Hamlet of Arviat Water License
Annual Report 2008
Arviat Water Use and Waste Disposal
Hamlet of Arviat
Water License NWB3ARV0308

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Building 764, Fred Coman Street, Iqaluit NU X0A 0H0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

May 2009

File No: N-O 15746

NWB Annual Report **Year being reported:** 2008

License No: NWB3ARV0308 **Issued Date:** January 4, 2004
Expiry Date: December 31, 2008

Project Name: Arviat Water Use and Waste Disposal

Licensee: Hamlet of Arviat

Mailing Address:
The Hamlet of Arviat
P.O. Box 119
Arviat, Nunavut
X0E 1J0

Name of Company filing Annual Report (if different from Name of Licensee please clarify relationship between the two entities, if applicable):
Nuna Burnside Engineering and Environmental Ltd.
Consulting Firm retained by the Hamlet

General Background Information on the Project (*optional):
See attached report

License Requirements: the licensee must provide the following information in accordance with
Part B Item 1

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): Wolf River

Water Quantity:

81,000	Quantity Allowable Domestic (cu.m)
74,900	Actual Quantity Used Domestic (cu.m)
	Quantity Allowable Drilling (cu.m)
	Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal
- [x] Solid Waste Disposal
- [x] Sewage
- [ ] Drill Waste
- [ ] Greywater
- [ ] Hazardous
- [ ] Other:

Additional Details:
See attached report

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

Other: (see additional details)

Additional Details:

A Spill Contingency Plan has been submitted by Nuna Burnside, as part of Environmental Emergency Contingency Plan for Hamlet of Arviat.

Revisions to the Abandonment and Restoration Plan

N/A - not applicable

Additional Details:

Progressive Reclamation Work Undertaken

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

A new solid waste facility is proposed as discussed in the report

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;

Details described below

Additional Details:

Wolf River Water Intake - 61°04'33.10" N, 94°12"03.96 W

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

Details described below

Additional Details:

Landfill - 61°05'17.33" N, 94°03"10.75 W
Sewage Lagoon - 61°05' 12.51" N, 94°02' 44.61" W

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

No additional sampling requested by an Inspector or the Board

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

See water license renewal submission by Nuna Burnside

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

No additional sampling requested by an Inspector or the Board

Additional Details: (Attached or provided below)

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

Inspection Report received by the Licensee (Date):

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

See details in attached report

Any additional comments or information for the Board to consider

See attached report

Date Submitted:	April 12, 2009	
Submitted/Prepared by:	Jim Walls, Nuna Burnside Engineering and Environmental	
Contact Information:	**Tel:**	519-941-5331
	Fax:	519-941-8120
	email:	jwalls@rjburnside.com

Nunavut Water Board

Hamlet of Arviat Water License
Annual Report 2008
Arviat Water Use and Waste Disposal
Hamlet of Arviat
Water License NWB3ARV0308

May 2009

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May 2009

1.0 Introduction

At the request of the Hamlet of Arviat, Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) has prepared this Annual Report as required by Water License NWB3ARV0308, which expired on December 31, 2008 (Appendix A). The Annual Report demonstrates the Hamlet of Arviat efforts to achieve due diligence with respect to NWB license requirements. An application for renewal/replacement of their license was submitted in December 2008.

2.0 Project Background

The Hamlet of Whale Cove 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 Hamlet of Arviat, Water and Waste Disposal license NWB3ARV0308 includes activities for municipal water intake, sewage disposal and waste disposal activities (Figure 2). As part of these activities the following facilities are operated:

- Wolf Creek Pump house
- Arviat Water Reservoirs and Truck Fill Station
- Arviat Sewage Lagoons
- Arviat Solid Waste Management Facility.

3.0 Summary of Water and Waste Disposal Activities

Water Use

The Hamlet of Arviat currently receives water from the Wolf River water supply located 8.0 km southwest of the Hamlet. A pump house located beside Wolf River pumps from the river seasonally to fill the community's two water reservoirs. Water from the reservoirs is pumped into water trucks and distributed to the community. Currently water is treated by chlorine injection when water is pumped into trucks. A new water filtration system is planned to be built in 2009.

The Hamlet records its water usage monthly. In 2008, the annual consumption is 74,900 m^3. This does not exceed the allowable amount of 81,000 m^3 per year, as stated in the license.

Sewage Collection and Disposal

Sewage collection is provided by the Hamlet. Each building has a sewage holding tank that is pumped out by the Hamlet's sewage pump out truck as needed. Pump out sewage is treated at the community sewage lagoons located approximately 2.8 km southeast of the Hamlet.

The sewage treatment system consists of three sewage lagoons and a wetland treatment area. The lagoons are discharged at a slow continuous rate during the growing season to make room for the following year's sewage. The sewage moves through the wetland treatment area towards Hudson Bay approximately 200 m from the lagoons' discharge point.

The volume of sewage waste water roughly corresponds to the annual water use of the Hamlet. Therefore approximately 74,900 m^3 of sewage is estimated to have been discharged into the sewage lagoons in 2008. There have been no issues with the sewage lagoons in 2008.

Solid Waste Management Facility

Solid waste in the community is collected by a garbage compactor truck and deposited in the community landfill located 2.8 km southeast of the community.

The current landfill is approaching its useful life. In September 2008, Nuna Burnside was retained by the Hamlet to evaluate potential locations for a new municipal solid waste disposal site. A new location for the landfill site was selected by Nuna Burnside in October 2008 and approved by the Hamlet Council. The construction of the landfill is planned for the 2009.

The new site is located approximately 7 km northwest of the community. The location of the new landfill is shown in Figure 2. The proposed new landfill will consist of a fill area, bulky waste metals area and landfarm area. Nuna Burnside will be preparing a schematic design of the landfill in 2009. This will be submitted to the NWB when completed.

4.0 Monitoring Program

The monitoring program created by the water license includes specific requirements regarding sampling locations, sampling frequency, parameters to be analyzed and effluent quality. The monitoring locations below are shown in Figure 3 and the requirements are summarized in Table 1.

Table 1: Surveillance Network Program for Water License NWB3ARV0308

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	• BOD • Fecal 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
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

5.0 Monitoring Results

5.1 Water Supply Facility

Monitoring of water volumes from ARV-1 have been recorded by the Hamlet. Copies of the reports are included in Appendix B.

Water sampling of the raw water intake is not required in the NWB licence. Water samples of treated water were taken by the public health board from various locations in the distribution system to test for E.Coli and Total Coliforms. The most recent sampling in 2007 indicated that there were no issues with water quality. (Appendix C)

5.2 Wastewater Treatment Facility

Sampling was not conducted by the Hamlet. Sample results from sampling completed by INAC in 2003 are included in Appendix C.

