N-O 09439.

NUNA BURNSIDE

Updated Operation and Maintenance (O&M) Plan for Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility Hamlet of Qikiqtarjuaq, Nunavut

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

Prepared by

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Revision Date

September 2010

File No: N-O 09439.0

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1.0 Introduction

The Hamlet of Qikiqtarjuaq (meaning "big island"), is a Community of approximately 600 people located on the eastern coast of Baffin Island on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet 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 Hamlet of Qikiqtarjuaq are 67°33' north latitude and 64°02' west longitude. As indicated on Figure 2, the community is situated on the northwest shore of Broughton Island.

Qikiqtarjuaq is located within the continuous permafrost zone. Historically, the maximal local depth of annual thaw of the active layer has ranged 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 supply requirements, sewage generation rates and solid waste generation rates, using information from the Nunavut Bureau of Statistics. The tables with the detailed calculations are included in Appendix B.

1.1 Purpose

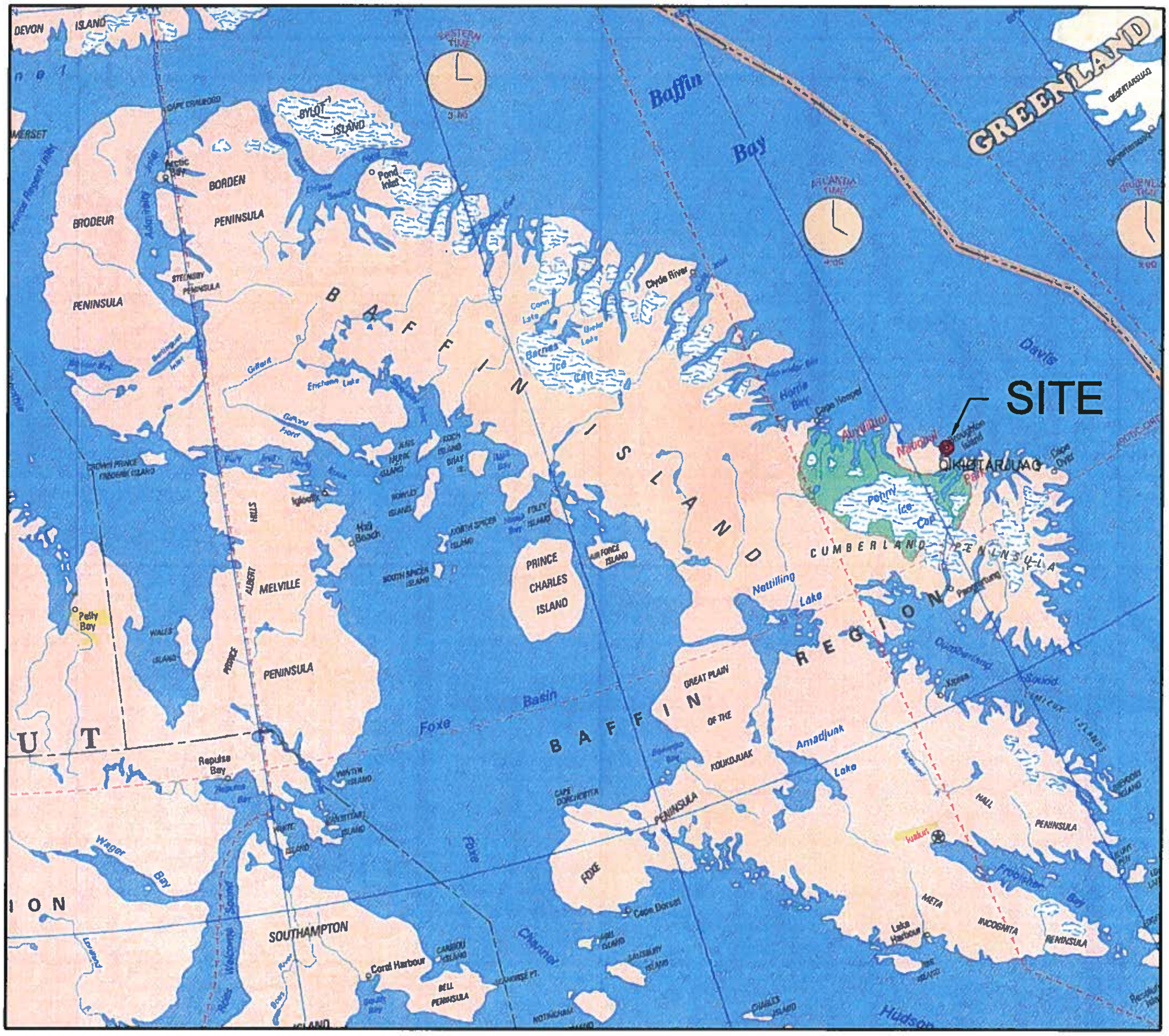
The Hamlet of Qikiqtarjuaq operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB 3BM-QIK0712, dated May 9, 2007 (See Appendix C). Part III requires that an Updated Operation and Maintenance (O&M) Plan be submitted for the facilities in accordance with all applicable regulations and following applicable guidelines. The O&M Plan will be used in conjunction with the normal operating procedures. This updated document provides a list

