



**Environmental Monitoring Program and
Quality Assurance/Quality Control Plan
Hamlet of Arviat**

Prepared by

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May 2009

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1.0 Introduction

This Environmental Monitoring Program and Quality Assurance/Quality Control Plan for the Hamlet of Arviat, was prepared as a requirement of Nunavut Water Board License NWBARV0308, issued January 2004 and expired December 31, 2008. Although this plan was prepared as a condition of the expired licence, it reflects the current condition of Hamlet facilities, and outlines the Environmental Monitoring Program and Quality Assurance/Quality Control for the new license application currently being submitted.

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2.0 Hamlet of Arviat

The Hamlet of Arviat is located within the Kivalliq Region, Nunavut, at general latitude 61°6'N and general longitude 94°3'W (Figure 1). The Community is located approximately 225 km south of Rankin Inlet and 265 km north of Churchill Manitoba.

The topography surrounding the Hamlet of Arviat is relatively flat with a slight rise when moving inland away from Hudson Bay. Local bedrock is generally overlain by glacial fluvial sediments. Arviat is located in the physiographic region of the Hudson Bay lowlands, characterized by low topographic relief, occasional bedrock outcrops and glacial and glacio-fluvial overburden sediments. Boulder fields and eskers are common. Approximately 20 to 30 percent of the land is shallow ponds with depths of 1 m or less. Land between the ponds is marshy, vegetated by grasses and sedges.

The closest climate station to Arviat is the Rankin Inlet Airport Weather Station. The Rankin Inlet area receives an average of 18.1 cm of rainfall and 107 cm of snowfall per annum. Mean annual precipitation totals 29.7 cm per annum. July mean high and low temperatures are 14.9°C and 5.9°C, respectively. January mean high and low temperatures are -28.3°C and -35.5°C, respectively. Winds are generally north-west (Environment Canada, 2008).

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. The water, wastewater, and solid waste systems include the following facilities and services:

- A Water Supply Facility consisting of a water intake pumphouse on Wolf River, two water reservoirs, treatment system and truckfill water station
- Trucked water to holding tanks in each building
- A Sewage Treatment Facility consisting of a sewage lagoon which receives trucked sewage collected from holding tanks in each building and sewage treatment via an exfiltration lagoon to a wetland discharging to the ocean
- A solid waste management facility, which includes a bulky metals area.

The location of these activities is shown in Figure 2.

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3.0 Environmental Monitoring and Quality Assurance / Quality Control

3.1 Purpose of Plan

The sewage lagoon and solid waste disposal facilities operated under Nunavut Water Board License NWB3ARV0308 issued on January 9, 2004 and expired December 31, 2008 (Appendix A). The Hamlet is currently applying for renewal of the licence. The license required the Hamlet to conduct a monitoring program, which includes regular water quality sampling and reporting. As required by the license, this Quality Assurance/Quality Control Plan (QA/QC Plan) has been prepared to achieve the following objectives:

- To ensure that all samples taken in the field follow established procedures in order to maintain a high quality, so that the results obtained represent both the physical and chemical nature of the samples being taken
- To ensure best management practices (BMP) are used throughout the sampling program
- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and protocols to be followed when conducting environmental sampling under the monitoring program.

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

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Arviat. Contact information for the Hamlet is provided in Appendix B.

3.2 Quality Assurance and Quality Control

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

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

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

3.3 Lab Accreditation

All analyses shall be conducted by laboratories that are accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) or an alternative accreditation approved by the NWB. A list of CAEAL laboratories is included in Appendix C.

Ideally, the same laboratory will be used for sample analysis each sampling event, to ensure consistency in methodology and reporting. Although all accredited laboratory should be able to provide the same result for a particular sample, some variation is expected, which is why consistent laboratory services are recommended.

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

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4.0 Field Sampling

4.1 Sample Collection

Effluent and surface water sampling by the Hamlet of Arviat is conducted as part of environmental management and to monitor regulatory compliance.

4.1.1 Sampling Location and Frequency

Monitoring Program

The monitoring program included in the water license includes specific requirements regarding sampling locations, sampling frequency and parameters to be analyzed. The following monitoring program has been submitted to the NWB as the proposed requirements for the water licence.

Table 1: Surveillance Network Program for Water License

Station	Description	Frequency	Analysis Requirements
ARV-1	Raw water supply at the Wolf River Water Supply prior to treatment	Monthly and annual	Measure and record in cubic metres of water pumped from station.
ARV-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facility	Monthly from May to August, Inclusive	<ul style="list-style-type: none"> • BOD • Faecal Coliforms • pH • Conductivity • Total Suspended Solids • Ammonia Nitrogen • Nitrate-Nitrite • Total Phenols • Sulphate • Sodium • Potassium • Magnesium • Calcium • Arsenic • Cadmium • Copper • Chromium • Iron • Lead • Mercury • Nickel • Zinc
ARV-3	Raw sewage at truck offload point	Monthly and annual	Measure and record in cubic metres the raw sewage offloaded from trucks.
ARV-4	Effluent Discharge from Final Discharge Point of the Sewage Disposal Facilities	Monthly from May to August, Inclusive	Same as ARV-2

The sampling stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the

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satisfaction of an Inspector. Each sampling location must have its Global Positioning System (GPS) coordinates determined. This task should be completed prior to the first sampling to be completed under this QA/QC Plan. Samples shall be taken at the same location during each sampling event. Sample locations are shown in Figure 3.