The sample results showed some exceedences of the CCME Water Quality Guidelines for the Protection of Aquatic Life. The exceedences were in aluminium (0.217 mg/L vs. 0.1 mg/L), copper (0.031 mg/L vs. 0.002 mg/L) and iron (4.888 mg/L vs. 0.300 mg/L). A result of 248 mg/L for total suspended solids exceeded the NWB licence requirements 100 mg/L.

5.3 Solid Waste Management Facility

Sampling of the landfill seepage was sampled by INAC in 2003 (Appendix C). The results were compared to the CCME Water Quality Guidelines for Protection of Aquatic Life in freshwater systems (Appendix D). The results of the parameters in exceedance are summarized in Table 2.

Table 2: Sample Results for Parameters in Exceedance at ARV-2

Parameter	CCME Standard	August 7, 2003
Iron (mg/L)	0.300	0.812
Copper (mg/L)	0.004	0.0098
Cadmium (mg/L)	0.000017	0.0002
Arsenic (mg/L)	0.005	0.007

6.0 INAC Inspection Reports

The most recent inspection report from INAC was written on July 31, 2008. The report identified several concerns for which the activities were out of compliance. A copy of the report is included in Appendix E. To address the concerns outlined in the inspection the licensee will produce the following reports:

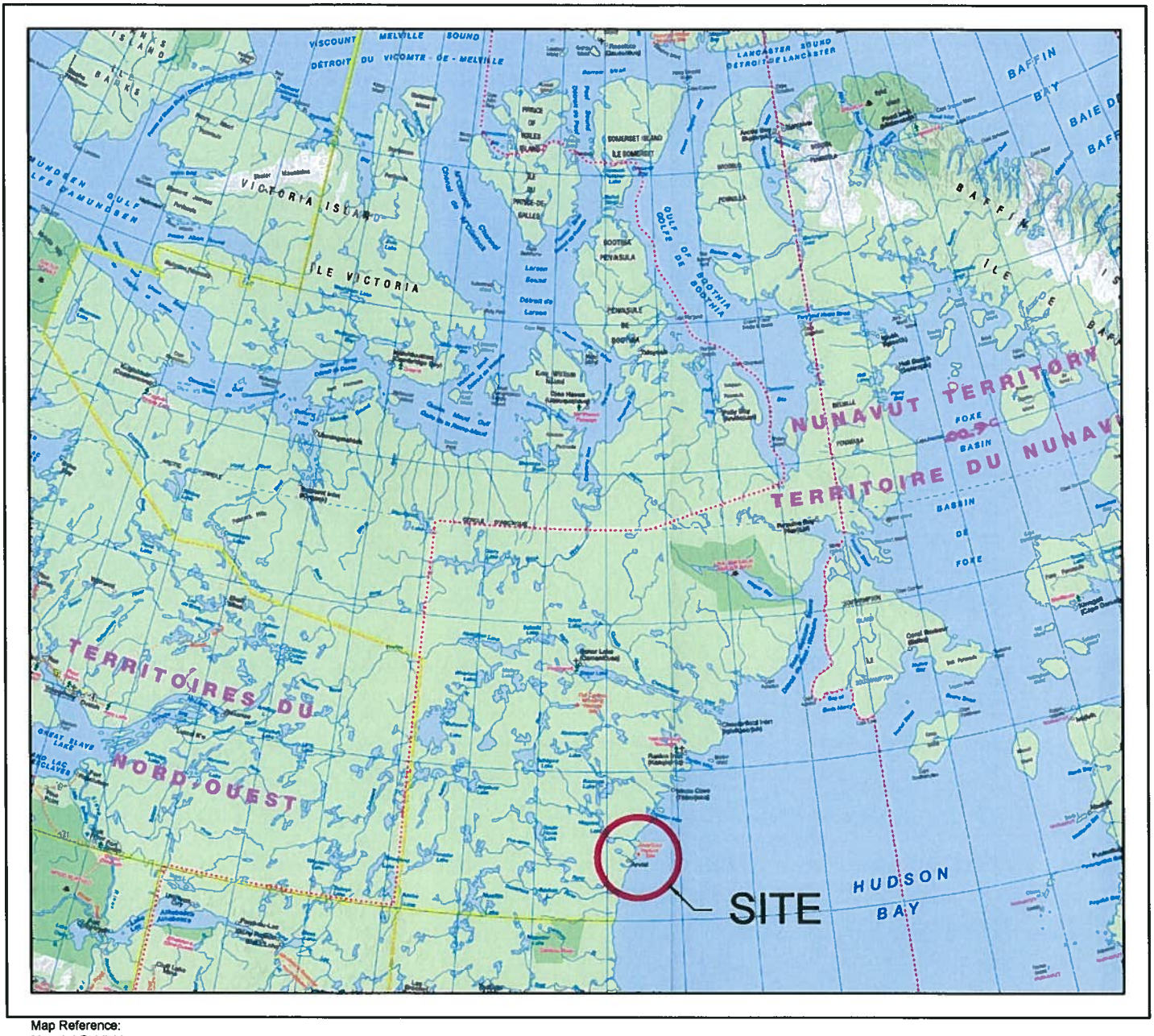
- Detailed Operations and Maintenance plans for the Sewage Treatment Facility, Water Supply Facility and Solid Waste Management Facility
- An Environmental Emergency Contingency Plan
- An Environmental Monitoring Program and Quality Assurance/Quality Control Plan.

7.0 References

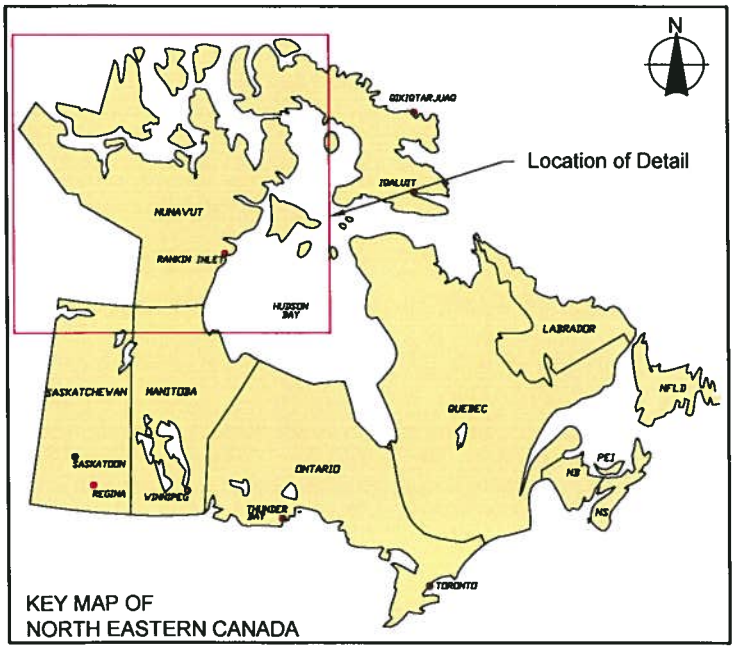
Canadian Council of Ministers of the Environment (CCME), 2007. *Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary table.* Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of the Environment, Winnipeg.

