# 1.0 Introduction

The Municipality of Qikiqtarjuaq (meaning "big island"), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the settlement is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Municipality of Qikiqtarjuaq are 67°33' north latitude and 64°02' west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

Qikiqtarjuaq is located within the continuous permafrost zone. Maximal local depth of annual thaw of the active layer ranges from 0.6 to 1.6 meters, depending on the thickness and nature of the surface cover. Materials located beneath the thin active layer are perennially frozen to a substantial depth. Qikiqtarjuaq sits on glacial drift primarily composed of silty sand and gravels mixed with boulders.

The vegetation present in Qikiqtarjuaq is typical of that evidenced on the Arctic tundra. Hardy grasses, mosses, and lichens sit in a thin organic layer on the surface, which is generally 0.2 m or less in thickness.

Qikiqtarjuaq receives an average of 39 mm of rainfall and 223 mm of snowfall per annum. July mean high and low temperatures are 7°C and 1°C, respectively. January mean high and low temperatures measure -21°C and -28°C, respectively. July and August are the only two months of the year that historically have had average daily temperatures above the freezing mark. Prevailing winds are generally north-northeast with an annual average velocity of 8.3 km/h. Climate normal information was obtained from Environment Canada's website, and is available in Appendix A.

The Detailed Design Report (Nuna Burnside, 2006) for the Improvements to the Water, Wastewater, and Solid Waste Facilities determined the projected population, and associated water requirements and sewage generation rates using information from the Nunavut Bureau of Statistics. The tables with the detailed calculations are available for inspection in Appendix B.

## 1.1 Purpose

The Municipality of Qikiqtarjuaq operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB3Q1K0106, dated November 28, 2000 (Appendix C). Part G, Section 1 requires that an Operation and Maintenance (O&M) Plan be submitted for the facilities in accordance with all applicable regulations and following applicable guidelines. This document is created based on the

Figure 1

Figure 2

improvements proposed for the sewage treatment system, which an amendment and renewal to the NWB license is being requested.

The O&M Plan of the sewage disposal facility will be used in conjunction with the normal operating procedures. This document provides a list of tasks and procedures that will assist the Municipality's operations staff in the O&M of the facility.

## 2.0 Background Information on Municipality Operations

The Municipality of Qikiqtarjuaq provides trucked water and sewage services, as well as regular solid waste pickup for the Community's residents, businesses, and institutions.

The Sewage Treatment Facility operated by the Municipality of Qikiqtarjuaq is located approximately 2.3 km from the Municipality. Sewage is collected by truck from customer holding tanks and discharged to the sewage lagoon located to the east of the community north of the DEW Line Access Road. The Municipality currently utilizes a facultative lagoon originally designed to hold sewage for 365 days, with an annual discharge in mid-August. The existing unlined earthen lagoon was constructed in 1992 (Figure 3). A second lagoon cell is being constructed to provide sewage retention for the projected 20-year design population. The current single-cell lagoon is approximately 96 m x 70m x 4 m, with a working capacity of 10,558 $m^3$. The contemplated double-celled lagoon will have working capacity of 38,850 $m^3$. Sewage effluent from the lagoon will be discharged overland, annually, through a large wetland treatment area, to the Final Discharge Point, which is located approximately 1 km from the Initial Discharge Point of the Sewage Treatment Facility.

Figure 3

# 3.0 Operation and Maintenance of the Sewage Treatment Facility

Satellite imagery of the Sewage Treatment Facility operated by the Municipality of Qikiqtarjuaq, which is described above, is provided in Figure 2. This Figure illustrates both the drainage pathway of the treatment wetland and the proximity to adjacent water bodies (in this case, the Davis Strait). The boundaries of the treatment wetland area are also illustrated in this figure.

In the event of 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 – Manager, Water Resources | Iqaluit | (867) 975-4550 | (867) 979-6445 |
| Municipality of Qikiqtarjuaq – SAO | Qikiqtarjuaq | (867) 927-8832 | (867) 927-8120 |
| Government of Nunavut (Regional Engineer) | Pond Inlet | (867) 975-7314 | |
| Environment Canada – Inspector | Iqaluit | (867) 975-4644 | (867) 975-4594 |
| Fire Department | Qikiqtarjuaq | (867) 927-4422 | |
| RCMP Detachment | Qikiqtarjuaq | (867) 927-0123 | |
| Community Health Center | Qikiqtarjuaq | (867) 927-8916 | |

## 3.1 Sewage Collection Procedures

Municipal staff shall carry out the following sewage collection operational procedures on a daily basis, dependent upon weather conditions:

- Household and commercial sewage holding tanks will be pumped out using a vacuum truck and hauled to the Sewage Lagoon Storage Facility
- Sewage from the vacuum truck will be discharged to the Sewage Lagoon Storage Facility, via a flume designed to prevent erosion of the lagoon wall
- Daily waste volumes deposited to the Sewage Lagoon Storage Facility (and trip counts) shall be recorded on the recording form attached in Appendix D

- In the event of an accident, a spill of sewage or petroleum products or a fire during sewage collection operations, the *Municipality of Qikiqtarjuaq Environmental Emergency Response Plan* (Appendix E) shall be implemented.