of tasks and procedures that will assist the Hamlet's operations staff in the O&M of the water reservoir, sewage lagoon and solid waste disposal facilities.

1.2 Document Overview

This Updated O&M Plan is organized into the following sections:

- Section 1.0: Introduction
- Section 2.0: Background Information on Hamlet Operations
- Section 3.0: Operation and Maintenance of the Water Storage and Treatment Facility
- Section 4.0: Operation and Maintenance of the Sewage Treatment Facility
- Section 5.0: Operation and Maintenance of the Solid Waste Disposal Facility
- Section 6.0: Emergency Procedures
- Section 7.0: Annual Reporting
- Section 8.0: Environmental Emergency Response Plan
- Section 9.0: Summary of Monitoring Program
- Section 10.0: Quality Assurance/Quality Control Plan
- Section 11.0: References



Map Reference:
Map of Canada
Published by the CAA

KEY MAP OF
NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT

UPDATED O & M PLAN
AUGUST 2010

August 2010
Project Number: N-O094390
Prepared by: C. Sheppard Verified by: J. Darlow

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N-O094390 UPDATED AUG 2010 O&M SL.dwg

Plot Time: Aug 23, 2010–2:11pm

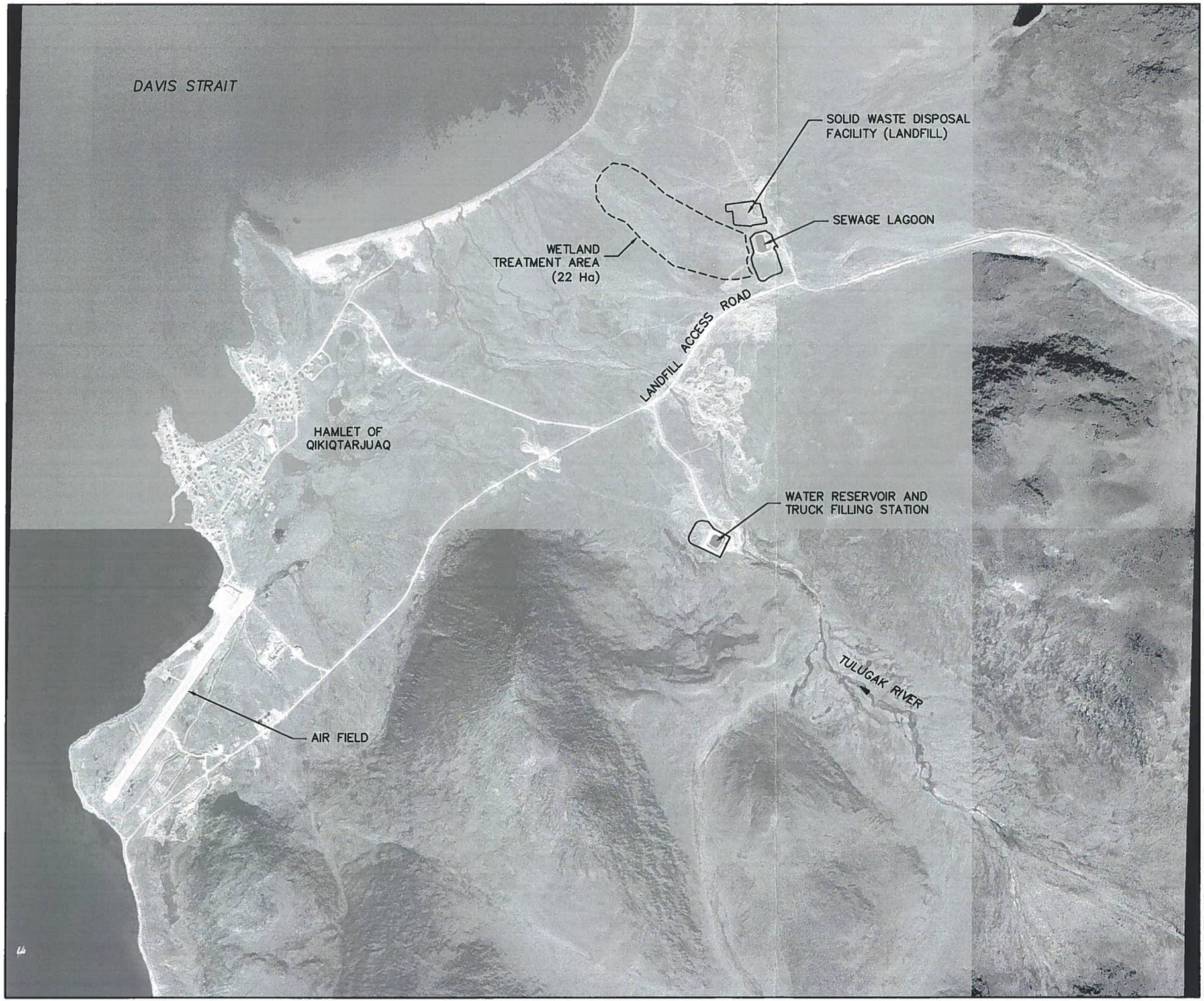


FIGURE 2

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

COMMUNITY & INFRASTRUCTURE PLAN

Satellite Image Source:
Background 2004 satellite image obtained from Digital Globe Inc.

N

0 200 400 600 800 1000 1200 1400 1600
Metres

1:20,000
August 2010
Project Number: N-O094390

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Darlow

BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN CP.dwg

Plot Time: Aug 26, 2010–2:16pm

2.0 Background Information on Hamlet Operations

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

2.1 Water Storage and Treatment Facility

The Tulugak River currently provides the water supply to the Hamlet of Qikiqtarjuaq. Water is currently drawn from the Tulugak River during the summer and stored in the reservoir for the remainder of the year. The earthen reservoir, located approximately 2.2 km from the Hamlet.

The water reservoir (Figure 3) has recently been expanded to approximately 90 m x 156 m x 9 m, and lined with a potable grade geomembrane liner system. This reservoir is designed with a useable capacity of 31,500 m^3; to meet the projected needs of the community to the year 2027. Water is treated with chlorine prior to distribution to the Community via Hamlet owned water trucks.

2.2 Sewage Treatment Facility