Indian and Northern Affairs Canada, Inspection Report, Arviat, July 31, 2008.

Figures



Map Reference:
Map Art Publishing



KEY MAP OF
NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT

ANNUAL REPORT 2008

January 2009
Project Number: N-O15746

Prepared by: C. Sheppard

Verified by: J. Walls

N-O15746 ANNUAL REPORT 2008 SL.dwg

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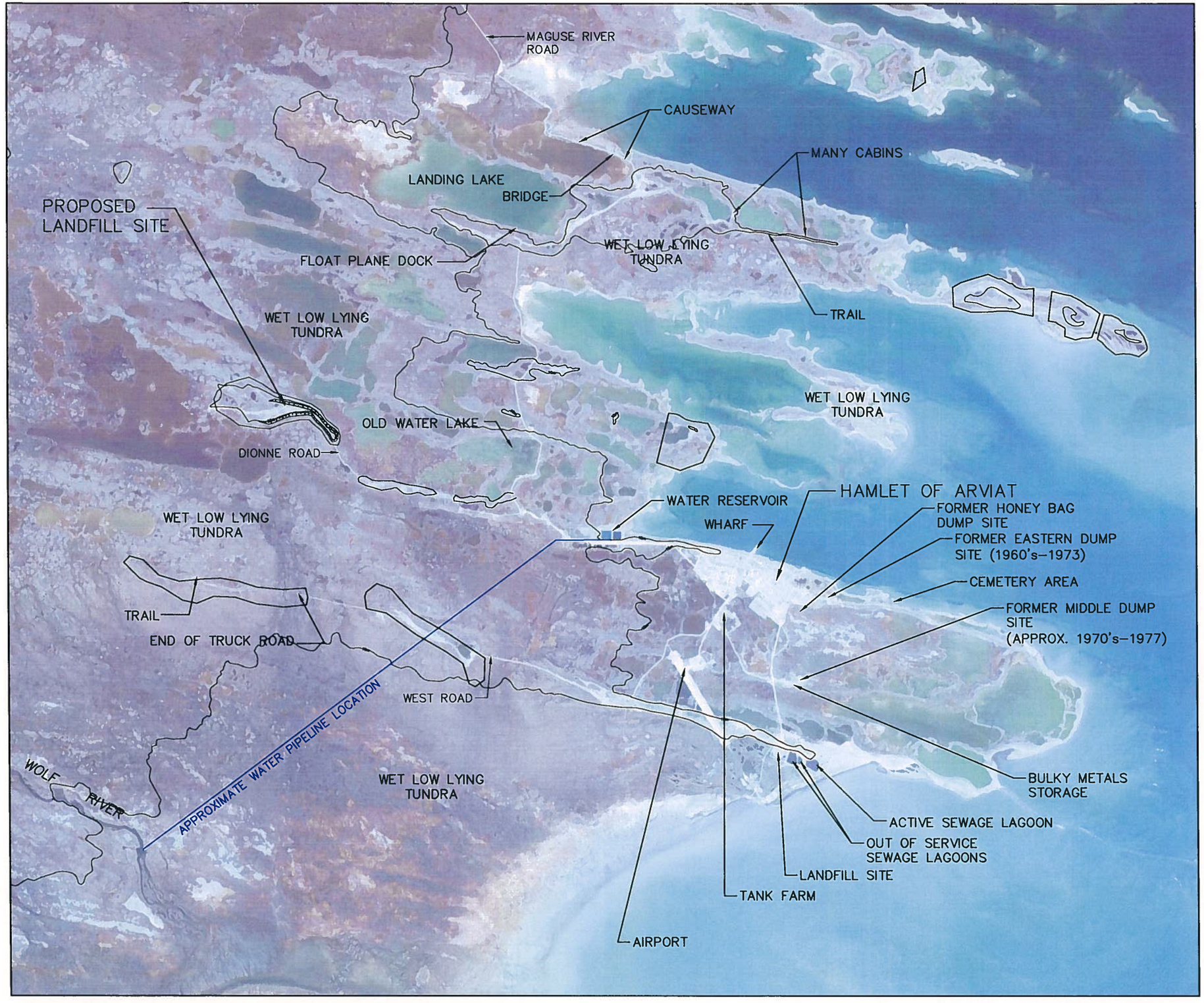

FIGURE 2

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
ANNUAL REPORT 2008

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.

N

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Kilometres

1:50,000
December 2008
Project Number: N-O15746

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

NUNA BURNSIDE

N-O15746 ANNUAL REPORT 2008 CP.dwg

Plot Time: Jun 08, 2009–11:39am

FIGURE 3

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
ANNUAL REPORT 2008

MONITORING LOCATIONS

LEGEND

● MONITORING LOCATIONS

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

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

N

0 200 400 600 800 1000 1200 1400 1600
Metres

1:20,000
December 2008
Project Number: N-O15746

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

N-O15746 ANNUAL REPORT 2008 ML.dwg

Plot Time: Jun 08, 2009 - 11:43am

BURNSIDE

Appendix A
Water Board Licence

P.O. Box 119
GJOA HAVEN, NU X0B 1J0
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.

P diPizzo

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 m^3, 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 m^3. 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 m^3.

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 m^3 *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 m^3 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:

Licence Number **NWB3ARV0308**

Water Management Area **NUNAVUT 06**

Location **ARVIAT, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **81,000 CUBIC METRES ANNUALLY**

Date of Licence **JANUARY 9, 2004**

Expiry Date of Licence **DECEMBER 31, 2008**

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:

Monitoring Station	Description
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.

