Methods of Analysis"
- CCME
- USEPA 500, 600, and SW846 Series Methodologies, and
- other recognized regulatory and industry sources

Certification and Accreditation

Accutest maintains a rigorous program of certification and accreditation from several governing sources. In 1989 the laboratory received accreditation from the Ontario Ministry of Agriculture, Food, and Rural Affairs (**OMAFRA**) to provide analysis of farm soil for the agricultural community.

In 1991 the laboratory received certification from the Canadian Association of Environmental Analytical Laboratories (**CAEAL**), Registration Number 2602. The Kingston laboratory's registration number is 2970. In 1995, following an independent laboratory audit by CAEAL, under the direction of the Standards Council of Canada (**SCC**), Accutest achieved full accreditation for specific parameters to **ISO 17025** criteria (Registration Number 164).

For up to date accreditation details, the SCC's web site can be found at: www.scc.ca

CAEAL's web site is: www.caeal.ca

Accutest is a Ministry of Transportation for Ontario (**MTO**) approved laboratory for the analysis of chloride content in concrete.

Interlaboratory Studies

Accutest regularly takes part in interlaboratory studies. As part of the accreditation programs of both CAEAL/SCC and OMAFRA, the performance of Accutest is monitored through the analysis of unknown quality control samples submitted by an external agency.

APPENDIX C
LABORATORY ANALYTICAL METHODS

- ALS 3 pages
- Accutest 3 pages

ALS



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5.4 TEST METHODS AND METHOD VALIDATION

5.4.1 General

All ALS locations use appropriate methods for all tests performed, including those for estimating uncertainty and statistical techniques for analyzing data. Test methods are documented and include all instructions needed to operate equipment and protect the integrity of samples and analytical results. Test method instructions and support information is kept current and accessible where needed.

Deviations from test methods occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer where applicable. Analytical department supervisors and managers have the authority to approve method deviations for the analysis of samples and to impose appropriate quality control into the analysis. If the deviation is judged to alter the outcome of a test, client acceptance of the deviation will be obtained prior to approval. Documentation follows the same requirements as for data quality and method objective -refer to section 4.9

5.4.2 Selection of Methods

Customers rely on ALS to select test methods that are appropriate to meet their needs and are appropriate for the tests performed. ALS uses 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 whenever possible. When needed, the standard method will be supplemented with additional instructions to ensure consistency of application and performance. Where an appropriate standard method is not available ALS may develop and validate an in-house test method, or adopt a third party validated method. ALS provides method information to clients upon request and on test reports.

For published reference methods, each ALS location confirms it can properly operate the standard method before introducing the test into the laboratory. If the standard method changes in a manner that may affect test results, the confirmation is repeated.

Unique circumstances may occur where a customer specifies the methodology to be used. The customer will be notified if ALS deems the recommended method is inappropriate or out of date.

5.4.3 Laboratory Developed Methods

When in-house development of a test procedure is needed, qualified individuals are assigned to the planning and development stages of the project. The plan is updated as development progresses and all changes are effectively communicated among all involved.

5.4.4 Non-standard Methods

If it is necessary to use methods not covered by standard methods, customer agreement will be obtained and will include clear specification of their requirements and the purpose of the test. The developed method will be appropriately validated before use.



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5.4.5 Validation of Methods

Method validations are conducted to confirm that the 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. For example, standard methods used for their intended application require a less extensive validation than non-standard methods or standard methods used outside of their intended scope.

All results relating to the validation of a given method, including the procedure used for validation and a statement of whether the method is fit for the intended use are retained in method validation records.

As appropriate, the validation studies performed will verify the range and accuracy of the results obtained, including uncertainty, detection limit, selectivity of the method, linearity, repeatability and/or reproducibility, robustness and/or sensitivity to interference. Measurement uncertainty values are reviewed to ensure they are sufficient to meet customers needs.

5.4.6 Estimation of Measurement Uncertainty

ALS has procedures for estimating measurement uncertainty. The procedures 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. In those cases where the nature of the test precludes calculation of uncertainty, ALS will at minimum identify the components of uncertainty and make a reasonable estimation where needed. This estimation will be based on knowledge of the performance of the method and validation data.

5.4.7 Control of Data

Automated calculations and data transfer systems are checked in a systematic manner when first programmed and re-verified appropriately when changes are made.