The Sewage Treatment Facility operated by the Hamlet of Qikiqtarjuaq is located approximately 2.3 km from the Hamlet. Sewage is collected by truck from customer holding tanks and discharged to the sewage lagoon located to the east of the community. The Hamlet currently utilizes an engineered facultative lagoon designed to meet the projected needs of the community to the year 2027. The lagoon is a double-celled lagoon with an approximate useable storage capacity of 38,900 m^3. Sewage effluent from the lagoon is 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.

2.3 Solid Waste Disposal Facility

Solid waste is collected by the Hamlet-owned garbage truck and transported to the waste disposal facility. The Facility is located approximately 2.3 km east of the community adjacent to the sewage lagoon. Access to the Solid Waste Disposal Facility is unmanned and public sorting/ scavenging of the waste is allowed. Specific areas for the segregation of hazardous and bulky waste (the Hazardous Waste Segregation Facility and the Bulky Waste Disposal Area, respectively) are provided. The Hazardous Waste Segregation Facility is located within the fenced area at the landfill, while the Bulky Waste Disposal Area is located in an adjacent, but unfenced, area.

3.0 Operation and Maintenance of the Water Storage and Treatment Facility

Satellite imagery of the Water Storage and Treatment Facility operated by the Hamlet of Qikiqtarjuaq is provided in Figure 3. This Figure shows the direction of water flowing from the Tulugak River, and the locations of the fill pipe and water storage reservoir.

Appendix D contains detailed descriptions of each unit operation at the Water Storage and Treatment Facility and provides additional O&M information for each.

3.1 Water Distribution Procedures

The following water distribution operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq on a daily basis (weather dependent):

- Residential, institutional, and commercial water storage tanks shall be filled from Hamlet-operated water delivery vehicles, with water obtained from the Hamlet Water Storage And Treatment Facility
- Daily water usage volumes obtained from the Hamlet Water Storage and Treatment Facility, as well as trip counts shall be recorded on the recording form similar to the form attached in Appendix E
- In the event of an accident, a spill of petroleum products or a fire during water distribution operations, the Environmental Emergency Contingency Plan detailed in Section 8.0 shall be implemented.