BURNSIDE

Appendix B
Water Use Reports

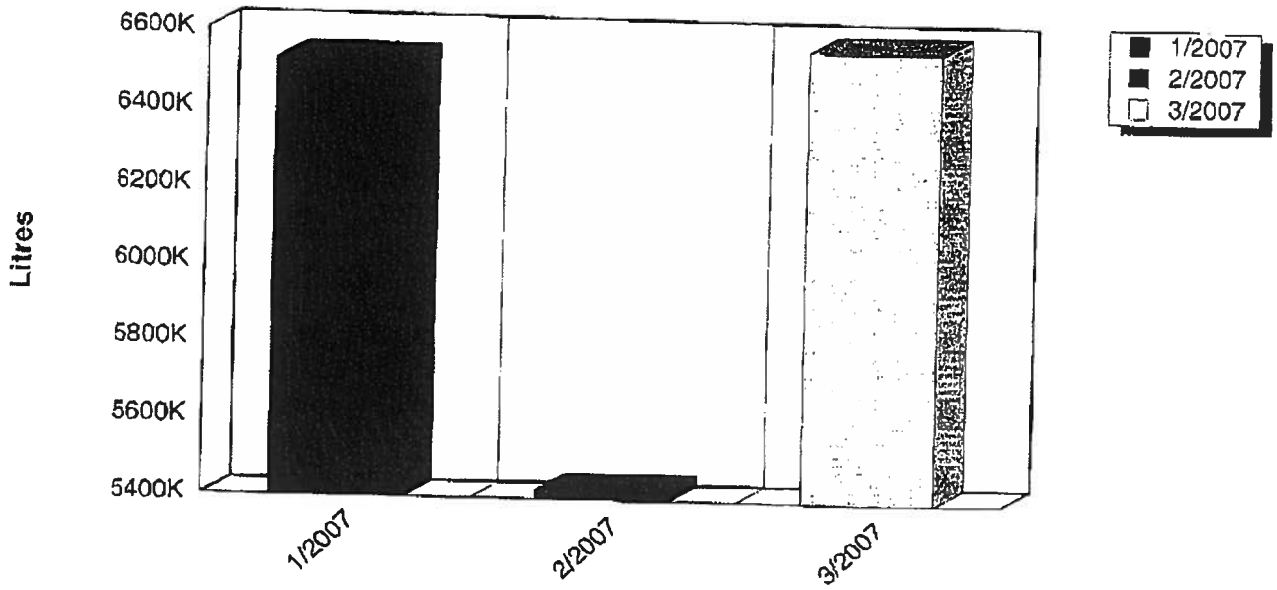
YTD Water Consumption

Hamlet of Arviat

For the Date Range: From: jan-01-2007 To: mar-31-2007

Page 1

Printed On: Dec 09 2008At: 10:59:36 AM



YTD Water Consumption - Details

Date	Quantity
January	6,524,528
February	5,425,463
March	6,568,468
Grand Total	**18,518,458.96**

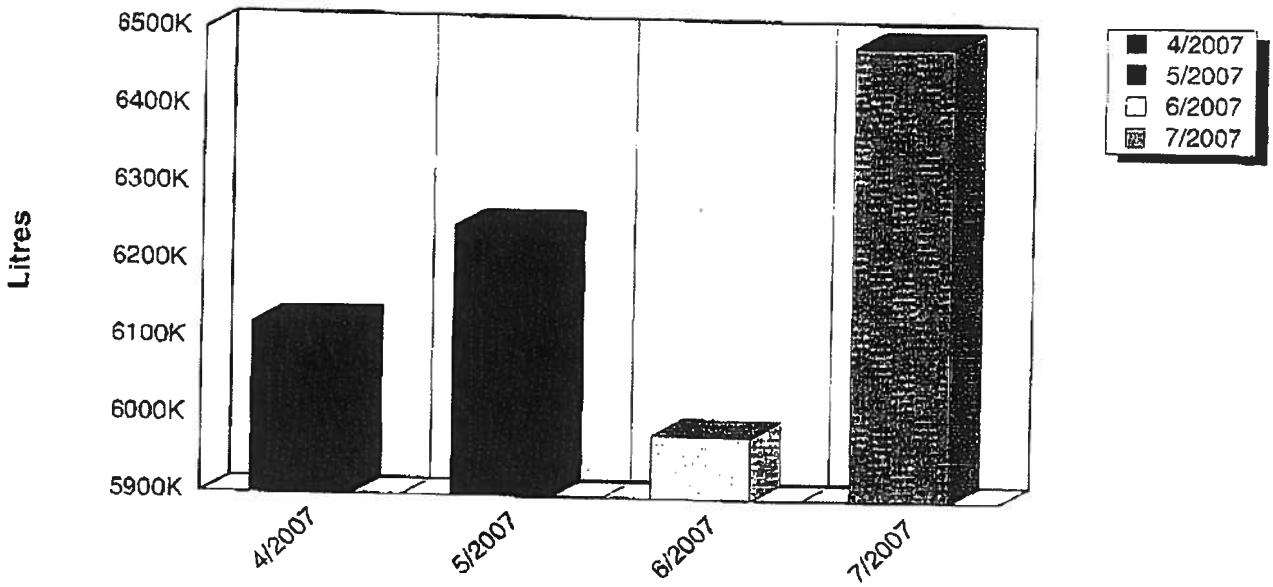
YTD Water Consumption

Hamlet of Arviat

For the Date Range: From: jan-01-2007 To: jul-31-2007

Page 2

Printed On: Dec 09 2008At: 10:58:48 AM



YTD Water Consumption - Details

Date	Quantity
April	6,121,260
May	6,250,079
June	5,982,130
July	6,489,847
Grand Total	**24,843,314.81**

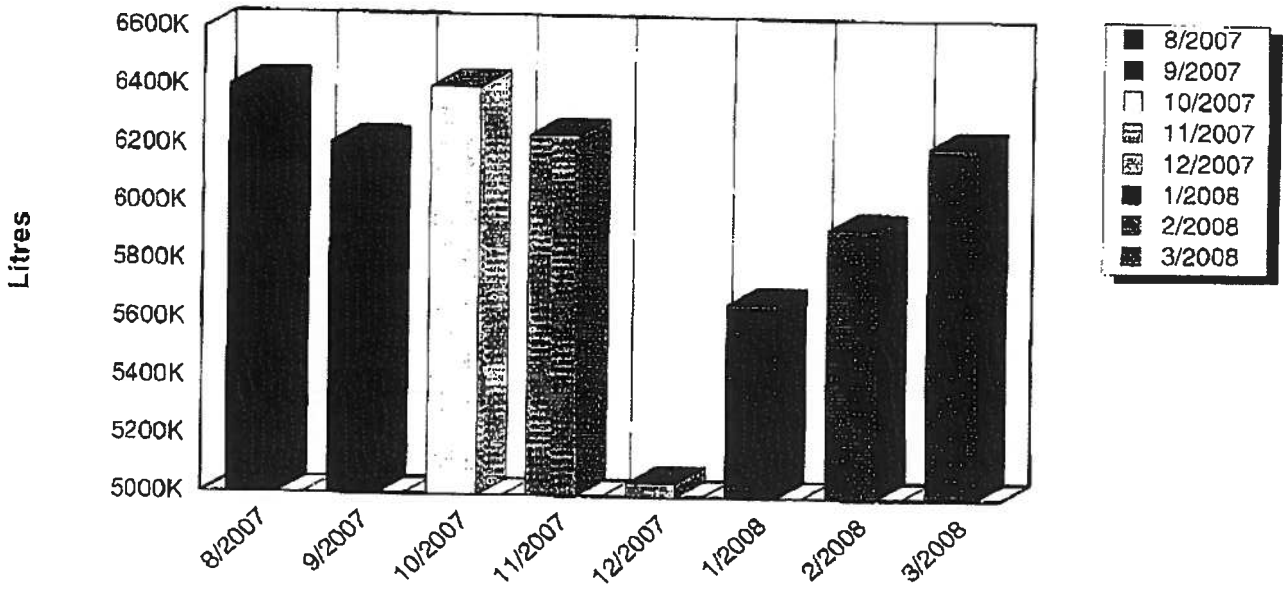
YTD Water Consumption

Hamlet of Arviat

Page 3

For the Date Range: From: aug-01-2007 To: mar-31-2008

Printed On: Dec 09 2008At: 10:56:15 AM



YTD Water Consumption - Details

Date	Quantity
August 2007	6,407,272
September	6,212,742
October	6,409,028
November	6,248,125
December 2007	5,046,857
January 2008	5,669,922
February	5,933,707
March	6,220,263
Grand Total	**48,147,916.86**