When computers and automated equipment are used for the acquisition, processing, recording, reporting, storage or retrieval of test data, ALS ensures:

- in-house developed software is sufficiently documented and validated
- procedures are implemented for protecting data, including integrity and confidentiality of entry, collection, storage transmission and processing – refer to sections 4.13, 5.1 and 5.10
- computers and automated equipment are maintained to ensure proper functioning and adequate environmental conditions – refer to section 5.1

Refer to:

- Local Master List: METHOD VALIDATION
- Local Master List: LIMS CALCULATIONS AND DATA TRANSFERS
- Local Master List: SOFTWARE DEVELOPED IN-HOUSE

ACCUTEST

Details of Quotation

BOD5

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
BOD5	BOD5 - AMBODEE1 SM 5210B	1	mg/L

Chlorophyll/Pheophytin

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Chlorophyll-a	Chlorophyll C SM10200H	0.2	mg/m3
Pheophytin-a	Chlorophyll C SM10200H	0.2	mg/m3

Knight P - SW (no metals)

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
pH	pH in water : Auto - AMAPCAE1 C SM4500-H+B	1	
Conductivity	Conductivity : Auto - AMAPCAE1 C SM2510B	5	uS/cm
Alkalinity as CaCO3	Alkalinity : Auto - AMAPCAE1 SM 2320B	5	mg/L
TDS (COND - CALC)	solids in water - AMSOLWE1 C SM2540	5	mg/L
Turbidity	Turbidity - AMTURBE1 C SM2130B	0.1	NTU
Phenols	Phenols 4-AAP - AMPHACE1 C SM5530D	0.001	mg/L
N-NH3	NH3 water low - AMNH3LE1 C SM4500-NH3D	0.02	mg/L
SO4	Anions by IC - DX-100 SM 4110C	1	mg/L
Cl	Anions by IC - DX-100 SM 4110C	1	mg/L
Br	Anions by IC - DX-100 SM 4110C	0.05	mg/L
N-NO2	Low NO2 - SKALAR C SM4500-NO2-B	0.005	mg/L
N-NO3	NO2/NO3 SKALAR - AMNOXSE1 C SM4500-NO3-F	0.1	mg/L
NO2 + NO3 as N	NO2/NO3 SKALAR - AMNOXSE1 C SM4500-NO3-F	0.1	mg/L
TOC	DOC/TOC in water Combustion C SM5310B	0.5	mg/L
DOC	DOC/TOC in water Combustion C SM5310B	0.5	mg/L
Total Suspended Solids	solids in water - AMSOLWE1 C SM2540	2	mg/L
Total P	Low Total P C SM4500-PF	0.003	mg/L
Total Kjeldahl Nitrogen	TKN low water - AMTKNLE1 C SM4500-Norg-C	0.1	mg/L

Reg 170 - Schedule 23

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Ba	ICP-MS PE6100 EPA 200.8	0.01	mg/L
B	ICP-MS PE6100 EPA 200.8	0.01	mg/L
Cd	ICP-MS PE6100 EPA 200.8	0.0001	mg/L
Cr	ICP-MS PE6100 EPA 200.8	0.001	mg/L
As	ICP-MS PE6100 EPA 200.8	0.001	mg/L
Se	ICP-MS PE6100 EPA 200.8	0.001	mg/L
Sb	ICP-MS PE6100 EPA 200.8	0.001	mg/L
Hg	Hg in water - AMHGCTE1 M SM3112B-3500B	0.0001	mg/L
U	ICP-MS PE6100 EPA 200.8	0.001	mg/L

SUBDIV. BACTI

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Total Coliforms	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL
Faecal Coliforms	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL

Details of Quotation

Faecal Streptococcus	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL
Escherichia Coli	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL
Heterotrophic Plate Count	SPC - AMBCOLM1 SM9215D	0	ct/1mL

SUBDIV. SUPPLY NO BACTI

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Fe	ICP-MS PE6100 EPA 200.8	0.03	mg/L
Mn	ICP-MS PE6100 EPA 200.8	0.01	mg/L
Hardness as CaCO ₃	Alkalis by FAA - AMAMFAE1 SM 3111B-3500B	5	mg/L
Alkalinity as CaCO ₃	Alkalinity : Auto - AMAPCAE1 SM 2320B	5	mg/L
pH	pH in water : Auto - AMAPCAE1 C SM4500-H+B	1	
Conductivity	Conductivity : Auto - AMAPCAE1 C SM2510B	5	uS/cm
F	F Autotitrator C SM4500-FC	0.1	mg/L
Na	ICP metals - AMMICPE8 M SM3120B-3500C	2	mg/L
N-NO ₃	NO ₂ /NO ₃ SKALAR - AMNOXSE1 C SM4500-NO ₃ -F	0.1	mg/L
N-NO ₂	NO ₂ /NO ₃ SKALAR - AMNOXSE1 C SM4500-NO ₃ -F	0.1	mg/L
N-NH ₃	NH ₃ water low - AMNH3LE1 C SM4500-NH ₃ D	0.02	mg/L
SO ₄	Anions by IC - DX-100 SM 4110C	1	mg/L
Cl	Anions by IC - DX-100 SM 4110C	1	mg/L
Phenols	Phenols 4-AAP - AMPHACE1 C SM5530D	0.001	mg/L
Turbidity	Turbidity - AMTURBE1 C SM2130B	0.1	NTU
Colour	Colour - AMCOLSE1 C SM2120C	2	TCU
Ca	ICP metals - AMMICPE8 M SM3120B-3500C	1	mg/L
Mg	ICP metals - AMMICPE8 M SM3120B-3500C	1	mg/L
Tannin & Lignin	Tannin & Lignin - AMTNLNE1 C SM5550B	0.1	mg/L
Total Kjeldahl Nitrogen	TKN low water - AMTKNLE1 C SM4500-Norg-C	0.1	mg/L
K	ICP metals - AMMICPE8 M SM3120B-3500C	1	mg/L
DOC	DOC/TOC in water Combustion C SM5310B	0.5	mg/L
H ₂ S	H ₂ S water - AMH2SCE1 C SM4500-S2-D	0.01	mg/L
Ion Balance	Ion Balance C Ion Balance	0.01	
TDS (COND - CALC)	solids in water - AMSOLWE1 C SM2540	5	mg/L

