Water Supply Facility
Operation and Maintenance (O&M) Plan
Hamlet of Rankin Inlet
Department of Community and Government Services, Government of Nunavut

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175 Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

December 2008
Revised April 2010

File No: N-O 14850

Executive Summary

Community and Government Services (CGS) of the Government of Nunavut (GN), provides water supply services for the Hamlet of Rankin Inlet.

Nunavut Water Board (NWB) license Number NWB3GRA0207 expired November 30, 2008 and a new water license application is in progress.

A Water Supply Facility Operation and Maintenance (O&M) Plan dated December 2008, was prepared by Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside), as required by the original license and in support of the application for a new license.

As noted in the December 2008 O&M Plan as per the NWB license, the Plan is to be reviewed and updated annually. This April 2010 update of the Plan also addresses comment provide by review agencies during the license renewal application process.

During the new license application review, various agencies provided comments and concerns regarding:

- The impact of water withdrawals from Nipissar Lake
- Sustainability of the Lake as a long term supply
- Compliance with the DFO end of pipe fish screen guidelines.

This O&M Plan includes the current studies and effects underway to address these issues.

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Hamlet of Rankin Inlet

December 2008
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1.0 Introduction

1.1 Hamlet Description

The Hamlet of Rankin Inlet is located on Rankin Inlet, on the west coast of Hudson Bay. It is 96-air km southwest of Chesterfield Inlet and 1088 air km east of Yellowknife, at 62º 49'N latitude and 92º 05' W longitude, as shown on Figure 1. The Hamlet has been growing substantially in the past 10 years. Economic activities now include government, commercial fishing, transportation/communications, carvings/handicrafts, trapping, hunting, and tourism. The community has a population of approximately 2,358 residents.

Community and Government Services (CGS) of the Government of Nunavut (GN), provides water supply and sewage disposal services for the Hamlet of Rankin Inlet.

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

- A water intake plant, which draws water from Nipissar Lake and provides treatment by chlorination
- A waste water treatment plant that provides primary treatment of sewage with use of a mechanical screen
- A current (old) solid waste disposal facility, which includes a bulky metals disposal area and a waste oil and liquid waste storage area
- A new solid waste management facility that has not been commissioned yet.

Key features of the community are shown on Figure 2.

1.2 Nunavut Water Board License

The Water Supply Facility currently operates under Nunavut Water Board License Number NWB3GRA0207 issued December 01, 2002 to the Government of Nunavut. The license expired November 30, 2008 (Appendix A). An application for a renewal/amendment of the licence was submitted in December 2008.

This O&M Plan includes items outlined in the requirements of the current license such as:

- Operation and Maintenance Plans
- Environmental Emergency Contingency Plan (Spill Contingency Plans) – separate document

- Monitoring Program and Quality Assurance/Quality Control Plan – separate document.

The O&M Plan is focussed on environmental impacts and compliance, which are the mandate of the NWB. It does not address the treatment and supply of drinking water for human consumption. It does not address human health and safety, these are the mandate of other agencies.

This O&M Plan should be updated annually, as required by the license and when the new NWB license is issued.

1.3 Climate

Rankin Inlet is affected by arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The Rankin Inlet area receives an average of 18.1 cm of rainfall and 107 cm of snowfall per annum. Mean annual precipitation totals 29.7 cm per annum. July mean high and low temperatures are 14.9^{o}C and 5.9^{o}C, respectively. January mean high and low temperatures are -28.3^{o}C and -35.5^{o}C, respectively. Winds are generally north-west, and average 23 km/h (Rankin Inlet Weather Station, Climate Normals 1991-2000, Environment Canada, 2008). A summary of climate conditions in Rankin Inlet is included in Appendix B.

1.4 Water Supply

The community of Rankin Inlet obtains its potable water from Nipissar Lake, located approximately two kilometres northwest of the community (Figure 2). Nipissar Lake covers an area of 1,090,565 m^2. Using an average depth of 4 metres the estimated volume is 4,362260 m^3. The total drainage area of Nipissar Lake is 323 hectares. Using an annual precipitation rate of 297.2 mm and an annual evapotranspiration rate of 200 mm, the total recharge to the lake is approximately 314 000 m^3 per year. Hydrology calculations are included in Appendix C.

1.5 Health and Safety

Health and safety of workers and the public is the first priority while operating the Water Supply Facility. The requirements of the Nunavut Safety Act must be followed at all times. All actions and operations must be undertaken with safety as the first priority.

It should be noted, that this document was prepared to meet the requirements of the NWB and is not to be considered a Health and Safety Plan.

1.6 Training

Staff training is an important aspect of the operation of a Water Supply Facility. Staff must be adequately trained to follow this O&M Plan and operate the facility. This O&M Plan is dependent on sufficient site specific training to ensure staff are appropriately trained to operate the facility.

1.7 Waste Disposal

The facility does not generate wastes other than small amounts of municipal type wastes, that are collected and disposed of through an agreement with the Hamlet of Rankin Inlet.

2.0 Operation and Maintenance of the Water Supply Facility

2.1 Overview

The community draws its water from the Nipissar Lake, located 2 km northwest of the Hamlet. The Water Supply Facility consists of a pump house and water intake located on the south-east side of the lake. A fuel storage tank is located in a fenced off area on the north side of the pumphouse. Photographs of the facility taken by Nuna Burnside in September 2008 are included in Appendix D.

2.2 Water Supply Facility Design

The Nipissar Lake pump house contains vertical turbine submersible pumps installed inside the twin intake lines. Each of the 10 Hp pumps has a 1020 L/min. capacity. Only one pump operates at a time. Operation of the pump is controlled by the water level in the water storage tank adjacent to the Williamson Lake pump house. An air compressor aerates water around the intake to prevent taste and odour problems.

2.3 Water Intake System Operational Procedures

The following operational procedures shall be carried out by the Government of Nunavut on behalf Hamlet of Rankin Inlet:

- Monitoring and inspections will occur as outlined in the NWB license and described in this O&M Plan

- In the event of an accident, a spill of petroleum products or a fire during water distribution operations, *the Hamlet of Rankin Inlet Environmental Emergency Contingency Plan* (separate document) shall be implemented

- No motorized vehicles should be operated in the lake or on the ice of the lake due to risk of fuel spills

- If the lake is used for fishing, no motorized augers shall be used and there should be no materials that could contaminate the water brought onto the ice of the lake.

2.4 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the staff of the Government of Nunavut on behalf of Hamlet of Rankin Inlet during periodic and seasonal maintenance operations at the Water Supply Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and surface grading in the summer, with any defects repaired as necessary

- Site warning signage, which identifies the boundaries of the Water Supply Facility shall be inspected weekly, and repaired or replaced as necessary

- The berms at the Water Supply Facility reservoir shall be inspected during the summer for erosion and settlement weekly, and repaired as necessary

- Any airborne litter shall be removed from the area of the pump house and taken to the Hamlet landfill in the spring and fall, or as required.

Forms to assist site staff in conducting the inspections and data recording are included in Appendix E.

The activities described above shall be completed by the staff of the Government of Nunavut on behalf of the Hamlet and details of any repairs shall be reported in the Annual Report submitted to the Nunavut Water Board, in compliance with the Water License.

2.5 Water Intake System Monitoring Program

All water sampling completed by the Government of Nunavut on behalf of the Hamlet of Rankin Inlet shall be in accordance with the *Hamlet of Rankin Inlet Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan* (separate document).