Additional sampling and analysis may be requested by an INAC Inspector or the NWB.

4.1.2 Sample Planning

To understand what sample containers, sampling techniques, and preservation methods are required, the sampler first need to understand what parameters will be analyzed in the laboratory. Table 2 is a summary of possible parameters required, grouped according to their different sampling requirements:

Table 2: Parameters Examined in NWB Water Licenses

Group	Description	Parameter
I	Microbiological	Biological Oxygen Demand (BOD) Faecal Coliforms (FC)
II	General Water Chemistry	pH Conductivity Ammonia Nitrogen (NH ₃ -N) Nitrate-Nitrite (NO ₃ -NO ₂) Sulphate (SO ₄) Sodium (Na) Total Suspended Solids (TSS) Potassium (K) Magnesium (Mg) Calcium (Ca) Alkalinity Bicarbonate Carbonate Color Turbidity Total Organic Carbon (TOC) Hydroxide Hardness Manganese (Mg) Total Hardness Chloride (Cl) Total Phosphorus Turbidity Hydroxide Hardness Fluoride Bromide
	Total Metals (except Mercury):	Aluminium (Al) Total Arsenic (As) Barium Boron Total Cadmium (Cd) Total Copper (Cu) Total Chromium (Cr) Total Iron (Fe) Total Lead (Pb) Manganese Molybdenum Total Nickel (Ni) Selenium Silver Strontium Thallium Titanium Uranium Vanadium Total Zinc (Zn)
III		Total Mercury (Hg)
IV		Total Phenols (Total-P)

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4.1.3 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers for each analysis are shown in Table 2. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers specific for the sampling program. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The **laboratory shall be contacted at least one month prior to the sampling event** in order to ensure that containers are available for sampling.

See laboratory contact information in Appendix C.

4.1.4 Field Sampling Log

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

- Date of sampling
- Time of sampling
- Weather conditions
- Monitoring Station Number (i.e. ARV-1, ARV-2, etc.)
- Results of any field measurements (temperatures, PH, conductivity, etc.)
- Sampler shall also indicate if sample used preservatives
- Any unusual conditions
- Any deviation from standard procedures.

4.1.5 Field Measurements

No field measurements are required as part of the Hamlet sampling program, however, it is strongly recommended that the following parameters be sampled immediately on site using appropriate portable field equipment:

- pH
- Temperature
- Dissolved oxygen
- Total alkalinity
- Turbidity
- Chlorine residuals.

It is important that separate equipment be used to sample between potable water and non-potable water (i.e. surface water). Furthermore, all instruments, glassware, etc. should be cleaned between each sample following manufacturer's recommended guidelines and/or BMPs.

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General Procedures for Sample Collection

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

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

Surface Water Sampling Procedures

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

Freshwater Streams, Surface Drainage, and Wetlands

The samples shall be collected as close to the middle of the stream where water flows freely and is free of debris. Samples shall be collected upstream of the sampler. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially

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filled with the water to be sampled and rinsed with the lid in place. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed. **Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.**

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

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

Lakes or Ponds

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

4.1.7 Sample Identification

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

The individual samples will be labeled with the following information:

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

4.1.8 Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the Laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the Laboratory. **If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical**

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problems with transport aircraft, all samples must be stored in a refrigerator at 4°C. Samples must not be frozen.

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

For the Hamlet of Arviat, Table 3 provides the appropriate preservation methods for possible parameters to be assessed.

Table 3: Sample Preservation

Type of Sample	Preservation Required
Group I Microbiological	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II General Water Chemistry	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II Total Metals (except mercury)	Acidify with 5 mL of <20 percent nitric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group III Total Mercury	Acidify with 2 mL of 1:1 sulfuric acid and 5 percent potassium dichromate Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group IV Total Phenols	Acidify with 4 mL of 1:1 sulfuric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected

Note: 1000 mL = 1 Liter

4.1.9 Sample Transportation

The main objective of the sampler is to minimize any chemical changes to the sample between the time it is collected and delivery to the laboratory. Heat, light and agitation can all impact the water chemistry and the samples shall be protected from these effects.

Effluent and surface water samples shall be stored and transported at a temperature of 4°C. Coolers and ice packs need to be available and are usually provided by the laboratory. Upon arrival at the laboratory, samples shall be refrigerated as soon as possible.

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5.0 Quality Control

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

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

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

5.1 Replicate or Duplicate Samples

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

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

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6.0 Laboratory Analysis / Reporting

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

The Hamlet may request clarification of the analysis by contacting the NWB Technical Advisor and a review of the analysis will be provided upon request.

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

The results shall be submitted to the NWB for review with the Annual report. A copy of the NWB Annual Report Form is included in Appendix E.

The content of the Annual Report and Guideline Criteria is outlined in the following documents:

- Solid Waste Management Facility Operations and Maintenance Plan
- Sewage Treatment Facility Operations and Maintenance Plan
- Water Supply Facility Operations and Maintenance Plan.

All staff involved in sampling and reporting must have sufficient training to ensure the sampling program operates effectively.