TSS

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Total Suspended Solids	solids in water - AMSOLWE1 C SM2540	2	mg/L

APPENDIX D

ANALTICAL LABORATORY QA/QC PROCEDURES

- ALS 4 pages
- Accutest 2 pages

ALS



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Refer to:

- Local Master List (where applicable): FIELD SAMPLING
- Local Master List (where applicable): SUB-SAMPLING

5.8 HANDLING OF SAMPLES

ALS procedures for sample handling include transportation conditions, receipt, handling, protection, storage, retention, and disposal. The procedures are designed to protect the integrity of the test samples and the interests of the customer and ALS.

ALS requests that our customers use our Chain of Custody (COC) for every shipment of samples. The form includes sufficient space to record field sampling date, time and location of sampling, sample ID and information relating to the integrity of the field sample. COCs are shipped with field supplies, and are also available on the alsenviro.com web site.

Samples are given a unique identification upon receipt. The identification is retained by the sample throughout its life in the laboratory, and ensures samples are not confused either physically or in records or reports. Where appropriate, the system allows for subdivision of test items and transfer within and from the laboratory.

Abnormalities or other departures from specified sampling or transportation procedures are documented. Where there is doubt concerning the integrity of the sample, its identification or suitability for testing, or the requested tests, the customer is consulted for further instructions before proceeding, and the discussion is documented.

All ALS locations have appropriate facilities to securely maintain sample integrity, both before testing and where archiving for future testing is required. Sample storage and handling criteria are recorded in individual test methods. Traceability and monitoring of critical temperatures is maintained and discussed in section 5.6.

Refer to:

- Local Master List: SAMPLE RECEIPT AND LOGIN
- Local Master List: SAMPLE STORAGE

5.9 ASSURING THE QUALITY OF TEST RESULTS

ALS has established quality control (QC) procedures for monitoring the validity of tests performed by its laboratories. Individual test methods specify the in-batch quality control requirements, frequency of use and data quality objectives. Where appropriate, in-batch QC is recorded on control charts to detect trends, statistical techniques are used to monitor method performance, and planned action is taken to correct problems and prevent incorrect results from being reported. In-batch QC tools include reference samples, control samples and standards, verification standards, blanks, duplicates, surrogates and spikes as appropriate to the field of testing.



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ALS laboratories participate in an extensive proficiency testing program where available. Where appropriate proficiency testing samples are not available, other monitoring tools are used.

Samples may be maintained for retesting where the integrity of the test result will not be compromised by the additional storage time.

All test data is reviewed and approved prior to release to the customer. The data review process includes manual transcription review, data-set review, inter-parameter relationship evaluation where appropriate to the tests performed, and report review. Manual transcriptions are reviewed for transcription errors. Data set review is conducted by authorized individuals and includes confirmation that quality control criteria are met and that anomalous data are qualified. Report review confirms that requested tests have been carried out and that all report information and formatting is correct for the specific customer.

Refer to:

- Local Master List: DATA QUALITY AND METHOD OBJECTIVES
- Local Master List: RECHECKS
- Local Master List: CONTROL CHARTS
- Local Master List: RELATIONAL CHECKS
- Local Master List: PROFICIENCY TESTING PROGRAMS
- Local Master List: DATA VALIDATION AND AUTHORIZATION

5.10 REPORTING RESULTS

All information listed below is either included in the final report or kept on file at ALS in the case of abbreviated or customized reports, and can be provided upon request.

- Title
- Name and address of the laboratory issuing the report
- Location where each test was conducted
- Unique identification of the test report on each page, and the total number of pages
- Customer name and address
- Identification of test method(s) used
- Unique identification of each sample, description of the sample such as matrix and customer identification, and condition where applicable
- Date of sample receipt
- Date of analysis
- Test results and units
- Report Qualifiers
- Name, function, and signature of the person authorizing the report
- Statement that the results relate only to the samples identified in the report

Other information necessary for the interpretation of results or requested by the customer may also be included in reports, such as test method deviations or exclusions, specific test conditions, uncertainty estimations, date of sampling, location of sampling and other sampling information.