The sampling program is focussed on meeting the requirements of the Water License, which is environmental protection not water quality for drinking.

Daily monitoring of residual chlorine levels shall be undertaken, to facilitate and confirm the maintenance of free chlorine residual in treated water in accordance with the *Public Health Act* (1992) and associated *Regulations*. Drinking water quality control is not the mandate of the NWB. Refer to other documents and agencies with jurisdiction for operational procedures and requirements regarding drinking water quality.

2.5.1 Water License Requirements

As outlined in the NWB water license, regular monitoring of the quantities of water obtained from the natural environment and processed through the Water Treatment Facility is required.

As part of the General Conditions, the licence requires that monthly and annual quantities in cubic metres of fresh water obtained be recorded and reported in the Annual Reports. It also requires that metres, recorders, or other such methods to record the volume of water used be installed, operated and maintained by the Licensee. The Licensee must maintain the Water Supply Facilities to the satisfaction of the Inspector.

A Surveillance Station will be established at the intake of the raw water supply before treatment (GRA-1). Monthly and annual quantities of raw water pumped will be measured and recorded in the official operations logbook on a form similar to that presented in Appendix E.

3.0 Operation and Maintenance of Water Storage and Distribution System (Utilidor)

3.1 Water Storage Design

The Hamlet has a storage tank that is used to provide water during emergencies such as fires. The tank has a useable storage capacity of 3,364,000 L and can provide water for up to two days. In case of an emergency lasting longer than two days, Williamson Lake can be accessed by means of a portable pump, flexible hose, and ice auger.

Water Storage Tank Data	
Height	12.8 m
Diameter	18.3 m
Useable Storage	
2 hour fire demand	545,000 L
2 day emergency storage	2,030,000 L
Peak balance	473,000 L
Total	3,364,000 L

3.2 Water Distribution System

3.2.1 Overview

There are two systems of water distribution in Rankin Inlet. Approximately 99% of the population receives piped water while the remainder is on trucked service. The Hamlet of Rankin Inlet delivers water to the community utilizing an 8172 L capacity water truck. The truck is filled from the truck fill arm, located on the northwest side of the Williamson Lake pump house and delivers three to five days per week. All water deliveries are metered.

3.2.2 Water Distribution System Design

Water from the Nipissar Lake pump house is pumped to the community through a shallow buried insulated main, which operates year-round.

Piping System Data	
Length	2000 m
Supply Line	200 mm diameter insulated HDPE
Return Line	150 mm diameter insulated HDPE
Access Vaults	7 vaults, each 1600 mm diam HDPE. Inside the vaults, each line is fitted with a butterfly valve and two 75 mm diam thaw ports.

The lines slope continuously upward from Nipissar Lake to Williamson Lake; there are no intermediate drain points.

The supply line passes through the Williamson Lake pumphouse where most of the water is chlorinated in the bottom of the water storage tank adjacent to the pumphouse. A small portion of the water is heated in the Nipissar Lake heat exchanger in the Williamson Lake pumphouse and then pumped back through the return line. Most of the heated water arriving in the Nipissar Lake pumphouse is injected back in to the supply line. Some of the heated water is bled into the Nipissar Lake intake casings to prevent freezing of the intake lines.

The Williamson Lake pumphouse is located on the north berm of the Williamson Lake, in the centre of the community. The pumphouse contains two wet-wells; four distribution pumps, two hot water boilers, three heat exchangers (one for the Nipissar Lake supply line, one for the Hamlet and one spare), chlorination equipment, a diesel standby generator, valves, alarms, and controls.

Water flows by gravity from the water storage tank through a valve into the two wet-wells; the valve is regulated by the water level in the wet-wells. The four 22.4 kW distribution pumps, each rated at 25 L/s, pump water from the wet-wells into the distribution system through a common header. The pump system is sized for maximum daily demand and the fire flow needs. One pump operates continuously, circulating heated water through the distribution loops with a portion returning to the pump house. As demand in the distribution system increases, additional pumps activate according to pressure drop in the system.

The heat for the distribution water is produced by two fuel oil fired boilers. The heated water circulates through the Hamlet heat exchanger, which in turn heats water for injection into the distribution header. Modulating valves, located on each loop where the loop returns to the pumphouse, control water temperatures in the loops by varying their flow rates. If a loop's return temperature falls below a set point, the modulating valve for that loop opens to increase the return flow rate. If the temperature rises above the set point, the valve closes to reduce the loop's return flow rate.

The boilers also provide heat for the building heating system through the Hamlet heat exchanger and for the Nipissar Lake supply line through the Nipissar heat exchanger.

The piped water distribution system consists of shallow-buried and insulated mains, usually installed in the same trenches as the sewer mains to save installation costs. Since the mains both originate and terminate at the Williamson Lake pumphouse, they are known as loops. As part of the freeze protection system, the water is constantly circulating in the loops. Water not consumed is returned to the wet-wells at the pumphouse.

Access vaults are placed throughout the distribution system at about 100 m intervals, or at bends or intersections. Vault type depends on the year of construction. Vaults constructed prior to 1976 are insulated corrugated metal pipe. Vaults constructed from 1977 to 1979 are rectangular concrete structures. Vaults from 1979 onward are prefabricated insulated double-walled steel structures.

In current designs, the water main passing through the vault is constructed of steel and is typically fitted with a butterfly valve, two 50 mm thaw access ports and two 25 mm drain ports. Many vaults are fitted with electrical outlets but the present design is limited to an access conduit to allow electrical cables and hoses into the vault without keeping the hatch open. The vaults also house cleanouts on the sewer mains to allow access to the sanitary sewer system in the event of a frozen or plugged sewer line.

Water service connections to single-family residential buildings consist of un-insulated 25 mm HDPE supply and return lines taped together, wrapped in a self-limiting heat tape and inserted into a 100 mm diameter insulated HDPE carrier pipe. Water flows from the main through the supply line to circulation pump and flow switch, located inside the building. Water required for consumption then flows through a water meter into the building's water fixtures. Water required for consumption flows into the return line and then back into the main.

By maintaining a constant flow, the circulation pump keeps the water in the service lines from freezing. The heat trace cable, controlled by the floor switch on the supply line, keeps the water from freezing when flow is reduced or stops due to circulation pump failure or other causes. This dual-line circulating system has been found to be the most economical and reliable method of providing water service to the buildings.

Installed service connections are valve at the main and can be shut off by means of valve extensions that expend to above ground level. Older service connections cannot be shut off from above the ground. For multi-family residential, commercial or industrial buildings, the water service connections are individually designated but use basically the same system as described above.

3.2.3 Water Storage and Distribution System Operational Procedures

The following operational procedures shall be carried out by the Government of Nunavut on behalf of the Hamlet of Rankin Inlet:

- Monthly water usage volumes obtained from the Hamlet Water Storage and Treatment Facility shall be recorded on the recording form attached in Appendix E

- Monitoring and inspections will occur as outlined in the NWB license and described in this O&M Plan

- Sampling will be conducted as per the Environmental Monitoring Program and Quality Assurance/Quality Control Plan, Hamlet of Rankin Inlet (separate document).

3.3 Periodic and Seasonal Maintenance Procedures

- Facility generators and associated fuel storage shall be monitored daily

- Chlorine residuals shall be monitored daily, or as directed by a Public Health Inspector (as defined by the Public Health Act (1992), not part of the NWB mandate

- The chlorine feed system shall be inspected daily (to prevent spills and environmental impacts).