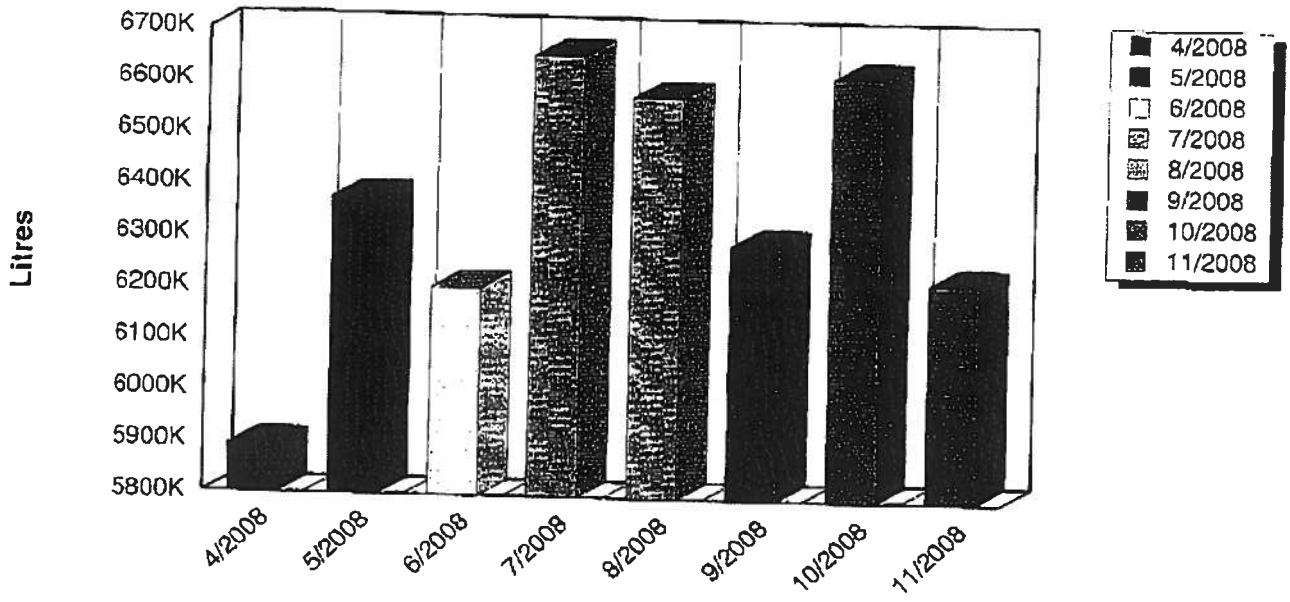
YTD Water Consumption

Hamlet of Arviat

Page 4

For the Date Range: From: Dec-01-2007 To: Nov-30-2008

Printed On: Dec 09 2008At: 10:54:48 AM



YTD Water Consumption - Details

Date	Quantity
April	5,893,376
May	6,376,550
June	6,203,530
July	6,657,807
August	6,579,507
September	6,294,093
October	6,623,360
November	6,224,003
Grand Total	**50,852,225.91**

BURNSIDE

Appendix C
Water Sample Results

Summary of Water Quality Samples, August 7, 2003

Parameter	Unit	Detection Limit	CCME Standards (Fresh water)	NWB Licence Requirements	ARV-1	ARV-2	ARV-3	ARV-Base
Colour	TCU	5			<5	120	200	10
Electrical Conductivity	µS/cm	0.3			58.8	3810	4650	75.4
pH	N/A	0.05		6-9	6.96	7.79	7.16	6.9
Turbidity	NTU	0.1			1.2	21.2	44.4	6.8
Alkalinity (as CaCO3)	mg/L							
Bicarbonate (as CaCO3)	mg/L							
Total Hardness (as CaCO3)	mg/L							
Ammonia as N	mg/L	0.005			<0.005	35.8	84.3	0.009
Calcium	mg/L	0.05			3.24	195	24.1	3.29
Chloride	mg/L	0.2			8.5	841	1070	14.0
Fluoride	mg/L							
Magnesium	mg/L	0.02			1.17	68.0	6.11	1.46
Nitrate and Nitrite as N	mg/L	0.008			<0.008	0.104	<0.008	0.008
Orthophosphate as P	mg/L							
Potassium	mg/L	0.03			0.62	54.5	48.5	0.79
Reactive Silica	mg/L							
Sodium	mg/L	0.02			3.88	459	604	6.2
Sulphate	mg/L	3			<3	298	117	<3
Total Dissolved Solids	mg/L	10			36		1330	40
Total Organic Carbon	mg/L							
Total Phosphorus	mg/L	0.002			0.011	4.03	21.9	0.017
Total Suspended Solids	mg/L	3		100	<3	32	**248**	8
$BOD_{(5)}$	mg/L			80				
Fecal Coliform	CFU/100ml			10000				
Aluminum	µg/L	30	100		44	<30	**217**	79
Arsenic	µg/L	1	5		<1	**7**	**9**	<1
Barium	µg/L				5.8	59.1	17.1	
Boron	µg/L							
Bromide	µg/L							
Cadmium	µg/L	0.1	0.017		**<0.1**	**0.2**	**0.2**	<0.1
Chromium	µg/L	0.3			<0.3	<0.3	1.0	<0.3
Cobalt	µg/L	0.1			<0.1	1.2	1.5	<0.1
Copper	µg/L	0.2	2.0-4.0[1]		2.9	**9.8**	**30.5**	3.1
Iron	µg/L	30	300		86	**812**	**4888**	247
Lead	µg/L	0.1	1.0-7.0[1]		0.1	0.9	1.5	1.1
Manganese	µg/L	0.1					318	23.0
Mercury	µg/L	0.01	0.026		<0.01	<0.01	<0.01	<0.01
Molybdenum	µg/L	0.01	73		<0.1	0.3	1.1	0.2
Nickel	µg/L	0.1	25-150[1]		0.2	10.0	9.2	2.0
Selenium	µg/L	1	1		<1	12	6	2.0
Silver	µg/L	0.1	0.1		<0.1	<0.1	0.2	<0.1
Strontium	µg/L	0.1			20.8	1350	310	21.1
Thallium	µg/L	0.1	0.8		<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.1			0.9	3.6	15.6	5.0
Uranium	µg/L	0.1			<0.1	0.6	0.4	<0.1
Vanadium	µg/L	0.1			0.1	0.1	6.9	<0.1
Zinc	µg/L	10	30		<10	**59**	21	<10
Phenols	µg/L	0.5					300	