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7.0 Annual Report

The results of the Environmental Monitoring Program shall be included in the NWB Annual Report as required by the license.

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8.0 Glossary

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

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

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

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9.0 References

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Figures



Map Reference:
Map Art Publishing

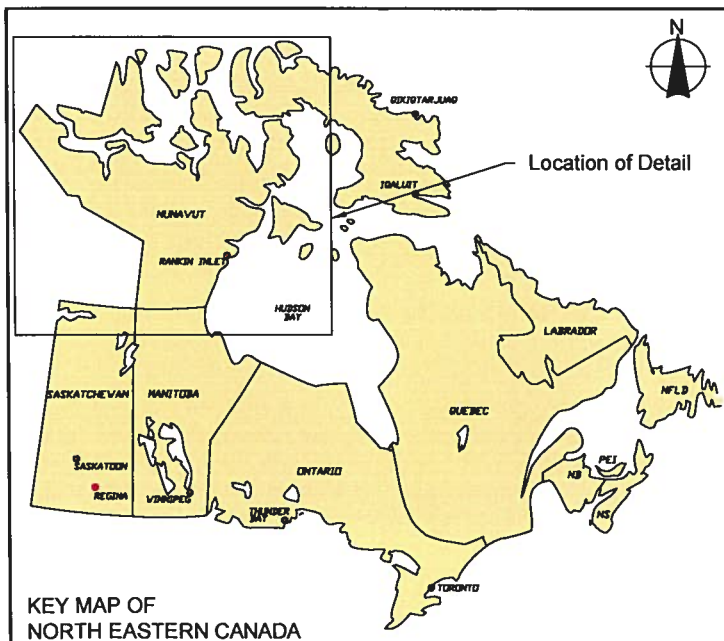


FIGURE 1 - SITE LOCATION MAP

HAMLET OF ARVIAT HAMLET OF ARVIAT, NUNAVUT

ENVIRONMENTAL MONITORING PLAN & QUALITY ASSURANCE & QUALITY CONTROL PLAN

January 2009

Project Number: N-O15746

Prepared by: C. Sheppard

Verified by: J. Walls

Burnside

N-O15746 ENVIRONMENTAL & QA-QC PLAN SL.dwg

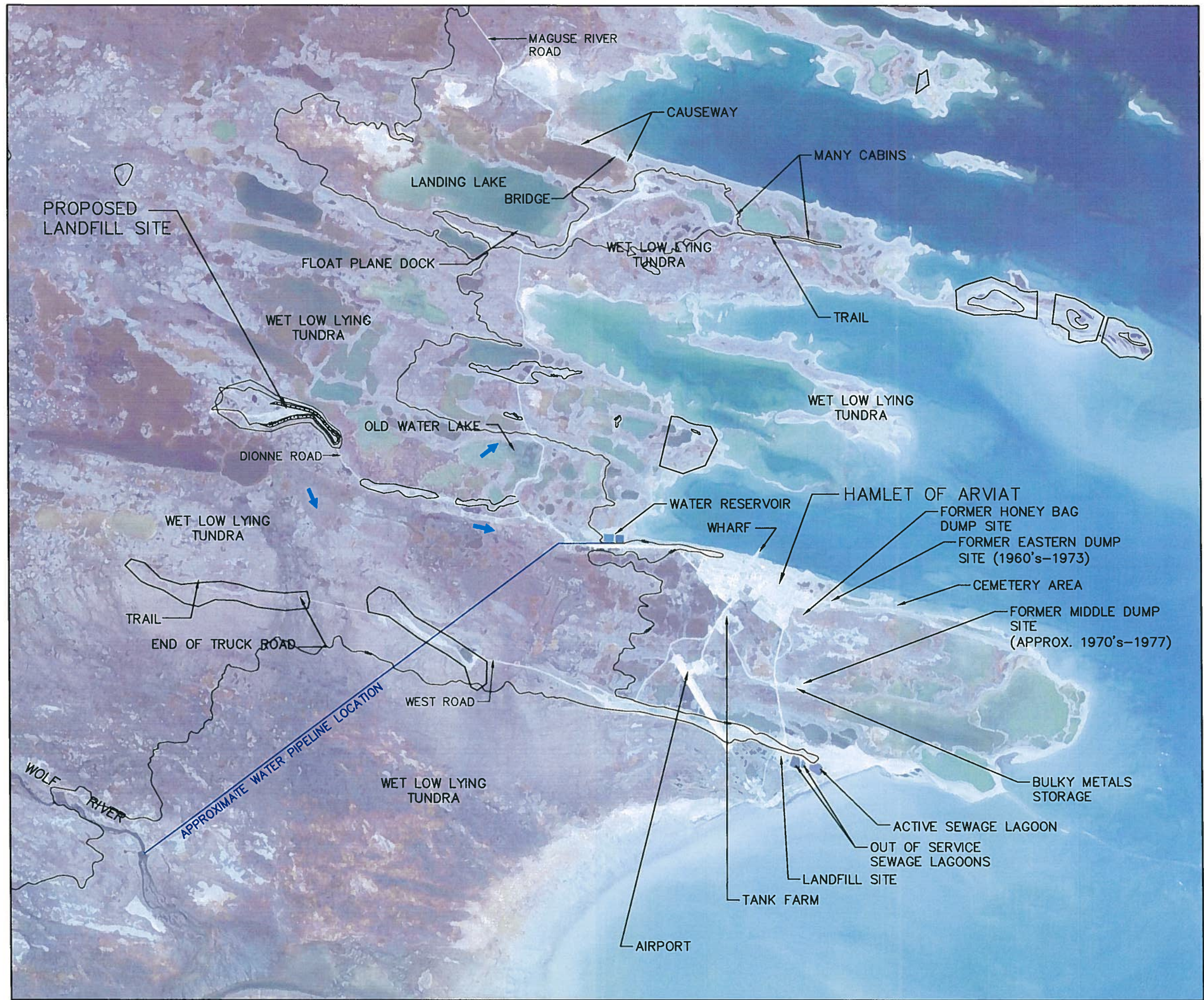


FIGURE 2
HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
 ENVIRONMENTAL MONITORING PROGRAM & QA/QC CONTROL PLAN

COMMUNITY PLAN

Satellite Image Source:
 Background colour satellite image obtained from Google Earth Pro.

Map Source:
 Background physical features obtained from the National Topographic Database Website.

1:50,000
 December 2008
 Project Number: N-015746

Projection: UTM Zone 15
 Datum: NAD83

Prepared by: C. Sheppard
 Verified by: J. Walls






FIGURE 3
HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
ENVIRONMENTAL MONITORING PROGRAM & QA/QC CONTROL PLAN


MONITORING LOCATIONS

LEGEND
● MONITORING LOCATION

Satellite Image Source:
Background colour satellite image obtained from Google Earth Pro.

Map Source:
Background physical features obtained from the National Topographic Database Website.




0 200 400 600 800 1000 1200 1400 1600
Metres

1:20,000
December 2008
Project Number: N-O15746
Prepared by: C. Sheppard

Projection: UTM Zone 15
Datum: NAD83
Verified by: J. Walls



Appendix A
Nunavut Water License



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TEL: (867) 360-6338

FAX: (867) 360-6369

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NUNAVUT WATER BOARD

NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3ARV0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated September 2, 2003, made by:

Hamlet of Arviat

to allow for the use of water and disposal of waste by the Hamlet of Arviat, Nunavut. With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence.

DECISION

After having been satisfied that the application was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S. 12.3.2 of the *Nunavut Land Claim Agreement* (NLCA), the NWB decided that the application could proceed through the regulatory process. After reviewing the submission of the Applicant and written comments expressed by interested parties, the NWB, having given due regard to the facts and circumstances, the merits of the submissions made to it and to the purpose, scope and intent of the *Nunavut Land Claims Agreement* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and furthermore to delegate its authority to approve the application to the Chief Administrative Officer pursuant to S. 49(a) of the NWNSRTA and determined that:

Licence Number NWB3ARV0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-39)

SIGNED this 9th day of January 2004 at Gjoa Haven, NU.



Philippe di Pizzo
Chief Administrative Officer

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I. BACKGROUND

The Hamlet of Arviat is located on the northern shore of a peninsula on the west coast of Hudson Bay. Arviat is located at 61°05' N and 94° 00'W, and is 241 km southwest of Rankin Inlet and 265 air km north of Churchill, Manitoba. The topography of Arviat, which is located on a low and narrow coastal strip, is characterized by low topographic variations, occasional bedrock outcrops and a thick mantle of glacio- fluvial debris. Features include till, fine- grained marine deposits, and extensive beaches. The permafrost is continuous, extending to depths from 30 m to over 100 m. The active layer varies between 0.5 m and 0.3 m. Numerous ponds and lakes are present in the vicinity of the Hamlet, making drainage difficult. The average annual precipitation in Arviat consists of 16 cm of rainfall and 118 cm of snowfall. The mean high in July is 13.1 degrees with a mean low of 4.5 degrees. In January, the mean high is -27.9 degrees and a mean low of -35.0 degrees. The predominant local vegetation consists of mosses and lichens on rocky outcrops, with hardy grasses and sages in swampy and/or more sheltered areas.

II. PROCEDURAL HISTORY

On September 2, 2003, an application for a water licence was filed by the Hamlet of Arviat, which was previously un-licensed by the NWB. The Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement*, on October 7, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

Based upon the results of the detailed assessment, which was completed, including consideration of any potential accidents, malfunctions, or cumulative environmental effects that the overall project might have in the area, the Board delegated to the Chief Administrative Officer authority to approve the application pursuant to S. 13.7.5 of the *Agreement*.

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the

compliance record of the Applicant. Specifically, the August 12, 2002 DIAND Inspection Report indicated:

1. The lagoon currently in operation does not have sufficient freeboard, and capacity should be increased;
2. Concentrations of ammonia exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*; and
3. Levels of Total Suspended Solids and BOD exceeded the *Municipal Wastewater Effluent Quality Guidelines*.

The NWB has imposed the requirement to produce an Annual Report. These Reports are for the purpose of ensuring that the NWB has an accurate annual update of municipal activities during a calendar year. This information is maintained on the public registry and is available to any interested parties upon request. The Licensee's attention is drawn to the attached standard form for completing the Annual Report (see Attachment I).