4.0 Emergency Response and Contingencies

In the event of an emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1: Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Rankin Inlet – SAO	Rankin Inlet	(867) 645-2895	(867) 645-2146
Government of Nunavut (Regional Engineer)	Rankin Inlet	(867) 645-8159	(867) 645-8196
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Rankin Inlet	(867) 645-2525	-
RCMP Detachment	Rankin Inlet	(867) 645-1111	(867) 645-2568
Community Health Center	Rankin Inlet	(867) 645-8300	(867) 645-8324

Contingency plans are designed to provide site staff with direction and options when there is an unexpected event or accident.

The Environmental Emergency Contingency Plan, Hamlet of Rankin Inlet (prepared as a separate document) provides procedures and direction in the case of a spill or accident.

As outlined in the Contingency Plan, the health and safety of workers and the public are the first priority.

5.0 Reporting

The Nunavut Water Board License on Part B: General Conditions include the requirement to file an Annual Report with the NWB no later than March 31st of the next calendar year. The report shall include:

- Tabular summaries of all data generated under the "Monitoring Program"
- The monthly and annual quantities in cubic metres of freshwater obtained from all sources
- The monthly and annual quantities in cubic metres of each and all waste discharged
- A summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures
- A list of unauthorized discharges and summary of follow-up action taken
- A summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year
- A summary of any studies, reports and plans (i.e. 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
- Any other details on water use or waste disposal requested by the Board by November 1st of the reporting year.

The format of the NWB Annual Report is included in Appendix F.

The creation of the report can be greatly simplified by staff regularly filling in and filing the Site Forms included in Appendix E. The forms include:

- Form 1 – Annual Water Intake Log – a monthly record of flow measurements
- Form 2 – Monthly Water Supply Facility Inspection Form – a monthly record of conditions and issues at the water supply facility
- Form 3 – Water Supply Facility Planning Form – which provides a list of items to be discussed by the site foreman, Hamlet, and GN Project Manager related to short term and long term water supply and treatment decision making.

In addition to these forms, there would be sampling information and analytical data collected. The Monitoring Plan and QA/QC Plan (prepared as a separate document) outlines sample collection and analytical data handling protocols. Using the forms and following the procedures provided herein should make submitting the annual monitoring report relatively straight forward.

6.0 Summary

6.1 Overview

This Operation and Maintenance Plan (O&M) has been prepared for the Hamlet of Rankin Inlet Water Supply Facility. The facility is operated by the Government of Nunavut on behalf of the Hamlet.

Appropriate training for site staff is necessary as part of the implementation of this O&M Plan. This document should be reviewed and updated annually, and whenever the NWB Water License is amended or new relevant legislation is issued.

Nipissar Lake drainage basin should be recognized in community land use plans and zoning. The drainage basin should be classified as a sensitive area where land uses must be restricted to prevent impacts to the lake water supply.

This O&M Plan pertains to those aspects of operating the water supply facility within the NWB mandate for environmental protection. This O&M Plan does not address issues of water quality for human consumption, which is the mandate of other agencies.

6.2 Outstanding Issues

6.2.1 DFO Issues

Comments from Fisheries and Oceans Canada (DFO), regarding the impacts of water withdrawals from Nipissar Lake, were addressed in a letter dated March 25, 2010 and included in Appendix G.

6.2.2 Water Usage and Nipissar Lake Drawdown

As outlined in the license application there are some discrepancies in the volumes reported related to water usage and distribution. There is also significant evidence to indicate Nipissar Lake is not large enough to be a sustainable water supply as the Hamlet grows. To address these issues in August 2009 the GN issued a Request for Proposal (RFP) for a Water Supply Capacity, Consumption and Conservation Study. The Scope of Work included:

a. Is Nipissar Lake an adequate source of water for the community of Rankin Inlet, currently, and in the future?
b. When will Nipissar Lake fail to be adequate?
c. What is the water usage on a per capita basis, in Rankin Inlet?
d. Why is the water usage, per capita, what is it?
   - How much water is lost through bleeders?
   - How much water is lost through distribution system leaks?

e. How can the GN/Municipality of Rankin Inlet undertake to reduce the amount of water usage?
   - How does currently metering and billing practises affect water use?
   - How can the number of bleeders be reduced?
   - How can system leaks be managed?

The Scope outlined the following methodology:

1. Assess

- The capacity of the water supply servicing the Hamlet of Rankin Inlet
  - Complete a survey of the existing shore line of Nipissar Lake
  - Determine Nipissar Lake volume loss compared to Bathymetry and Topographical Survey that was completed in 1995
  - An assessment of climate variables affecting the Nipissar Lake watershed capacity
  - A review of historical precipitation and evapo-transpiration rates to establish if the current volume reduction of Nipissar Lake is a result of climatic variables or municipal consumption/wastage

- The consumption of water in Rankin Inlet, taking into consideration the specific demographic dynamic of the community and the unique climate in which Rankin Inlet is situated
  - Compile existing pumphouse metering data and general consumption data, and graphically present trends
  - Identify abnormalities in residential and commercial meter readings
  - Review historical and current consumption data to determine if Nipissar Lake is an adequate water source for the community
  - Current and future development being undertaken in Rankin Inlet and its anticipated effect on consumption

- Recommend means by which water can be conserved.

2. Report

The final deliverable for the assessment criteria in 1, above, shall be a report (submitted at 50% and 100% complete) which outlines the findings of the assessments undertaken by the consultant. Proponents shall give a detailed proposal on the scope of their report as it relates to their proposed methodology in item 1, above.

3. Leak Detection Equipment Report and Training

The Department of Community and Government Services has an interest in purchasing leak detection equipment and training Operations and Maintenance (O&M) Staff in its use. Services of a consultant are required to:

- Review the water distribution system in Rankin Inlet and prepare a report outlining the type of equipment available and recommending suitable equipment for purchase
- Develop specifications (for use in tendering) for supply of equipment presented in report (after approval by GN).

This project was awarded to FSC Architects and Engineers and is in progress.

Until this work is complete the need for a new or supplemental water supply and related engineering cannot be determined.

It has been suggested that the licence be issued with the following conditions:

- By December 31, 2010, provide an assessment of the water supply capacity of Nipissar Lake and a detailed assessment of Hamlet water supply requirements for the future. Outline a detailed plan for the required engineering and development of a new or supplemental water supply. Following the necessary agency consultation and approvals, conduct the necessary engineering improvements by December 31, 2011.