BOLD - indicates exceedence of CCME standards

BOLD and shaded- indicates exceedence of NWB licence requirements

CCME - Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Updated 2007

[1] Value depends on water hardness, see CCME Guidelines

Scan 030812 3Bm-ARV0308 Final Cert of Analysis - ILAE file

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788
Fax: (867)-669-2718

- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR **Attn:** Scott Stewart

Sample ID: potable ARV-1 **Taiga Sample ID:** 232645

Client Project: **Sample Type:** potable water **Received Date:** 12-Aug-03

Location: Hamlet of Arviat **Sampling Date:** 07-Aug-03

Report Status: **Final** ***Approved by:*** H. Cuthbertson

Test Parameter	Result	Units	Detection Limit	Analysis Date
Physicals				
Colour	<5		5	27-Aug-03
Conductivity, Specific	58.8	µS/cm	0.3	17-Aug-03
pH	6.96	pH units	0.05	17-Aug-03
Solids, Total Dissolved	36	mg/L	10	20-Aug-03
Solids, Total Suspended	<3	mg/L	3	20-Aug-03
Turbidity	1.2	NTU	0.1	20-Aug-03
Nutrients				
Ammonia as N	<0.005	mg/L	0.005	25-Aug-03
Nitrate+Nitrite as N	<0.008	mg/L	0.008	21-Aug-03
Phosphorous, Total	0.011	mg/L	0.002	22-Aug-03
Major Ions				
Calcium	3.24	mg/L	0.05	19-Aug-03
Chloride	8.5	mg/L	0.2	19-Aug-03
Magnesium	1.17	mg/L	0.02	19-Aug-03

Report Date: Wednesday, October 29, 2003

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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR

Attn: Scott Stewart

Sample ID: potable ARV-1

Taiga Sample ID: 232645

Potassium	0.62	mg/L	0.03	20-Aug-03
Sodium	3.88	mg/L	0.02	20-Aug-03
Sulphate	<3	mg/L	3	20-Aug-03
Metals, Total				
Aluminum	44	µg/L	30	20-Sep-03
Antimony	0.6	µg/L	0.1	20-Sep-03
Arsenic	<1	µg/L	1	18-Aug-03
Barium	5.8	µg/L	0.1	20-Sep-03
Beryllium	<0.1	µg/L	0.1	20-Sep-03
Cadmium	<0.1	µg/L	0.1	20-Sep-03
Cesium	<0.1	µg/L	0.1	20-Sep-03
Chromium	<0.3	µg/L	0.3	20-Sep-03
Cobalt	<0.1	µg/L	0.1	20-Sep-03
Copper	2.9	µg/L	0.2	20-Sep-03
Iron	86	µg/L	30	18-Aug-03
Lead	0.1	µg/L	0.1	20-Sep-03
Lithium	0.5	µg/L	0.3	20-Sep-03
Manganese	12.8	µg/L	0.1	20-Sep-03
Mercury	<0.01	µg/L	0.01	25-Aug-03
Molybdenum	<0.1	µg/L	0.1	20-Sep-03
Nickel	0.2	µg/L	0.1	20-Sep-03

Report Date: Wednesday, October 29, 2003

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788
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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR

Attn: Scott Stewart

Sample ID: potable ARV-1

Taiga Sample ID: 232645

Rubidium	1.8	µg/L	0.1	20-Sep-03
Selenium	<1	µg/L	1	20-Sep-03
Silver	<0.1	µg/L	0.1	20-Sep-03
Strontium	20.8	µg/L	0.1	20-Sep-03
Thallium	<0.1	µg/L	0.1	20-Sep-03
Titanium	0.9	µg/L	0.1	20-Sep-03
Uranium	<0.1	µg/L	0.1	20-Sep-03
Vanadium	0.1	µg/L	0.1	20-Sep-03
Zinc	<10	µg/L	10	20-Sep-03

Report Date: Wednesday, October 29, 2003

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788
Fax: (867)-669-2718

- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR *Attn:* Scott Stewart

Sample ID: seep ARV-2 **Taiga Sample ID: 232649**

Client Project: **Sample Type:** sewage **Received Date:** 12-Aug-03

Location: Hamlet of Arviat **Sampling Date:** 07-Aug-03

Report Status: Final ***Approved by:*** Helene Huyer

Test Parameter	Result	Units	Detection Limit	Analysis Date
Physicals				
Colour	120		5	27-Aug-03
Conductivity, Specific	3810	µS/cm	0.3	19-Aug-03
pH	7.79	pH units	0.05	19-Aug-03
Solids, Total Suspended	32	mg/L	3	20-Aug-03
Turbidity	21.2	NTU	0.1	20-Aug-03
Nutrients				
Ammonia as N	35.8	mg/L	0.005	25-Aug-03
Nitrate+Nitrite as N	0.104	mg/L	0.008	21-Aug-03
Phosphorous, Total	4.03	mg/L	0.002	22-Aug-03
Major Ions				
Calcium	195	mg/L	0.05	19-Aug-03
Chloride	841	mg/L	0.2	19-Aug-03
Magnesium	68.0	mg/L	0.02	19-Aug-03
Potassium	54.5	mg/L	0.03	20-Aug-03

Report Date: Wednesday, December 10, 2003

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788
Fax: (867)-669-2718

- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR **Attn:** Scott Stewart

Sample ID: seep ARV-2 **Taiga Sample ID: 232649**

Sodium	459	mg/L	0.02	20-Aug-03
Sulphate	298	mg/L	3	20-Aug-03
Metals, Total				
Aluminum	<30	µg/L	30	20-Sep-03
Antimony	6.2	µg/L	0.1	20-Sep-03
Arsenic	7	µg/L	1	18-Aug-03
Barium	59.1	µg/L	0.1	20-Sep-03
Beryllium	<0.1	µg/L	0.1	20-Sep-03
Cadmium	0.2	µg/L	0.1	20-Sep-03
Cesium	<0.1	µg/L	0.1	20-Sep-03
Chromium	<0.3	µg/L	0.3	20-Sep-03
Cobalt	1.2	µg/L	0.1	20-Sep-03
Copper	9.8	µg/L	0.2	20-Sep-03
Iron	812	µg/L	30	25-Aug-03
Lead	0.9	µg/L	0.1	20-Sep-03
Lithium	21.5	µg/L	0.3	20-Sep-03
Manganese	858	µg/L	0.1	18-Nov-03
Mercury	<0.01	µg/L	0.01	25-Aug-03
Molybdenum	0.3	µg/L	0.1	20-Sep-03
Nickel	10.0	µg/L	0.1	20-Sep-03
Rubidium	278	µg/L	0.1	20-Sep-03