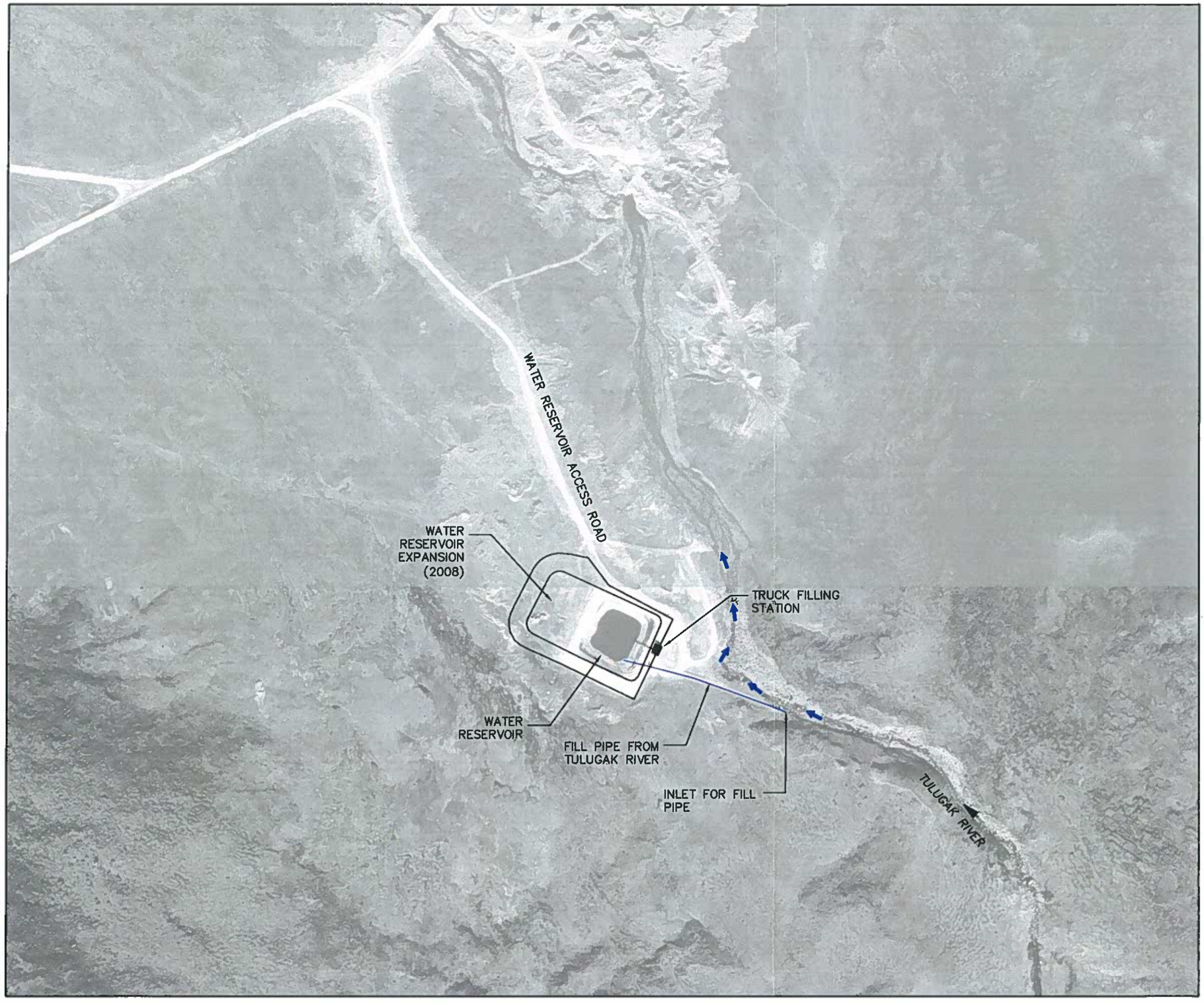


FIGURE 3

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

WATER RESERVOIR SITE PLAN

LEGEND

INTERPRETED SURFACE WATER FLOW DIRECTION

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

N

0 50 100 150 200 250 300 350 400
Metres

1:5,000
August 2010
Project Number: N-O094390

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Darlow

NUNA BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN WATER SP.dwg

Plot Time: Aug 26, 2010 - 2:17pm

3.2 Water Storage Facility Refilling Operational Procedures

The following operational procedures are to be carried out by the Hamlet of Qikiqtarjuaq, during refilling operations at the Hamlet Water Supply Facility reservoir:

- Raw water from the Tulugak River shall be transferred by gravity from the intake location (Figure 3) to the water reservoir
- Water transfer operations shall be completed during the seasonal melt to ensure the reservoir has been filled to within 1 meter of the top of berm
- During water transfer operations, the fill pipe and associated intake structures shall be inspected twice daily for defects or blockages and to ensure the reservoir is not overfilled
- Upon completion of water transfer operations, the fill pipe and intake structures shall be secured, the reservoir berms inspected, and any required maintenance (as described below) performed.

3.3 Water Supply Facility Truckfill Station Operational Procedures

The following operational procedures are to be carried out by the Hamlet of Qikiqtarjuaq, during water treatment and truckfill operations at the Hamlet Water Storage and Treatment Facility:

- Water from the reservoir at the Facility shall be transferred by submersible pump to the water distribution vehicles through the truckfill station, at a rate of approximately 1,000 L/min (minimum recommended for fire protection)
- Water treatment consists of microfiltration and disinfection using chlorine
- The chlorine feed system shall be inspected daily
- Water being transferred to the distribution vehicles shall be dosed with sodium hypochlorite at a rate sufficient that a free chlorine residual of 0.2 mg/L, after thorough mixing and 20 minutes of contact time is maintained, in accordance with the Public Health Act (1992) and associated Regulations
- Chlorine residuals shall be monitored daily, or as directed by a Public Health Inspector (as defined by the Public Health Act (1992))
- Facility generators and associated fuel storage shall be monitored daily.

3.4 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the Hamlet of Qikiqtarjuaq 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 grading in the summer, and repaired as necessary
- Ditches and drainage channels at the Water Supply Facility shall be inspected during the summer for erosion and 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 Truckfill Station at the Water Supply Facility shall be inspected for damage or displacement weekly, and repaired as necessary
- Any airborne litter shall be removed from the Water Supply Facility to the Hamlet landfill weekly, or as required
- The berms at the Water Supply Facility shall be inspected during the summer for erosion and settlement weekly, and repaired as necessary
- The liner of the Water Supply Facility shall be inspected annually, and repaired as necessary.

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

3.5 Facility Monitoring Procedures

Volumetric monitoring of the raw water from the Tulugak River and the treated water from the reservoir shall be completed during water transfer operations, as per the Hamlet's Water License. The Monitoring Program is detailed in Section 9.0.

Daily monitoring of residual chlorine levels shall be undertaken, to facilitate and confirm the maintenance of a free chlorine residual in treated water in accordance with the *Public Health Act* (1992) and associated *Regulations*.

Water sampling completed by the Hamlet of Qikiqtarjuaq shall be in accordance with the Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan, which is included in Section 10.0.

4.0 Operation and Maintenance of the Sewage Treatment Facility

Satellite imagery of the Sewage Treatment Facility operated by the Hamlet of Qikiqtarjuaq is provided in Figure 4. 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 approximate boundaries of the treatment wetland area are also illustrated in this figure.

4.1 Sewage Collection Procedures

The following sewage collection operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq 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 similar to the form in Appendix E
- In the event of an accident, a spill of sewage or petroleum products or a fire during sewage collection operations, the Environmental Emergency Contingency Plan detailed in Section 8.0 shall be implemented.