7.0 References

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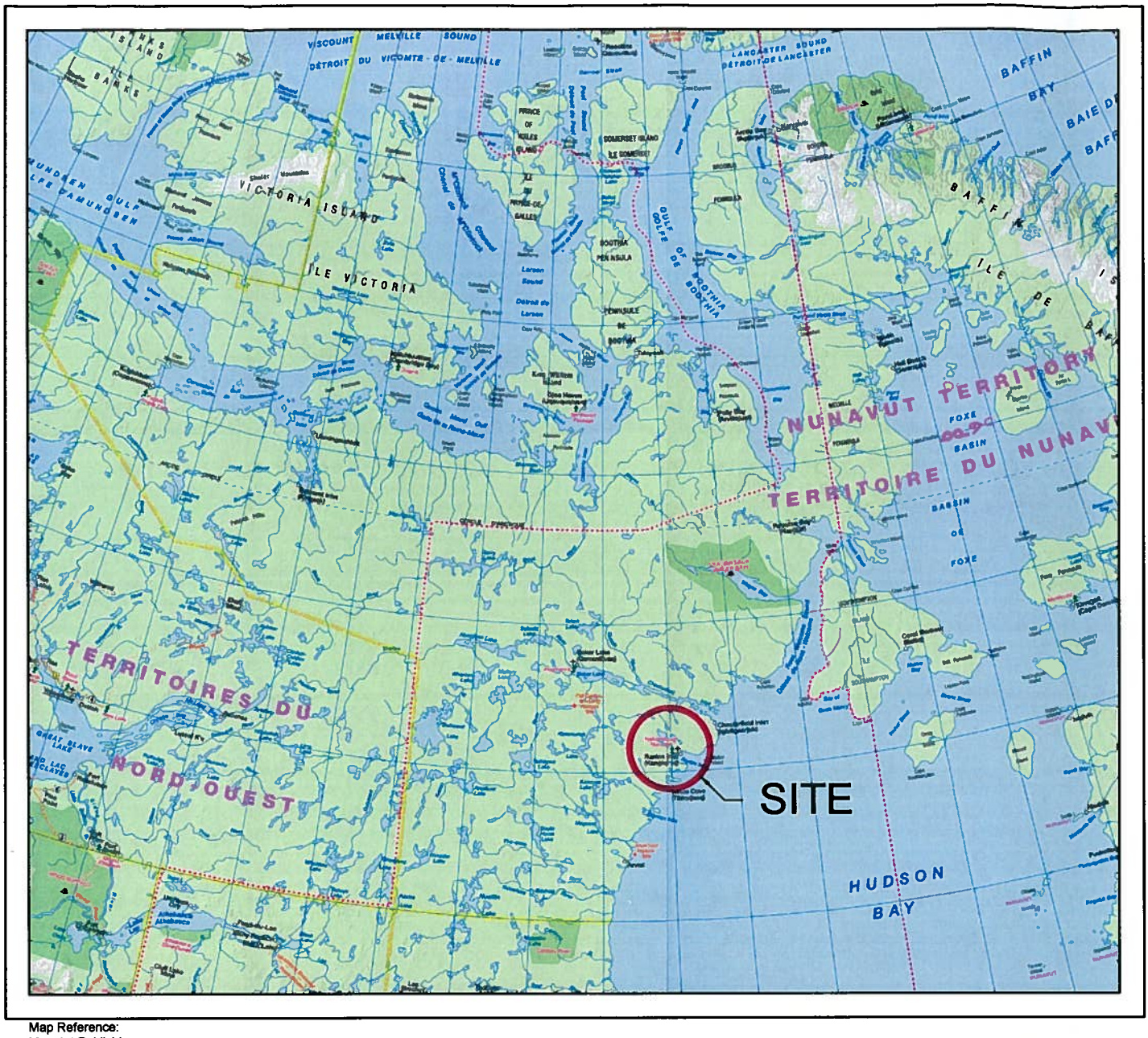
Figures



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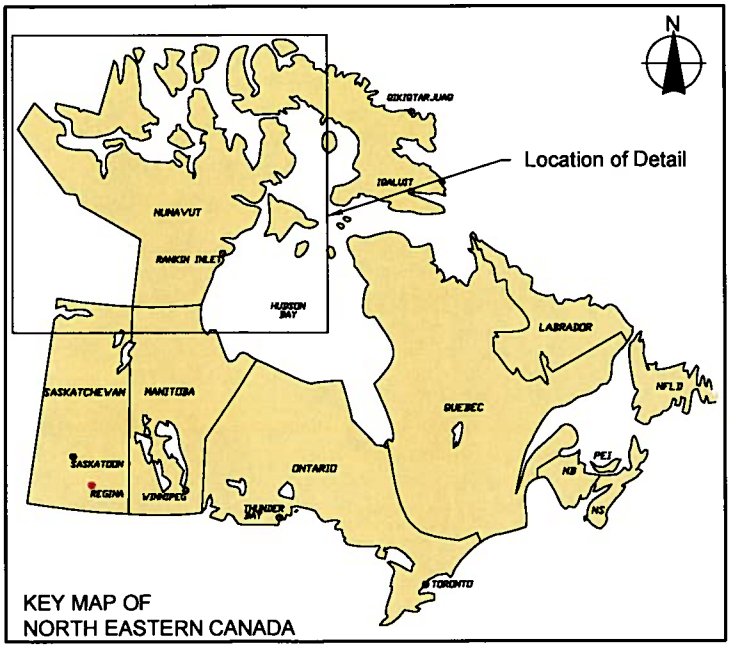

KEY MAP OF
NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT

WATER SUPPLY FACILITY
OPERATION & MAINTENANCE PLAN

December 2008
Project Number: N-O14850

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

N-O14850 WATER SUPPLY O&M PLAN - GOVERNMENT SL.dwg

Plot Time: Mar 05, 2009 - 11:56am

FIGURE 2

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT
WATER SUPPLY FACILITY O&M PLAN

COMMUNITY PLAN

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

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

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

Projection: UTM Zone 15
Datum: NAD83

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

BURNSIDE

N-O14850 WATER SUPPLY O&M PLAN - GOVERNMENT CP.dwg

Plot Time: Mar 05, 2009 - 11:38am

FIGURE 3

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT
WATER SUPPLY FACILITY O&M PLAN

WATER SUPPLY FACILITY

LEGEND

- - - - INTERPRETED NIPISSAR LAKE DRAINAGE AREA OUTLINE

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

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Kilometres

1:12,500
December 2008
Project Number: N-O14850

Projection: UTM Zone 15
Datum: NAD83

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

BURNSIDE

N-O14850 WATER SUPPLY O&M PLAN - GOVERNMENT WSF.dwg

Plot Time: Mar 05, 2009 - 12:01pm

BURNSIDE

Appendix A

Nunavut Water Licence NWB3GRA0207

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: NWB3GRA0207

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence originally filed by the Hamlet of Rankin Inlet on 20 November 2002:

Department of Public Works & Services, Government of Nunavut

to allow for the use of water and disposal of waste in the Hamlet at Rankin Inlet, 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, which had originally been filed by the Hamlet of Rankin Inlet on November 20, 2002, 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 go through the regulatory process.

Based on the review of the comments and concerns , it was noted that the issue of the operation of Water Treatment and Sewage Treatment Facilities in Rankin Inlet by the Department of Public Works and Services (Government of Nunavut) prevented the issuance of water licence to the Hamlet of Rankin Inlet for the operation of these Facilities. It was determined that the most appropriate action was to issue a water licence to the Hamlet of Rankin Inlet for the operation of the Solid Waste Disposal Facility, while the Department of Public Works and Services would be licensed for the operation of the Water Treatment and Sewage Treatment Facilities, on behalf of the Government of Nunavut.

Applications reflective of this division of activities were received from both the Hamlet of Rankin Inlet and the Department of Public Works and Services. Notice of these applications was posted with local organizations in Rankin Inlet. As the technical information previously reviewed remained unchanged, the Nunavut Water Board accepted written concerns and comments on these applications until December 6, 2002.

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 NWB3GRA0207 be issued subject to the terms and conditions contained therein. (Motion #: 2002-22)

SIGNED this 1st day of December, 2002 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

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I. INTRODUCTION

Following an application filed by Ferguson Simek Clark on behalf of the Hamlet of Rankin Inlet on 6 June 2002 to the Nunavut Water Board, the Board conducted an initial assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet. The assessment was conducted so that the Nunavut Water Board could make a fully informed decision on the application. The application was referred for review and comments to Federal, Territorial and local organizations. Based upon the results of this initial assessment and the technical review, including consideration of any potential accidents, malfunctions, or cumulative environmental effects that the overall project might have in the area, the Board concluded that this application was complete and could go through the regulatory process.