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Statements of compliance, opinions and interpretations may be included on test reports for specific analyses. In all such cases, the basis on which they have been made will be documented, and they will be clearly identified in the test report.

ALS obtains subcontract laboratory results in hard or electronic reports. When these results are presented to the customer in ALS reports, the identification of the subcontractor is clearly indicated on the final report.

When test reports are transmitted by telephone, facsimile, e-mail or other electronic means, the procedure for protecting the integrity and confidentiality of data includes:

- only providing results to those individuals specified by the client for each sample submission
- use of a standardized facsimile cover page that relates the procedures to follow if received in error
- use of an e-mail footer that relates the procedures to follow if received in error

It is ALS practice to never disclose information about a client's analysis to a third party without the 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.

Final results are reported in a manner that minimizes the possibility of misunderstanding or misuse.

Test report amendment(s) are made by issuing a replacement report identifying that a revision was made and describing all changes in the cover page comment section.

Refer to:

- Local Master List: REPORTING TEST RESULTS

6.0 REFERENCES

ISO/IEC 17025:2005(E) General Requirements for the competence of testing and calibration laboratories, Second Edition, 2005-05-15. [L:\Quality System Documents\External Documents\17025 \(E\) 2005.pdf](L:\Quality System Documents\External Documents\17025 (E) 2005.pdf)

Program, policy and guidance documents of the following accreditation bodies:

- Canadian Association for Environmental Analytical Laboratories (CAEAL), located at: www.caeal.ca
- Standards Council of Canada (SCC), located at: www.scc.ca
- American Industrial Hygiene Association (AIHA), located at: www.aiha.org
- National Environmental Laboratory Accreditation Conference (NELAC), located at: www.epa.gov/nelac

ACCUTEST

In-house QA/QC

Utmost care is taken to provide our clients with analytical data of the highest quality. Accutest maintains several layers of data approval where, at any point in the analytical process, the reviewer has the authority to reject a data set based upon rigid QA/QC protocol. In addition, the following steps are taken during routine analyses, though not limited to:

- reagent blanks/standard reference materials are analyzed within each sample batch
- where appropriate, internal standards and/or spikes are analyzed within each sample batch to verify instrument calibration
- all reagents are prepared from ACS or better grade chemicals
- a minimum of 10% of all samples are analyzed in duplicate
- samples are retained for 2 months after receipt
- all standard, blank, and spike values are catalogued for reference
- travel blanks, field blanks, equipment blanks, and travel spikes are provided on request

Instrumentation

Accutest operates and maintains the following analytical instruments in a high degree of repair and routine calibration for the tests performed:

- Varian Star 3900 Gas Chromatograph, 70-Port Autosampler, Varian 2200 Mass Spectrometer (GC/MS);
- Varian CP-3800 Gas Chromatograph, SOLATek 72-Port Autosampler, Varian 2200 Mass Spectrometer (GC/MS) in parallel with a Flame Ionization Detector (FID);
- Varian CP-3800 Gas Chromatograph, SOLATek 72-Port Autosampler, Varian 2100T Mass Spectrometer (GC/MS) in parallel with a Flame Ionization Detector (FID);
- Agilent 6890N Gas Chromatograph, 7683 Autosampler, 5973 Mass Selective Detector (GC/MS);
- Varian CP-3800 Gas Chromatograph, autosampler with direct injection, Varian 2000 Mass Spectrometer (GC/MS);
- Agilent 6890N Gas Chromatograph, autosampler with dual direct injection, dual FIDs;
- Varian CP-3800 Gas Chromatograph, autosampler with dual FIDs;
- Varian CP-3800 Gas Chromatograph, autosampler direct injection, dual analytical column, dual Electron Capture Detection (GC/ECD);
- Agilent 6890N Gas Chromatograph, autosampler direct injection, dual analytical column, dual Electron Capture Detection (GC/ECD);
- Varian ProStar HPLC with PDA and Fluorescence Detection, 84-Port Autosampler;
- Varian Vista AX ICP/AES;
- Perkin-Elmer Elan 6100 ICP/MS;
- Perkin-Elmer Elan 9000 ICP/MS;
- Atomic Absorption Spectrometers, Hydride Generator, Mercury Analyzer;
- Dionex Ion Chromatographs, Spectrophotometers, TOC Analyzers;
- Automated 56-Port PC-Titrate pH, Alkalinity, Conductivity analyzer; and
- pH and Specific Ion Meters, Turbidity Meter, COD Digestor, Incubators, Digestors, Filtration Apparatus, and Microscopes.