The NWB has also imposed on the Licensee the requirement to produce an Operations and Maintenance Manual for their sewage and solid waste operations. The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II). Additionally, the Plan shall address the operational issues identified at the Sewage Disposal Facility in the July 11, 2002 DIAND Inspection Report

The NWB believes that a term of five (5) years is appropriate, and will allow enough time for the Hamlet to establish a consistent compliance record with the terms and conditions of its licence. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

Water Use

The Municipality currently receives water from the Wolf Creek water supply located 8.0 km southwest of the Hamlet. Water is stored in a 57,000 m³, 2-cell reservoir located 1.5 km west of the Hamlet, adjacent to the truck fill station. The water receives a chlorine treatment and is then distributed to the community by truck. Water requirements for 2003 were reported as 64,871 m³. Demand for 2008 was not reported in application. Utilizing the water demand formula developed by the Department of Municipal and Community Affairs (Government of the Northwest Territories), projected demand requirements for 2008 was calculated at 78,273 m³.

No concerns were expressed by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Based upon the projected requirements of the Hamlet, the Board has set the terms and conditions in the water licence, which govern water usage. Accordingly, and based upon the projected requirements of the Hamlet, the Board has set the terms and conditions in the water licence, which govern water usage and which are contained herein. The maximum permitted usage of water by the Hamlet of Arviat, over the term of the water license and for all purposes, has been set at 81,000 m³ *per annum*.

Deposit of Waste

Sewage

The Hamlet of Arviat utilizes a Sewage Disposal Facility approximately 2.8 km southeast of the Municipality. This Sewage Disposal Facility is located in an area adjacent to the Solid Waste Disposal Facility, and consists of a 55,000 m³ single-cell exfiltration lagoon. The effluent from this lagoon proceeds downstream to the marine environment through an undefined, natural wetland along a 200 m flow path prior to entering Hudson Bay.

Specific comments relevant to sewage disposal operations in the Hamlet were provided by DIAND, and Environment Canada. DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. DIAND and Environment Canada further recommended that the Hamlet take steps to remedy capacity and effluent quality issues currently evidenced at the Sewage Disposal Facility.

Additionally, DIAND provided recommendations concerning effluent discharge criteria, which are consistent with the *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories* (Northwest Territories Water Board; 1992), as well as specific recommendations concerning the Monitoring Program. This Program is established to collect data on water quality to assess the effectiveness of treatment for protection of public health and to assess potential impacts to the environment associated with the municipal facilities. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. The Board also draws the attention of the Licensee to their requirements to implement the Quality Assurance/Quality Control (QA/QC) Plan to be provided by the NWB. The purpose of the QA/QC Plan is to ensure that samples taken in the field as part of the Monitoring Program will maintain a high quality, so as to accurately represent the physical and chemical nature of the samples being taken. It should also be noted that while minimum sampling requirements have been imposed, additional sampling may be requested by an Inspector.

Solid Waste

The Hamlet's solid waste management site is located adjacent to the Sewage Disposal system, approximately 2.8 km southeast of the community. Waste is segregated, with a generic landfill area,

a bulky wastes area, and an area segregated for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered annually.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND, DFO and Environment Canada. DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. DIAND further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. DIAND, Environment Canada and DFO recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence.

LICENCE NWB3ARV0308

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

HAMLET OF ARVIAT

(Licensee)

of

ARVIAT, NUNAVUT, X0A 0J0

(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water for a period subject to restrictions and conditions contained within this licence:

NWB3ARV0308

Licence Number

NUNAVUT 06

Water Management Area

ARVIAT, NUNAVUT

Location

WATER USE AND WASTE DISPOSAL

Purpose

MUNICIPAL UNDERTAKINGS

Description

81,000 CUBIC METRES ANNUALLY

Quantity of Water Not to be Exceeded

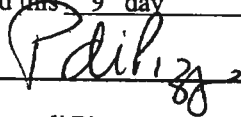
JANUARY 9, 2004

Date of Licence

DECEMBER 31, 2008

Expiry Date of Licence

Dated this 9th day of January 2004 at Gjoa Haven, NU.


Philippe di Pizzo
Chief Administrative Officer

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

- a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Arviat, Nunavut (63°21' N; 90° 42'W);
- b. This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be subject to such requirements; and;
- c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

2. Definitions

In this Licence: NWB3ARV0308

“Act” means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*;

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

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

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

“Average Concentration” means the arithmetic mean of the last four consecutive analytical results for contained in composite or grab samples collected from the Waste Disposal Facility’s final discharge point;

“Average Concentration For Faecal Coliforms” means the geometric mean of the last four consecutive analytical results for faecal coliforms contained in composite or grab samples collected from the Waste Disposal Facility’s final discharge point;

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

“Chief Administrative Officer” means the Executive Director of the Nunavut Water Board;

“Commercial Waste Water” means water and associated waste generated by the operation of a commercial enterprise, but does not include toilet wastes or greywater;

“Composite Sample” means a water or wastewater sample made up of four (4) samples taken at regular periods over a 24 hour period;

“Effluent” means treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond or a treatment plant;

“Final Discharge Point” means an identifiable discharge point of a Waste Disposal Facility beyond which the Licensee no longer exercises care and control over the quality of the Effluent;

“Freeboard” means the vertical distance between water line and crest on a dam or dyke’s upstream slope;