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 55.1 and Article 13 of the *Nunavut Land Claims Agreement*, public notice of the application was posted. No public concerns were expressed, and the NWB waived the requirement to hold a public hearing for the application. Authority to approve the application was delegated to the Chief Administrative Officer pursuant to S. 13.7.5 of the *Agreement*. After considering and reviewing the comments submitted by interested parties, the NWB has issued licence NWB3GRA0207.

II. GENERAL CONSIDERATIONS

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. The NWB believes that a term of five years is appropriate. Because this is the first licence issued to the Department by the Nunavut Water Board for operations in Rankin Inlet, a 5-year licence will allow enough time for the Department to establish a consistent compliance record. The 5-year licence will allow the Licensee to properly carry out the terms and conditions of the licence and to ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under the licence to the satisfaction of the NWB.

Annual Report

The requirements imposed on the Licensee in this licence 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. Refer to attached standard form for completing Annual Report (see Attachment I).

Regulated Parameters

Effluent quality criteria imposed in this Licence are consistent with the *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories* (Northwest Territories Water Board; 1992), and follow advice received from both the Department of Indian and Northern Affairs and Environment Canada.

Operation and Maintenance Manual (O&M)

The purpose of an Operation and Maintenance Manual is to assist Department staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Department 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).

Abandonment and Restoration (A&R)

To ensure that all future abandoned facilities are reclaimed in an appropriate manner, the NWB has imposed the requirement for the submission of Abandonment and Restoration Plans. These plans should be submitted when the Licensee files preliminary design drawings for the construction of new facilities to replace existing ones.

Monitoring Program

The Monitoring Program is a program 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. As this is the first Municipal Water Licence issued to the Department by the Board, minimum requirements have been imposed, but additional sampling may be required by an Inspector.

Quality Assurance/Quality Control (QA/QC) Plan

The requirements to develop a QA/QC Plan imposed on the Licensee in this licence are for the purpose of ensuring the NWB 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.

LICENCE NWB3GRA0207

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

DEPARTMENT OF PUBLIC WORKS & SERVICES, GOVERNMENT OF NUNAVUT
(Licensee)

of **RANKIN INLET, NUNAVUT, X0A 0S0**
(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 **NWB3GRA0207**

Water Management Area **NUNAVUT 05**

Location **RANKIN INLET, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **400,000 CUBIC METRES ANNUALLY**

Date of Licence **DECEMBER 1, 2002**

Expiry Date of Licence **NOVEMBER 30, 2007**

Dated this 1st of December 2002 at Gjoa Haven, NU.

Original signed by:

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 by the Department of Public Works and Services, Government of Nunavut for municipal undertakings at the Hamlet of Rankin Inlet, Nunavut (64°49'N, 92°05'W);

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

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

2. Definitions

In this Licence: **NWB3GRA0207**

"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 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 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;

"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;

"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;

"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 program established to collect data on surface water and groundwater quality to assess impacts to the 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 Treatment Facility" comprises the area and engineered lagoon and decant structures designed to contain sewage as described in the Application for Water Licence;

"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;

"Water Supply Facility" means the area and associated intake infrastructure at Nipissar Lake, as described in the Application for Water Licence.

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 each and all waste discharged;

   iii. a summary of modifications and/or major maintenance work carried out on the Solid Waste Disposal Facility, including all associated structures and facilities;

   iv. a list of unauthorized discharges and summary of follow-up action taken

   v. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

   vi. 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; and

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

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

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

4. Meters, devices or other such methods used for measuring the volumes of 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 Solid Waste Disposal Facility.

7. The Licensee shall ensure a copy of this Licence is maintained at the municipal office and at the site of operation at all times. 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

8. 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 Nipissar Lake 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 400,000 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 Treatment Facility or as otherwise approved by the Board.

2. All Effluent discharged from the Sewage Treatment Facility at "Monitoring Program" Station Number GRA-3 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1 x 10^6CFU/dl
BOD_5	120 mg/L
Total Suspended Solids	180 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 dykes and earthfill structures associated with a Sewage Treatment Facility.

4. The Sewage Treatment Facility shall be maintained and operated in such a manner as to prevent structural failure.

5. The Licensee shall maintain the Sewage Treatment Facility to the satisfaction of an Inspector.

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 the 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 Sewage Treatment Facility provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

    a. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;

    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, before December 1, 2003 submit to the Board for approval, a Plan for the Operation and Maintenance of the Water Treatment Facility and the Sewage Treatment Facility in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996).

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.

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 sewage treatment 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 Surveillance Stations at the following locations:

Station Number	Description
GRA-1	Raw Water supply prior to treatment
GRA-3	Effluent discharge from the Sewage Treatment Facility

2. The Licensee shall sample monthly at Monitoring Station GRA-3 during the months of May to August, inclusive.

3. The Licensee shall analyze samples collected at Station Number GRA-3 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	

4. Additional sampling and analysis may be requested by an Inspector;

5. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence;

6. 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;

7. All analyses shall be performed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Certified Laboratory, or as otherwise approved by an Analyst;

8. The Licensee shall measure and record in cubic metres the monthly and annual quantities of water pumped from Monitoring Program Station Number GRA-1 for all purposes;

9. The Licensee shall measure and record the annual quantities of sewage solids removed from the sewage disposal facility ~~shall be measured and recorded~~;

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; and

11. Modifications to the Monitoring Program may be made only upon written approval of the Chief Administrative Officer.

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Appendix B
Climate Data

Rankin Inlet Climate Data

Table 1: Rankin Inlet Climate Normals Data Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Total Precipitation (mm)	6.6	8.9	12.6	14.3	18.4	29.8	39.5	57.6	43.8	34.6	19.8	11.3	297.2
Rain (mm)	0.0	0.1	0.0	1.0	7.4	25.0	39.5	57.3	39.2	11.9	0.1	0.0	181.5
Snow (cm)	6.7	9.3	12.9	13.6	11.5	4.9	0.0	0.3	4.6	23.1	20.9	11.9	107.8
Wind Speeds (km/hour)	23.9	23.9	23.4	22.4	22.1	19.8	19.2	21.1	24.2	26.5	25.3	24.0	
Average Temperatures (°C)	-31.9	-30.1	-25.2	-16.3	-5.9	4.2	10.4	9.5	3.4	-5.3	-17.8	-26.7	

*Canadian Climate Normals 1971-2000, Environment Canada, Rankin Inlet Airport Weather Station

Water Use Projections for the Hamlet of Rankin Inlet, Nunavut

Water Use Projections Table
Key Assumptions

Starting Year:	2006	Starting Population:	2358
Population Growth Rate:	1.4%	Residential Water Usage Rate [L/cd]::	220.0