## 3.2 Lagoon Operation Procedures

Municipal staff shall carry out the following operational procedures during lagoon decant operations:

- Household and commercial sewage is to be deposited to the Sewage Lagoon Storage Facility for the 10 month period prior to discharge. Initially, the existing cell should be filled first and then the new cell filled second. For the first few years, the operator may find that only one of the cells needs to be decanted each year. In subsequent years, the existing cell should be decanted to the Wetland Treatment Area first followed by the decanting of the new cell. It should be noted that raw sewage should not be added to the cell that is being decanted. The decanting of both cells should occur via the outlet discharge piping over a 60 day period (at the end of the 20 year design this will be approximately 650 $m^3$/day)

- Decant operations shall occur between July 1$^{st}$ and October 1$^{st}$, dependant on weather conditions

- The Municipality of Qikiqtarjuaq shall advise an Inspector with the Nunavut Water Board at least 10 days in advance of starting decant operations of the wastewater lagoons

- During decant operations, the sewage lagoon decant control structures and treatment wetland drainage features shall be inspected daily for defects or blockages, and cleaned/repaired immediately as necessary

- During decant operations, effluent quality monitoring shall be undertaken in accordance with the terms and conditions outlined in the NWB water license, or at the direction of an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*

- Upon completion of decanting operations, the decant structure valves shall be closed, the lagoon berms inspected, and any required maintenance (as described below) performed

## 3.3 Periodic and Seasonal Maintenance Procedures

Municipal staff shall complete the following seasonal maintenance operations at the Sewage Treatment Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and grading in the summer. The operator shall inspect the roadway each summer and undertake repairs as necessary

- Ditches and drainage channels shall being inspected for erosion (once per month) during the summer, and repaired as necessary

- Site warning signage, which identifies the boundaries of the Sewage Treatment Facility (which includes the Sewage Lagoon Storage Facility and the Wetland Treatment Areas) shall be inspected weekly, and repaired or replaced as necessary

- The discharge flume to the Sewage Lagoon Storage Facility shall be inspected for damage or displacement monthly, and repaired as necessary

- Any airborne litter shall be removed from the Sewage Treatment Facility to the Municipality landfill in the Spring and Autumn, or as required

- The Sewage Lagoon Storage Facility shall be inspected for erosion and settlement monthly, and repaired as necessary

- The Sewage Lagoon Storage Facility shall be inspected following decant operations, to determine the thickness of sludge which has accumulated in the lagoon since the previous inspection

- Desluding of the lagoons should be scheduled when it is determined that the sludge thickness is 300 mm. Desludging of the lagoon cells can be accomplished using a trash pump to transfer the sludge to a tanker truck. The sludge would then be transported to an existing land farm facility to the south of the community. The sludge from the lagoon would go through a natural dewatering/decomposition process. This process could occur over a few years to take advantage of the natural freeze thaw cycles that would occur. Sludge samples would be submitted to an accredited laboratory for analysis to determine when the sludge could be used either for cover material at the landfill site or spread on the tundra.

Municipal staff shall maintain records detailing any repairs to the facility and shall include a description of the repairs in the Annual Report to be submitted to the Nunavut Water Board, in compliance with the Municipalities' Water License.

## 3.4 Facility Monitoring Procedures

As outlined in the NWB water license, regular monitoring of the effluent from the Sewage Treatment Facility is required. The Monitoring Program is to include effluent samples collected at the Final Discharge Point of the Wetland Treatment Facility, during the months of June to October, inclusive. Effluent samples collected shall be analyzed for the following parameters:

- Biological Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Conductivity
- Oil and Grease (OGG) (Visual)
- Magnesium (Mg)
- Sodium (Na)
- Chloride (C1)
- Total Hardness
- Ammonia Nitrogen ($NH_3$-N)
- Total Cadmium (Cd)
- Total Cobalt (Co)
- Total Chromium (Cr)
- Total Copper (Cu)
- Total Aluminum (Al)
- Total Mercury (Hg)
- Faecal Coliforms (FC)
- pH
- Nitrate-Nitrite ($NO_3$-$NO_2$)
- Total Phenols (Total-P)
- Calcium (Ca)
- Potassium (K)
- Sulphate ($SO_4$)
- Total Alkalinity
- Total Zinc (Zn)
- Total Iron (Fe)
- Total Manganese (Mn)
- Total Nickel (Ni)
- Total Lead (Pb)
- Total Arsenic (As)
- Total Organic Carbon (TOC)

Any additional analytical parameters, which are identified in the NWB water license, or by an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* shall also be tested for.

Sampling completed by the Municipality of Qikiqtarjuaq shall be in accordance with the Municipality of Qikiqtarjuaq Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan, which is appended to this Plan (Appendix F).

A monitoring station will be established at the point where raw wastewater is off-loaded by the vacuum trucks. Monthly and annual quantities of raw wastewater offloaded will be measured and recorded in the official operations logbook on a form similar to that presented in Appendix D.

## 3.5 Annual Reporting Procedures

Results of analytical testing and monitoring are to be recorded on a regular basis by the Municipality's operation staff. Copies of the analytical certificates and Chain of Custody forms are to be kept for future reference to determine the effectiveness of the treatment facility.

# 4.0 References

Department of Municipal and Community Affairs, Government of Northwest Territories, October 1996. *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. Queen's Printer: Yellowknife, Northwest Territories.

National Research Council. August 2004. *National Guide to Sustainable Municipal Infrastructure: Optimization of Lagoon Operations*. Ottawa, Ontario.

Nuna Burnside Engineering and Environmental Ltd. January 2005. *Detailed Design of the Improvements to the Water Reservoir, Wastewater Lagoon and Solid Waste facility in the Municipality of Qikiqtarjuaq*. Rankin Inlet, Nunavut.

Nunavut Water Board. September 2000. *Municipality of Qikiqtarjuaq Water License NWB3QIK0106.* Gjoa Haven, Nunavut.

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## Figures



## Appendices