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

“Greywater” means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes;

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

“Licensee” means the holder of this Licence;

“Modification” means an alteration to a physical work that introduces new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion, and changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

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

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

“Sewage” means all toilet wastes and greywater;

“Sewage Disposal Facilities” comprises the area and engineered lagoon and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on September 2, 2003 and illustrated in Drawing # 2003-0440-04/1-3;

“Solid Waste Disposal Facilities” comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on September 2, 2003 and illustrated in Drawing # 2003-08-26;

“Toilet Wastes” means all human excreta and associated products, but does not include greywater;

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

“Waste Disposal Facilities” means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on September 2, 2003 and illustrated in Drawing # 2003-0440-04/1-3; and

“Water Supply Facilities” comprises the area and associated intake infrastructure at the Wolf Creek Water Supply, as described in the Application for Water Licence filed by the Applicant on September 2, 2003 and illustrated in Drawing # 1998-08-24/2.

PART B: GENERAL CONDITIONS

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

- i. tabular summaries of all data generated under the "Monitoring Program";
 - ii. the monthly and annual quantities in cubic metres of fresh water obtained from all sources;
 - iii. the monthly and annual quantities in cubic metres of each and all waste discharged;
 - iv. a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and facilities;
 - v. a list of unauthorized discharges and summary of follow-up action taken;
 - vi. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;
 - vii. a summary of any studies, reports and plans (e.g., Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;
 - viii. any other details on water use or waste disposal requested by the Board by November 1st of the year being reported; and
2. The Licensee shall comply with the "Monitoring Program" described in this Licence, and any amendments to the "Monitoring Program" as may be made from time to time, pursuant to the conditions of this Licence.
 3. The "Monitoring Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.
 4. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.
 5. The Licensee shall, within ninety (90) days after the first visit of the Inspector, post the necessary signs, where possible, to identify the stations of the "Monitoring Program." All signage postings shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector.

6. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130) any spills of Waste, which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Water Supply or Waste Disposal Facilities.
7. The Licensee shall ensure a copy of this Licence is maintained at the municipal office at all times.
8. Any communication with respect to this Licence shall be made in writing to the attention of:

(i) Chief Administrative Officer:

Executive Director
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369

(ii) Inspector Contact:

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4298
Fax: (867) 979-6445

(iii) Analyst Contact:

Taiga Laboratories
Department of Indian and Northern Affairs
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2781
Fax: (867) 669-2718

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

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from the Wolf Creek Water Supply using the Water Supply Facilities or as otherwise approved by the Board.
2. The annual quantity of water used for all purposes shall not exceed 81,000 cubic metres.
3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.
4. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all Sewage to the Sewage Disposal Facilities or as otherwise approved by the Board.
2. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Program Station ARV-4 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1×10^4 CFU/dl
BOD ₅	80 mg/L
Total Suspended Solids	100 mg/L
Oil and grease	No visible sheen
pH	between 6 and 9

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, shall be maintained at all dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.
4. The Licensee shall advise an Inspector at least ten (10) days prior to initiating any decant of the sewage lagoon.

5. The Sewage Disposal Facility shall be maintained and operated, to the satisfaction of an Inspector in such a manner as to prevent structural failure.
6. The Licensee shall dispose of and contain all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Board.
7. The Licensee shall implement measures to ensure hazardous materials and/or leachate from the Solid Waste Disposal Facility does not enter water.
8. The Licensee shall submit to the Board for review within six (6) months of the issuance of this license a report identifying each Final Discharge Point. The report shall at least include:
 - a. Plans, specifications and a general description of each Final Discharge Point together with its specific geo-referenced location;
 - b. A description of how each Final Discharge Point is designed and maintained.
9. If, during the term of this Licence, additional Final Discharge Points are identified, the Licensee shall submit the information as required by Part D, Item 8 for each new Final Discharge Point within 30 days after the discharge point is identified and at least 60 days prior to depositing Effluent from the new Final Discharge Point and/or proposed changes are made to a Final Discharge Point.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval design drawings stamped by a qualified engineer registered in Nunavut prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.
2. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Waste Disposal Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:
 - i. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;
 - ii. said modifications do not place the Licensee in contravention of the Licence or the *Act*;

- iii. the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and
 - iv. the Board has not rejected the proposed modifications.
- 3. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met may be carried out only with written approval from the Board.
 - 4. The Licensee shall provide as built plans/drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

- 1. The Licensee shall, within 6 months of the issuance of this license, submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with "*Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities*" (October 1996). This Plan shall specifically address hazardous waste disposal and operational issues at the Solid Disposal Facility.
- 2. The Licensee shall implement the Plan specified in Part F, Item 1 as and when approved by the Board.
- 3. The Licensee shall revise the Plan referred to in Part F, Item 1, if not acceptable to the Board. The revised Plan shall be submitted to the Board for approval within thirty (30) days of notification of the Board decision
- 4. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:
 - i. employ the appropriate contingency plan as provided for in the Operation and Maintenance Plan;
 - ii. report the incident immediately via the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
 - iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.
- 5. In the absence of a contingency plan contained within an approved Operation and Maintenance Plan, and should during the period of this Licence an unauthorized discharge of

waste occur, or if such a discharge is foreseeable, the Licensee shall:

- i. take whatever steps are immediately practicable to protect human life, health and the environment;
- ii. without delay seek guidance from the Departments of Community Government and Transportation and Sustainable Development with regards to mitigation and remedial actions required to address the discharge;
- ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
- iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities and the construction of new facilities to replace existing ones. The Plan shall include, but not be limited to where applicable:
 - i. water intake facilities;
 - ii. the water treatment and waste disposal sites and facilities;
 - iii. petroleum and chemical storage areas;
 - iv. any site affected by waste spills;
 - v. leachate prevention;
 - vi. an implementation schedule;
 - vii. maps delineating all disturbed areas, and site facilities;
 - viii. consideration of altered drainage patterns;
 - ix. type and source of cover materials;
 - x. future area use;
 - xi. hazardous wastes; and
 - xii. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.
2. The Licensee shall implement the plan specified in Part G, Item 1 as and when approved by the Board.
3. The Licensee shall revise the Plan referred to in Part G, Item 1 if not approved. The revised Plan shall be submitted to the Board for approval within thirty (30) days of receiving notification of the Board's decision.
4. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

<u>Monitoring Station</u>	<u>Description</u>
ARV-1	Raw water supply at the Wolf Creek Water Supply prior to treatment
ARV-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
ARV-3	Raw Sewage at truck offload point
ARV-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

2. The Licensee shall sample monthly at Monitoring Station ARV-2 and ARV-4 during the months of May to August, inclusive. Samples shall be analyzed for the following parameters:

BOD	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Ammonia Nitrogen
Nitrate-Nitrite	Oil and Grease (visual)
Total Phenols	Sulphate
Sodium	Potassium
Magnesium	Calcium
Total Arsenic	Total Cadmium
Total Copper	Total Chromium
Total Iron	Total Lead
Total Mercury	Total Nickel
Total Zinc	

3. The Licensee shall measure and record in cubic metres the monthly and annual quantities of water pumped from Monitoring Station ARV-1 for all purposes.
4. The Licensee shall measure and record in cubic metres the monthly and annual quantities of raw sewage offloaded from trucks at Monitoring Station ARV-3 for all purposes.

5. Additional sampling and analysis may be requested by an Inspector.
6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 120 days of the issuance of this license.
7. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board.
8. All analyses shall be performed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Certified Laboratory, or as otherwise approved by an Analyst.
9. The Licensee shall measure and record the annual quantities of sewage solids removed from the Sewage Disposal Facility.
10. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Monitoring Program" in the Licensee's Annual Report, as required *per* Part B, Item 1.
11. Modifications to the Monitoring Program may be made only upon written approval of the Chief Administrative Officer.



Appendix B

Contact List for Arviat

Contact Information – Hamlet of Arviat

Contact	Location	Telephone Number	Fax Number
Hamlet of Arviat SAO	Arviat	(867) 857-2841	(867) 857-2519
24-Hour NWT/Nunavut Spill Report Line	Yellowknife	(867) 920-8130	(867) 873-6924
INAC–Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Government of Nunavut - Regional Engineer <i>Brian Duguay</i>	Rankin Inlet	(867) 645-8156	(867) 645-8196
Environment Canada - Inspector	Iqaluit	(867) 975-4644	(867) 979-4594
Fire Department	Arviat	(867) 857-2525	-
RCMP Detachment	Arviat	(867) 857-1111	-
Community Health Centre	Arviat	(867) 857-3100	-



Appendix C
Contact Information for
CAEAL Laboratories

Contact Information for Canadian Association of Environmental Analytical Laboratories (CAEAL)

ALS Laboratory Group – Environmental Division

Toll Free: 1-800-668-9878

1329 Niakwa Road East, Unit 12
Winnipeg, Manitoba
R2J 3T4
Phone: (204) 255-9720
Fax: (204) 255-9721

75 Con Road
Yellowknife, NWT
X1A 2M1
Phone: (861) 766-5308
Fax: (867) 920-4238

Taiga Environmental Laboratory

4601-52 Avenue
Yellowknife, NWT
X1A 2R3
Phone: (867) 669-2788
Fax: (867) 669-2718

AGAT Laboratories Limited

5623 McAdam Road
Mississauga, Ontario
L4Z 1N9
Phone: (905) 501-9998
Fax: (905) 501-0589
Toll Free: 1-800-856-6261



Appendix D
Canadian Water Quality
Guidelines for Aquatic Life

NWB Annual Report

Year being reported: Select ▼

License No: **Issued Date:**
Expiry Date:

Project Name:

Licensee:

Mailing Address:

Name of Company filing Annual Report (if different from Name of Licensee please clarify relationship between the two entities, if applicable):

General Background Information on the Project (*optional):

Licence Requirements: the licensee must provide the following information in accordance with

Select ▼ Select ▼

A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; drill waste management; solid and hazardous waste management.

Water Source(s):	<input type="text"/>
Water Quantity:	Quantity Allowable Domestic (cu.m)
	Actual Quantity Used Domestic (cu.m)
	Quantity Allowable Drilling (cu.m)
	Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal

- ☐ Solid Waste Disposal
- ☐ Sewage
- ☐ Drill Waste
- ☐ Greywater
- ☐ Hazardous
- ☐ Other:

Additional Details:

A list of unauthorized discharges and a summary of follow-up actions taken.