Planning Year	Calendar Year	Projected Population[1]	Projected Water Consumption[2]	Projected Total Consumption Volume				Based on Recorded Usage Rate in 2008	
			[Lpcd]	[Litres/day]	[Litres/year]	[m3/day]	[m3/year]	[m3/day]	[m3/year]
	2006	2358	331.8	782435	285,588,672	782	285,589		
	2007	2392	332.8	796150	290,594,757	796	290,595		
0	2008	2426	333.8	809900	295,613,377	810	295,613	2108	769420
	2009	2460	334.8	823683	300,644,356	824	300,644		
	2010	2495	335.8	837907	305,836,035	838	305,836		
	2011	2530	336.8	852166	311,040,449	852	311,040		
5	2012	2566	337.8	866868	316,406,662	867	316,407		
	2013	2602	338.8	881605	321,785,974	882	321,786		
	2014	2639	339.8	896790	327,328,173	897	327,328		
	2015	2676	340.8	912010	332,883,827	912	332,884		
	2016	2714	341.8	927681	338,603,444	928	338,603		
	2017	2752	342.8	943389	344,336,861	943	344,337		
10	2018	2791	343.8	959549	350,235,308	960	350,235		
	2019	2831	344.8	976164	356,299,679	976	356,300		
	2020	2871	345.8	992818	362,378,709	993	362,379		
	2021	2912	346.8	1009931	368,624,715	1010	368,625		
	2022	2953	347.8	1027084	374,885,693	1027	374,886		
	2023	2995	348.8	1044698	381,314,687	1045	381,315		
	2024	3037	349.8	1062353	387,758,957	1062	387,759		
	2025	3080	350.8	1080472	394,372,269	1080	394,372		
	2026	3124	351.8	1099056	401,155,495	1099	401,155		
	2027	3168	352.8	1117684	407,954,795	1118	407,955		
20	2028	3213	353.8	1136781	414,925,019	1137	414,925	2466	900000
	2029	3258	354.8	1155922	421,911,589	1156	421,912		
	2030	3304	355.8	1175534	429,070,078	1176	429,070		
	2031	3351	356.8	1195620	436,401,342	1196	436,401		
	2032	3398	357.8	1215753	443,749,704	1216	443,750		
	2033	3446	358.8	1236361	451,271,817	1236	451,272		
	2034	3495	359.8	1257448	458,968,526	1257	458,969		
	2035	3544	360.8	1278584	466,683,053	1279	466,683		
	2036	3594	361.8	1300200	474,573,133	1300	474,573		
	2037	3645	362.8	1322300	482,639,599	1322	482,640		
30	2038	3697	363.8	1344886	490,883,286	1345	490,883		

Note:

1) Population in 2006 taken from Statistics Canada 2006 Census of Population. A population growth of 1.5% was applied to the subsequent years.

2) The projected water consumption is based on the Nunavut water usage formula [RWU L/c/d x (-1 + (0.323 x Ln (population)].

3) The Residential Water Usesage Rate is estimated to be 220 L/c/d for populations greater than 2000 and assumes that the water is distributed by a piping system.

Hydrology Calculations, Hamlet of Rankin Inlet

Annual Rainfall (m/year)	0.2972	*Canadian Climate Normals 1971-2000, Environment Canada, Rankin Inlet Airport Weather Station
Evapotranspiration (m/year)	0.200	* Specific values for Rankin Inlet were not available, estimated using several references, see below.

Nippissar Lake Drainage Basin

Lake Drainage Area (m^2)	3,230,000
Rain and Runoff (m^3/year)	959,956
Evapotranspiration (m^3/year)	646,000
Net Recharge of Lake (m^3/year)	313,956

Nippissar Lake Volume

Lake Area (m^2)	1,090,565
Estimated Average Depth (m)	4
Estimated Lake Volume (m^3)	4,362,260

Evapotranspiration Rates

Location	Value (mm)	Reference
Arviat, Nunavut	203	FSC Architects & Engineers, 2003
Mackenzie Basin, Yukon	241	Serrereze et al, 2003
Lena Basin, Russai	182	Serrereze et al, 2003
Knob Lake, Quebec	280	Church, 1974
Boot Creek, Inuvik, NWT	75	Church, 1974
Mackenzie River Basin, Yukon	216	Yi Yip, 2008
Average	**200**	

References:

FSC Architects & Engineers, 2003. Design Concept for Arviat Sewage Lagoon prepared for Department of Community Government and Transportation, Government of Nunavut.

Church, M. 1974. Hydrology and Permafrost with Reference to Northern North America. In Proceedings: Workshop Seminar on Permafrost Hydrology, 7-20. Ottawa: Canadian National Committee, International Hydrological Decade (IHD).

Yi Yip, Q.M. 2008. Climate Impacts on Hydrometric Variables in Mackenzie River Basin. University of Waterloo, Waterloo, 2008.

Serreze, M.C., D.H. Bromwich, M.P. Clark, A.J. Etringer, T. Zhang and R. Lammers, 2003. Large-scale hydro-climatology of the terrestrial Arctic drainage system. Journal Geophysical Research, 108(D2). Doi:10. 1029/2002JD000919

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Appendix C
Projected Water Requirements

Form 1
Annual Water Intake Log
Hamlet of Rankin Inlet

Year: _____

Date	Date of Record	Total Town Supply (Current Month) (m^3)	Total Town Supply (Since Start) (m^3)	Recorded By	Comments
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Annual Totals					

Form 2
Monthly Water Supply Facility Inspection Form
Hamlet of Rankin Inlet

Inspected By:_____ Date:_____

Wind Direction:_____ Temperature:_____

Precipitation:_____ Ground Cover:_____

Issues and Conditions	Description/Condition/Problems	Action/Maintenance Required
Health and Safety (dangers and concerns)		
Signs		
Access Road and Truck Pad (condition, drainage, snow, surface, etc.)		
Pumps		
Water Intake Screen		
Berm		
Fuel Storage Tanks		

Issues and Conditions	Description/Condition/Problems	Action/Maintenance Required
Wildlife		
Ice		
Litter		
Other Issues and Concerns		

Form 3
Water Supply Facility Planning
Hamlet of Rankin Inlet

Prepared By: _____

Date: _____

Water Supply Facility Planning Issue	Current Operations	To Do Items and Schedule
Health and Safety		
Site Inspection Results/Concerns		
Current Volumes		
Water Treatment Process		
Annual Reporting		
Nunavut Water Board License Requirements		

Water Supply Facility Planning Issue	Current Operations	To Do Items and Schedule
Flow Monitoring		
Staffing		
Equipment		
Costs		
Other Issues/Concerns		