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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR

Attn: Scott Stewart

Sample ID: seep ARV-2

Taiga Sample ID: 232649

Selenium	12	µg/L	1	20-Sep-03
Silver	< 0.1	µg/L	0.1	20-Sep-03
Strontium	1350	µg/L	0.1	18-Nov-03
Thallium	< 0.1	µg/L	0.1	20-Sep-03
Titanium	3.6	µg/L	0.1	20-Sep-03
Uranium	0.6	µg/L	0.1	20-Sep-03
Vanadium	0.1	µg/L	0.1	20-Sep-03
Zinc	59	µg/L	10	20-Sep-03

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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR *Attn:* Scott Stewart

Sample ID: sewage ARV-3 **Taiga Sample ID:** 232650

Client Project: **Sample Type:** sewage **Received Date:** 12-Aug-03

Location: Hamlet of Arviat **Sampling Date:** 07-Aug-03

Report Status: Final ***Approved by:*** Helen Hayes

Test Parameter	Result	Units	Detection Limit	Analysis Date
Physicals				
Colour	200		5	27-Aug-03
Conductivity, Specific	4650	µS/cm	0.3	19-Aug-03
pH	7.16	pH units	0.05	19-Aug-03
Solids, Total Dissolved	1330	mg/L	10	20-Aug-03
Solids, Total Suspended	248	mg/L	3	20-Aug-03
Turbidity	44.4	NTU	0.1	20-Aug-03
Nutrients				
Ammonia as N	84.3	mg/L	0.005	25-Aug-03
Chemical Oxygen Demand	300	mg/L	1	26-Aug-03
Nitrate+Nitrite as N	< 0.008	mg/L	0.008	21-Aug-03
Phosphorous, Total	21.9	mg/L	0.002	22-Aug-03
Major Ions				
Calcium	24.1	mg/L	0.05	19-Aug-03
Chloride	1070	mg/L	0.2	19-Aug-03

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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR *Attn:* Scott Stewart

Sample ID: sewage ARV-3 **Taiga Sample ID: 232650**

Magnesium	6.11	mg/L	0.02	19-Aug-03
Potassium	48.5	mg/L	0.03	20-Aug-03
Sodium	604	mg/L	0.02	20-Aug-03
Sulphate	117	mg/L	3	20-Aug-03
Metals, Total				
Aluminum	217	µg/L	30	18-Nov-03
Antimony	1.8	µg/L	0.1	20-Sep-03
Arsenic	9	µg/L	1	18-Aug-03
Barium	17.1	µg/L	0.1	20-Sep-03
Beryllium	< 0.1	µg/L	0.1	20-Sep-03
Cadmium	0.2	µg/L	0.1	20-Sep-03
Cesium	< 0.1	µg/L	0.1	20-Sep-03
Chromium	1.0	µg/L	0.3	20-Sep-03
Cobalt	1.5	µg/L	0.1	20-Sep-03
Copper	30.5	µg/L	0.2	20-Sep-03
Iron	4888	µg/L	30	25-Aug-03
Lead	1.5	µg/L	0.1	20-Sep-03
Lithium	10.6	µg/L	0.3	20-Sep-03
Manganese	318	µg/L	0.1	18-Nov-03
Mercury	< 0.01	µg/L	0.01	25-Aug-03
Molybdenum	1.1	µg/L	0.1	20-Sep-03

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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR *Attn:* Scott Stewart

Sample ID: sewage ARV-3 **Taiga Sample ID: 232650**

Nickel	9.2	µg/L	0.1	20-Sep-03
Rubidium	39.6	µg/L	0.1	20-Sep-03
Selenium	6	µg/L	1	20-Sep-03
Silver	0.2	µg/L	0.1	20-Sep-03
Strontium	310	µg/L	0.1	18-Nov-03
Thallium	<0.1	µg/L	0.1	20-Sep-03
Titanium	15.6	µg/L	0.1	20-Sep-03
Uranium	0.4	µg/L	0.1	20-Sep-03
Vanadium	6.9	µg/L	0.1	20-Sep-03
Zinc	21	µg/L	10	20-Sep-03
Subcontracted Organics				
Phenols	300	µg/L	0.5	21-Aug-03

Report Date: Wednesday, December 10, 2003

Taiga Environmental Laboratory
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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR
Attn: Scott Stewart

Sample ID: Arviat Base
Taiga Sample ID: 232651

Client Project:
Sample Type: sewage
Received Date: 12-Aug-03

Location: Hamlet of Arviat
Sampling Date: 07-Aug-03

Report Status: Final
Approved by: Helen Haynes

Test Parameter	Result	Units	Detection Limit	Analysis Date
Physicals				
Colour	10		5	27-Aug-03
Conductivity, Specific	75.4	µS/cm	0.3	19-Aug-03
pH	6.90	pH units	0.05	19-Aug-03
Solids, Total Dissolved	40	mg/L	10	20-Aug-03
Solids, Total Suspended	8	mg/L	3	20-Aug-03
Turbidity	6.8	NTU	0.1	20-Aug-03
Nutrients				
Ammonia as N	0.009	mg/L	0.005	25-Aug-03
Nitrate+Nitrite as N	0.008	mg/L	0.008	21-Aug-03
Phosphorous, Total	0.017	mg/L	0.002	22-Aug-03
Major Ions				
Calcium	3.29	mg/L	0.05	19-Aug-03
Chloride	14.0	mg/L	0.2	19-Aug-03
Magnesium	1.46	mg/L	0.02	19-Aug-03

Report Date: Wednesday, October 29, 2003

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- CERTIFICATE OF ANALYSIS -

Prepared For: DIAND WR

Attn: Scott Stewart

Sample ID: Arviat Base

Taiga Sample ID: 232651

Potassium	0.79	mg/L	0.03	20-Aug-03
Sodium	6.20	mg/L	0.02	20-Aug-03
Sulphate	<3	mg/L	3	20-Aug-03
Metals, Total				
Aluminum	79	µg/L	30	20-Sep-03
Antimony	1.0	µg/L	0.1	20-Sep-03
Arsenic	<1	µg/L	1	18-Aug-03
Barium	4.6	µg/L	0.1	20-Sep-03
Beryllium	<0.1	µg/L	0.1	20-Sep-03
Cadmium	<0.1	µg/L	0.1	20-Sep-03
Cesium	<0.1	µg/L	0.1	20-Sep-03
Chromium	<0.3	µg/L	0.3	20-Sep-03
Cobalt	<0.1	µg/L	0.1	20-Sep-03
Copper	3.1	µg/L	0.2	20-Sep-03
Iron	247	µg/L	30	18-Aug-03
Lead	1.1	µg/L	0.1	20-Sep-03
Lithium	0.7	µg/L	0.3	20-Sep-03
Manganese	23.0	µg/L	0.1	20-Sep-03
Mercury	<0.01	µg/L	0.01	25-Aug-03
Molybdenum	0.2	µg/L	0.1	20-Sep-03
Nickel	2.0	µg/L	0.1	20-Sep-03