Spill No.: (as reported to the Spill Hot-line)
 Date of Spill:
 Date of Notification to an Inspector:
 Additional Details: (impacts to water, mitigation measures, short/long term monitoring, etc)

Revisions to the Spill Contingency Plan

Select

Additional Details:

Revisions to the Abandonment and Restoration Plan

Select

Additional Details:

Progressive Reclamation Work Undertaken

Additional Details (i.e., work completed and future works proposed)

Results of the Monitoring Program including:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where sources of water are utilized;

Select

Additional Details:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where wastes associated with the licence are deposited;

Select

Additional Details:

Results of any additional sampling and/or analysis that was requested by an Inspector

Select 

Additional Details: (date of request, analysis of results, data attached, etc)

Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported.

Select 

Additional Details: (Attached or provided below)

Any responses or follow-up actions on inspection/compliance reports

Select 

Additional Details: (Dates of Report, Follow-up by the Licensee)

Any additional comments or information for the Board to consider

Date Submitted:

Submitted/Prepared by:

Contact Information:

Tel:

Fax:

email:



Appendix E

Annual Monitoring Report Format



Canadian Water Quality Guidelines for the Protection of Aquatic Life

SUMMARY TABLE

Update 7.0
September 2007

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

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

Continued.

SUMMARY TABLE

Update 7.0

Canadian Water Quality Guidelines for the Protection of Aquatic Life

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

Continued.

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

Continued.

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

Continued.

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

Continued.

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

Continued.

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

^aUnless otherwise indicated, supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

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

^cInterim guideline.

^dNo fact sheet created. For more information on this guideline, please refer to *Canadian Water Quality Guidelines* (CCREM 1987).

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

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

^gAluminium guideline= $5 \mu\text{g}\cdot\text{L}^{-1}$ at pH <6.5
= $100 \mu\text{g}\cdot\text{L}^{-1}$ at pH \geq 6.5

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

ⁱGuideline value slightly modified from CCREM 1987 + Appendixes due to re-evaluation of the significant figures.

^jThe technical document for the guideline is available from the Ontario Ministry of the Environment.

^kSubstance has been re-evaluated since CCREM 1987 + Appendixes. Either a new guideline has been derived or insufficient data existed to derive a new guideline.

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

^mCopper guideline = 2 µg·L⁻¹ at a water hardness of 0–120 mg·L⁻¹ (soft to medium) as CaCO₃
= 3 µg·L⁻¹ at a water hardness of 120–180 mg·L⁻¹ (hard) as CaCO₃
= 4 µg·L⁻¹ at a water hardness >180 mg·L⁻¹ (very hard) as CaCO₃

ⁿDissolved oxygen for warm-water biota: early life stages = 6000 µg·L⁻¹
other life stages = 5500 µg·L⁻¹
for cold-water biota: early life stages = 9500 µg·L⁻¹
other life stages = 6500 µg·L⁻¹

^oLead guideline = 1 µg·L⁻¹ at a water hardness of 0–60 mg·L⁻¹ (soft) as CaCO₃
= 2 µg·L⁻¹ at a water hardness of 60–120 mg·L⁻¹ (medium) as CaCO₃
= 4 µg·L⁻¹ at a water hardness of 120–180 mg·L⁻¹ (hard) as CaCO₃
= 7 µg·L⁻¹ at a water hardness >180 mg·L⁻¹ (very hard) as CaCO₃

^pNickel guideline = 25 µg·L⁻¹ at a water hardness of 0–60 mg·L⁻¹ (soft) as CaCO₃
= 65 µg·L⁻¹ at a water hardness of 60–120 mg·L⁻¹ (medium) as CaCO₃
= 110 µg·L⁻¹ at a water hardness of 120–180 mg·L⁻¹ (hard) as CaCO₃
= 150 µg·L⁻¹ at a water hardness >180 mg·L⁻¹ (very hard) as CaCO₃

^qThe guideline of 4.0 µg·L⁻¹ for phenoxy herbicides is based on data for ester formulations of 2,4-dichlorophenoxyacetic acid.

^rThe technical document for the guideline is available from British Columbia Ministry of Environment, Lands and Parks.

^sTemperature: (for more information, see CCREM 1987)

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

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

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

^tExpressed on a TEQ basis using NP TEFs, see Table 2 in factsheet.

^uFor protection from direct toxic effects; the guidelines do not consider indirect effects due to eutrophication.

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

^wMay not fully protect higher trophic level fish; see factsheet for details.

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

ultra-oligotrophic <4 µg·L⁻¹

oligotrophic 4–10 µg·L⁻¹

mesotrophic 10–20 µg·L⁻¹

meso-eutrophic 20–35 µg·L⁻¹

eutrophic 35–100 µg·L⁻¹

hyper-eutrophic >100 µg·L⁻¹

^yGuidelines are expressed in µg nitrate·L⁻¹. These values are equivalent to 2900 µg nitrate-nitrogen·L⁻¹, and 3600 µg nitrate-nitrogen·L⁻¹, for freshwater and marine respectively.

^zGuideline is expressed as µg nitrite-nitrogen·L⁻¹. This value is equivalent to 197 µg nitrite·L⁻¹.

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

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

Reference

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

Reference listing:

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

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