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Appendix D
Site Photographs

Photo 1: Nipissar Lake Pump house

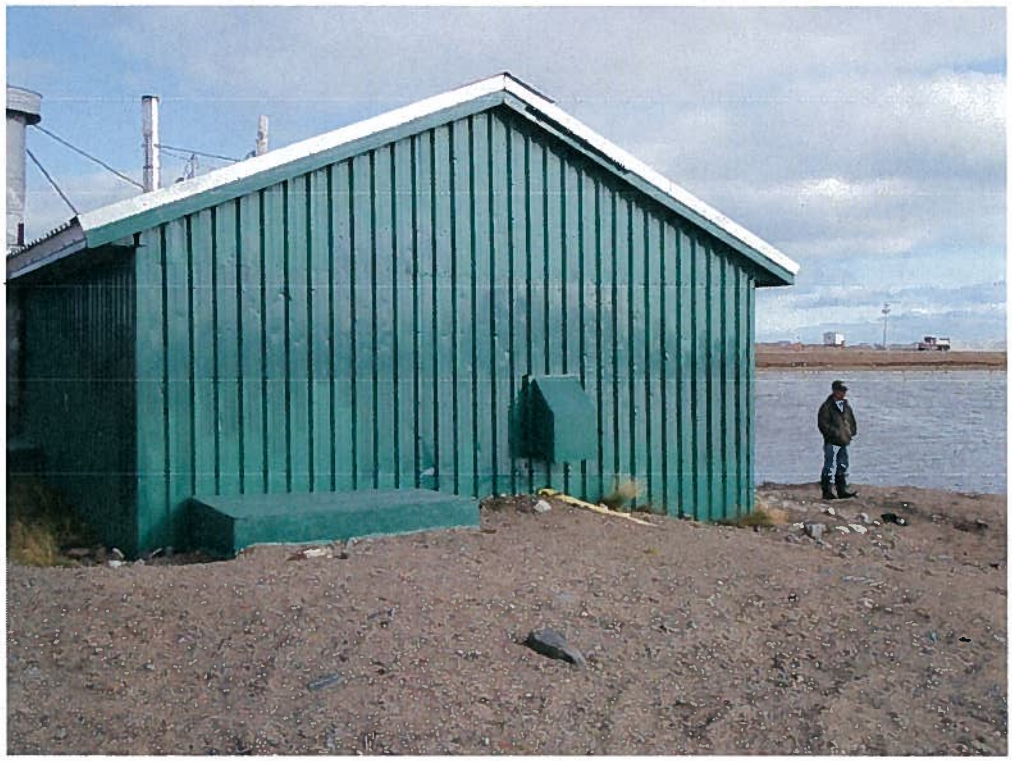

Photo 2: Back of Nipissar Lake pumphouse

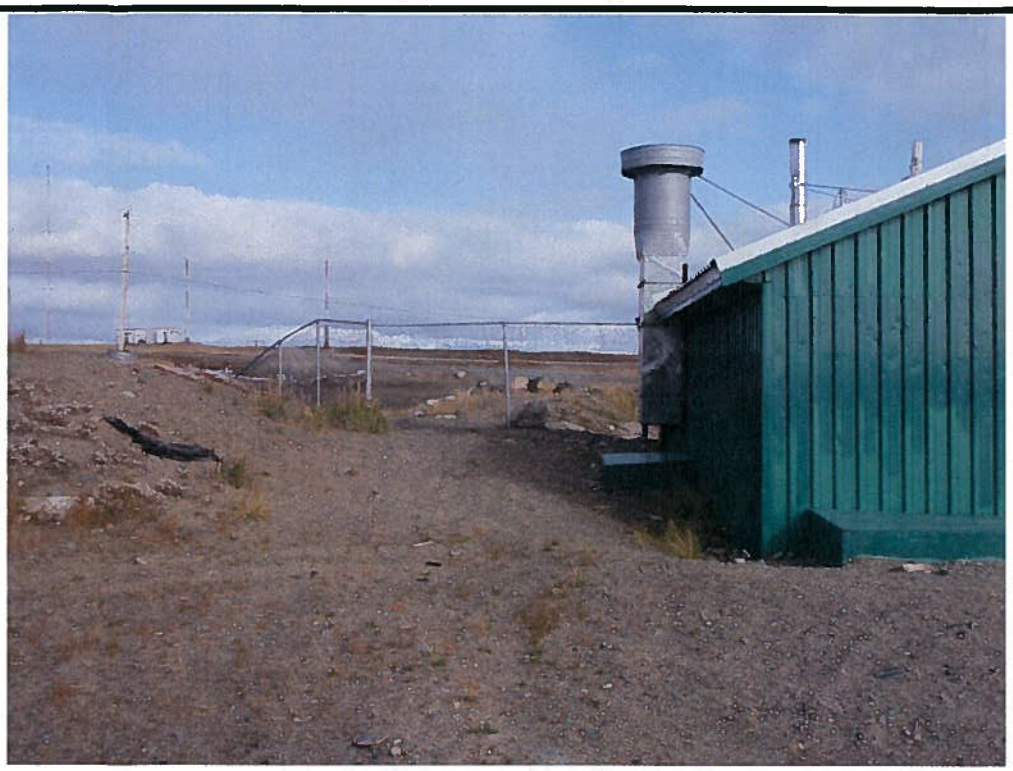

Photo 5: Northwest corner of pump house

Photo 6: Access driveway to pump house

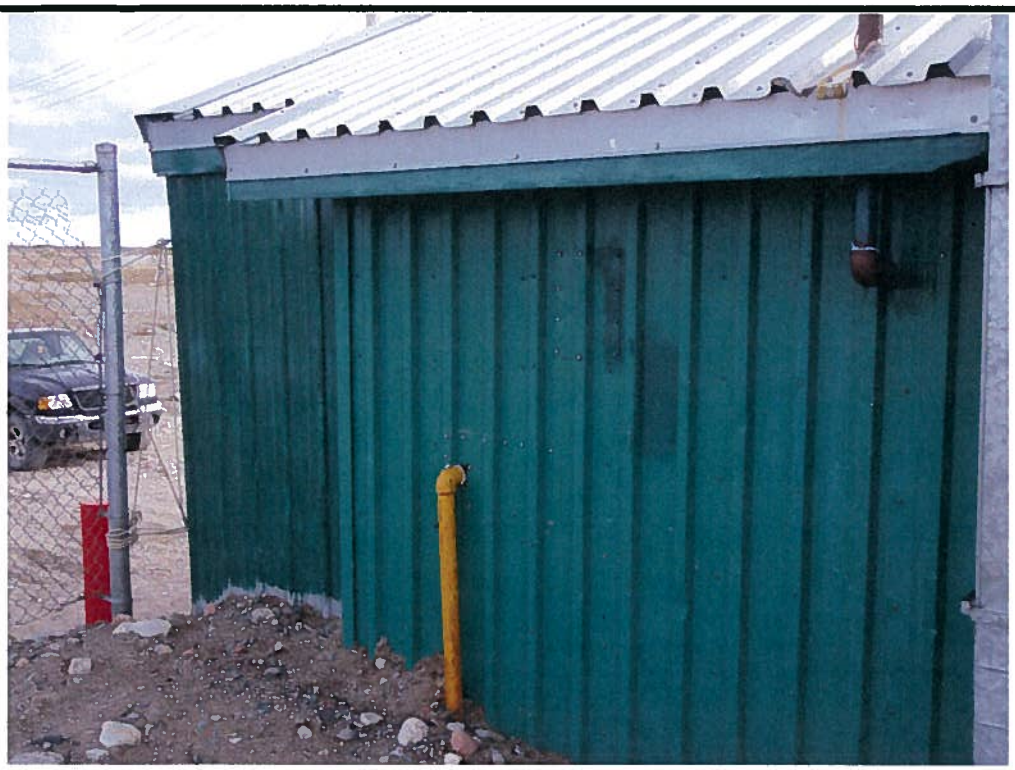

Photo 9: Fuel intake pipe into pumphouse

Photo 10: Fuel storage tank inside of pump house

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Appendix E

Site Forms

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 accodance 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):
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:	

BURNSIDE

Appendix F
Annual Monitoring Report Format

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 accodance 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):
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 G

March 25, 2010 Letter to

DFO Regarding Freshwater Intake from

Nippisar Lake

Nuna Burnside Engineering and Environmental Ltd. 15 Townline Orangeville ON L9W 3R4 Canada
telephone 519-941-0342 **fax** (519) 941-8120 **web** info@nunaburnside.com

NUNA BURNSIDE
An Aboriginal Owned Company

March 25, 2010

Ms. Loriena Melnick
Habitat Management Biologist
Fisheries and Oceans Canada – Eastern Arctic Area
PO Box 358
Iqaluit, Nunavut X0A 0H0

Dear Ms. Melnick:

Re: Fresh Water Intake From Nipissar Lake
Type 'A' Water License Application – 3 AM GRA
Rankin Inlet, Nunavut
DFO Habitat File No. N4-09-0037
File No. N-O 14850

1.0 Introduction

As per the letter from Fisheries and Oceans Canada (DFO) to the Nunavut Water Boards (NWB), dated December 16, 2009, and the discussions held during the Technical Meeting teleconference on March 3, 2010, we have obtained additional information to address concerns regarding potential impacts to fish habitat. As outlined herein, we were able to make an assessment of the potential for the intake to impact fish. At this time, we are not able to assess the potential impacts of lake drawdown, due to water taking exceeding the capacity of the Nipissar Lake watershed. As discussed, the GN has undertaken lake studies in 2009 and will continue through 2010, to determine the current and future impacts to lake levels resulting from Hamlet with drawls and the potential impacts on the aquatic environment.