Report Date: Wednesday, October 29, 2003

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- CERTIFICATE OF ANALYSIS -

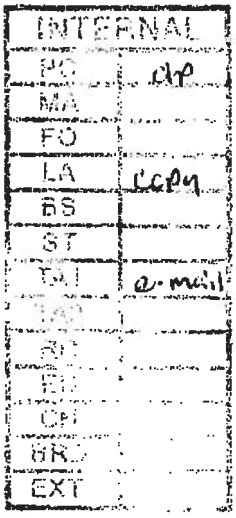
Prepared For: DIAND WR

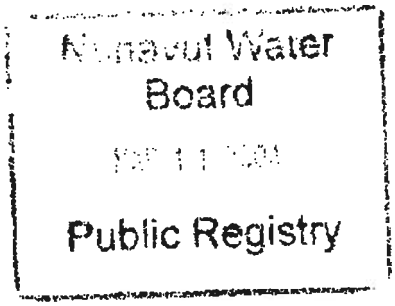
Attn: Scott Stewart

Sample ID: Arviat Base

Taiga Sample ID: 232651

Rubidium	2.1	µg/L	0.1	20-Sep-03
Selenium	2	µg/L	1	20-Sep-03
Silver	<0.1	µg/L	0.1	20-Sep-03
Strontium	21.1	µg/L	0.1	20-Sep-03
Thallium	<0.1	µg/L	0.1	20-Sep-03
Titanium	5.0	µg/L	0.1	20-Sep-03
Uranium	<0.1	µg/L	0.1	20-Sep-03
Vanadium	<0.1	µg/L	0.1	20-Sep-03
Zinc	<10	µg/L	10	20-Sep-03





BURNSIDE

Appendix D
CCME Water Quality Guidelines

Canadian Water Quality Guidelines for the Protection of Aquatic Life

SUMMARY TABLE

Update 7.0
September 2007

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

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

Continued.

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

Continued.

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

Continued.

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

Continued.

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

Continued.

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

Continued.

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

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

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

[c]Interim guideline.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Reference

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

Reference listing:

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

For further scientific information, contact:

Environment Canada
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Internet: http://www.ec.gc.ca/ceqg-rcqe

For additional copies, contact:

CCME Documents
Toll Free: (800) 805-3025
www.ccme.ca

Aussi disponible en français

Excerpt from Publication No. 1299; ISBN 1-896997-34-1

BURNSIDE

Appendix E
INAC Inspection Report

Indian and Northern Affairs Canada | Affaires Indiennes et du Nord Canada

WATER USE INSPECTION REPORT

Date: July 31st ,2008	**Licensee Rep.** (Name/Title): Dave Quksuk – Hamlet Foreman
Licensee: Hamlet of Arviat	**Licence No.:** NWB3ARV0308

WATER SUPPLY

Source(s): Wolf River Creek	**Quantity used: Unknown** – Records reviewed
Owner:/Operator: Government of Nunavut	Treatment systems operated by C&GS , GN

Indicate: **A** - Acceptable **U** - Unacceptable **NA** - Not Applicable **NI** - Not Inspected

Intake Facilities: A	**Storage Structure:** A	**Treatment Systems:** A	**Chemical Storage:** NI
Flow Meas. Device: U	**Conveyance Lines:** A	**Pumping Stations:** A	**Screen : NI**

Comments: The Government of Nunavut, Dept. of Community and Government Services provides the oversight and drinking water treatment services for the community. Records were on site. Pumping from Wolf Creek into local reservoir was on-going during the inspection.

WASTE DISPOSAL

Sewage: **Sewage Treatment System** (Prim./Sec/Ter.): **Primary cell and wetlands treatment**

Natural Water Body: No	**Continuous Discharge** (land or water): **seepages**	
Seasonal Discharge: Decanting	**Wetlands Treatment:** Y	**Trench:** None

Solid Waste: Non-combustible waste consolidated at waste metals area.

Owner/Operator: Hamlet of Arviat

Landfill: A- evidence of segregation	**Burn & Landfill:** A	**Other:**

Indicate: **A** - Acceptable **U** - Unacceptable **NA** - Not Applicable **NI** - Not Inspected

Discharge Quality: U	**Decant Structure:** NI	**Erosion:** A
Discharge Meas. Device: NA	**Dyke Inspection:** NA	**Seepages:** U
Dams, Dykes: NI	**Freeboard:** A	**Spills:** A
Construction: NI	**O&M Plan:** U	**A&R Plan:** U
Periods of Discharge: Cont.	**Effluent Discharge Rate:** Unknown	

Comments: Sewage from Lagoon seeps continually through the toe of the berm and then overland to the ocean.

FUEL STORAGE:

Waste Oil Storage: None noted **Owner/Operator:** Nunavut Power Corp.

Indicate: **A** - Acceptable **U** - Unacceptable **NA** - Not Applicable **NI** - Not Inspected

Berms & Liners: NI	**Water within Berms:** NI	**Evidence of Leaks:** NI
Drainage Pipes: NI	**Pump Station & Catchments Berm:** NI	
Pipeline Condition: NI	**Condition of Tanks: NI**	

SURVEILLANCE NETWORK PROGRAM (SNP)

Samples Collected: 0	**Owner /Operator:** No samples from Municipality have been submitted	
Samples Collected: 3	**INAC:** Potable (Reservoir), Effluent discharge, Dump Leachate	
Signs Posted	**SNP:** None	**Warning: Some signs were noted**
Records & Reporting: No records of water usage, waste discharge.		
Geotechnical Inspection: N/A		

Non-Compliance of Act or Licence: The Hamlet of Arviat's water license expires December 2008. The Community has not been collecting samples nor filing the required paperwork. The Municipality was advised to contact the Nunavut Water Board as soon as possible to avoid delays in the application process.

A.Keim
Inspector's Name

Sent by E-mail
Inspector's Signature

BURNSIDE

Appendix F
Site Photographs

Photo 1: Truck fill station

Photo 2: Water reservoir

Photo 3: Water pipeline to Wolfe River

Photo 4: Waste oil storage next to Hamlet garage

Photo 5: Looking south across fill area at front of landfill

Photo 6: Looking southeast across landfill towards ocean

Photo 7: Entrance to landfill


Photo 8: Looking southwest across sewage lagoon towards landfill site