2.0 Water Supply

The community draws its water from the Nipissar Lake, located 2 km northwest of the Hamlet. Nipissar Lake covers an area of 1,090,565 m^3. Using an average depth of 4 metres the estimated volume of the lake is 4,362260 m^3. The total drainage area of Nipissar Lake is 323 hectares. Using an annual precipitation rate of 297.2 mm and an annual evapotranspiration rate of 200 mm, the calculated total recharge to the lake is approximately 314 000 m^3 per year (Nuna Burnside 2009). This is lower than the numbers given in the Nipissar Lake Watershed Model, which calculates the useable storage of the lake to be about 1,400,000 m^3 and the estimated annual recharge as 600,000 m^3 per year (Stanley Assoc., 1996).

The Nipissar Lake pump house has vertical turbine submersible pumps installed inside twin intake lines. Each of the 10 up pumps has a 1020 L/min (17L/sec) capacity. Only one pump operates at a time. Operation of the pump is controlled by the water level in the water storage tank adjacent to the Williamson Lake pump house. An air compressor aerates water around the intake to prevent taste and odour problems.

According to the water use estimates, the Hamlet is using more water per year than the estimated annual recharge of the lake. The Government of Nunavut is conducting studies to identify an alternative water supply that they can pump into the reservoir during the summer months to maintain the water levels in the lake in the future.

3.0 General and Site Information

The name of the water source at the intake location is Nipissar Lake.

The location of Nipissar Lake is 2km northwest of the Hamlet and the pump station located on the east side of the lake 15V 545131.99 m E, 6966238.89 m N.

The type of waterbody is an in-land lake that has no direct connection to any watercourse or estuary associated with Hudson Bay.

The water intake has been elevated above the lake bed by approximately 2.0m. The intake has an air compressor aerates water around the intake to prevent taste and odour problems, this can also prevent fish from entering the intake due to air bubbles surrounding it similar to a bubble curtain used in construction projects to isolate the work area from fish bearing waters. The air bubbles could create a barrier around the intake therefore not allowing fish to enter the intake.

Initial construction of the intake was 30 years ago with modifications to the intake in 2009 based on a previous as built drawing. The intake construction consists of a barrel or cylindrical screen (Stainless Steel) that is aligned vertically and elevated approximately 2.0m from the lake bed.

4.0 Biophysical Information

Potential for fish presence in this waterbody would normally be limited due to the type of waterbody not having direct connection to watercourses or the estuary. Local knowledge states that fish have been released to the lake in the past although fishing is not permitted due to protection of the water supply and its water quality. Native species known to exist in the lake are Arctic grayling *(Thymallus arcticus)* and lake trout *(Salvelinus namaycush)* based on local knowledge (pers. comm. Joe Strickland). Based on the species noted above the potential for reproduction and possibility of smaller sizes and year class of fish may exist if the stock is naturally producing. The potential for forage species such as cyprinids may be possible unless the fish feed primarily on aquatic insects. The fish species known to exist would be classified as subcarangiform.

Physical description of the intake location is on the lake bed elevated 2.0m above the substrate in approximately 5.3m of water. The max depth of the lake is approximately 6.7m. Substrate at depth is reportedly sand and gravel, however there is no confirming documentation. The position of the intake is vertical based on the lake bed.

5.0 Water Use Information

The purpose of water withdrawal is for the consumption and supply for the Hamlet of Rankin Inlet. The inlet consists of 2 intakes with one being a continuous draw depending on consumption uses and reservoir levels. If the reservoir is full then one intake will run continuously but re-circulate the water within the intake system to reduce the potential for freezing during winter conditions. The average intake rate is 17L/sec or 1020L/min for one intake.

Effects on Nipissar Lake from the water taking would primarily be lowering of lake levels during dry periods in the summer. How this is related to the aquatic environment will need to be assessed based on the species known to exist (Arctic grayling and lake trout) and their usage of seasonal depth ranges depending on spawning and forage activities.

Structures associated with the intake include the insulated line, aeration line, pump house and transmission line, reservoir, and distribution system.

The water license application will be for an existing intake and possibly upgrades to the intake screen if required based on DFOs review. Future alternations to the intake are dependent on the findings of the current studies.

6.0 Fish Screen Information

The intake screen open and effective areas will need to be determined based on a rectangular screen opening of 3/16" (4.763mm) and 1" (25.4mm). The intake has been described as cylindrical screen (24"H x 18"Ø) with a sealed top and bottom made of stainless steel. It is unknown at this time what type of screen exists on the intake (i.e. wedge wire, woven wire), and this information must be acquired and verified to determine the "% open area" based on the DFO Fish Screen Guidelines and associated calculations.

Based on a review of the DFO guidelines, protection of fish with a minimum fork length of 25mm must be attained although the largest opening in the existing screen being 1" (25.4mm) therefore allowing for small fish to enter the intake depending on the intake velocity. As mentioned above, the aeration line aerates the water around the intake prior to being drawn into the system to reduce taste and odour issues related to stagnant water. No other cleaning, maintenance, or special requirements are known at this time.

7.0 Calculation Based on Assumptions

If we use a conservative estimate of 50% open area then we can determine what size the intake screen must be to satisfy the guideline requirements based on subcarangiform fish. The result based on a 12"Ø cylinder screen and a flow rate of 17L/sec and the assumed 50% open area the length of the intake screen would need to be 13.2" or longer to ensure that smaller fish can over come the velocity of the intake.

The dimensions of the intake are 24" long and therefore would equate to an open area of approximately 26% based on the DFO guideline calculations. Due to the required efficiency of intake screens it may be safe to assume that the % open area would be

greater than 26% and that the existing screen complies with the DFO Freshwater Intake End-of-Pipe Intake Guidelines (DFO, 1995) based on length of the screen.

8.0 Summary

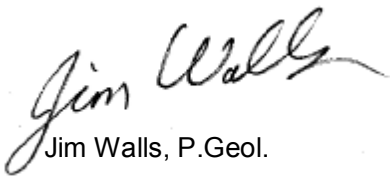
Based on the information currently available and conservative estimates, the current intake complies with DFO requirements, however the impact to aquatic habitat due to fluctuations to lake level due to seasonal drawdowns remains unknown.

We suggest the new license include the Condition to assess the impact of lake level fluctuations, due to Hamlet water taking, on fish habitat in Nipissar Lake by December 31, 2010. The findings should also include recommendations for action with a time line, should it be required.

If you have any questions or comments, or require further information, please contact our Aquatic Resource Specialist, Chris Pfohl, A.Sc.T., or the undersigned.

Yours truly,

Nuna Burnside Engineering and Environmental Ltd.



Jim Walls, P.Geol.

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