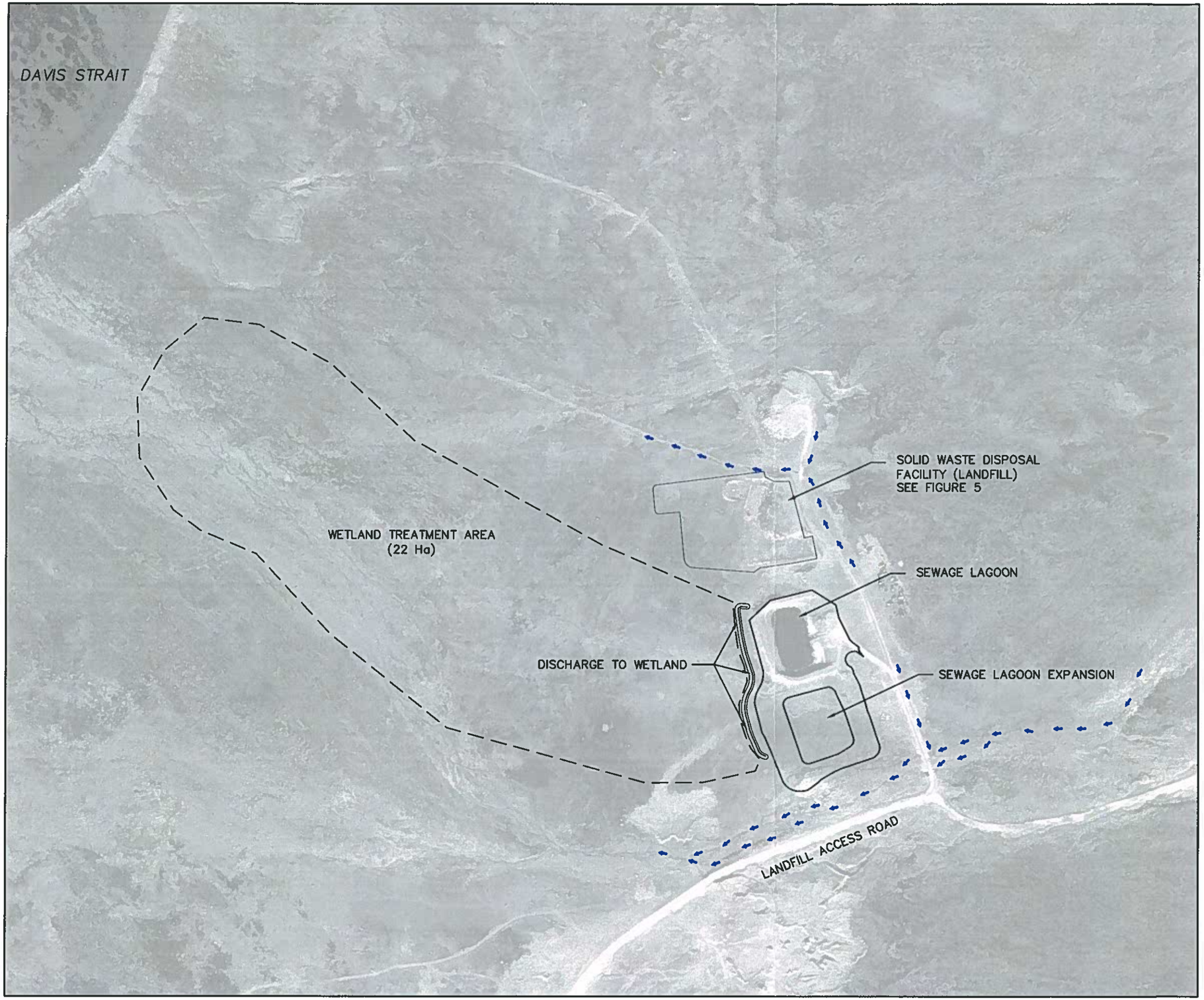


FIGURE 4

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

SEWAGE LAGOON SITE PLAN

LEGEND

INTERPRETED EXISTING SURFACE WATER FLOW DIRECTION

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

N

0 50 100 150 200 250 300 350 400
Metres

1:5,000
August 2010
Project Number: N-O094390

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Darlow

NUNA BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN SEWAGE SP.dwg

Plot Time: Aug 26, 2010 - 2:20pm

4.2 Lagoon Operation Procedures

The following operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq, during lagoon decant and wetland treatment operations:

- Effluent from the Sewage Lagoon Storage Facility shall be decanted to the Wetland Treatment Area via the outlet discharge piping over a 60 day period (approximately 650 m^3/day)
- Decant operations shall occur between June 15th and October 1st, dependant on weather conditions
- The Hamlet of Qikiqtarjuaq shall advise the INAC Inspector at least 10 days prior to starting decant operations of the wastewater lagoon, copy to Nunavut Water Board
- An effluent sample should be collected and submitted to the laboratory for chemical analyses prior to starting decant operations. Analytical results should be submitted to NWB
- To decant; bring a potable generator to site, connect to heat track, when line is thawed open discharge valve, disconnect generator, and when lagoon has been emptied close discharge valve
- During decant operations, the sewage lagoon decant control structures and treatment wetland drainage features shall be inspected daily for defects or blockages, and 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

4.3 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the Hamlet of Qikiqtarjuaq during periodic and 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 in addition to be repaired 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 Hamlet 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 shall occur every 5 to 10 years or as required based on the determination of the sludge thickness.

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

4.4 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 detailed Section 9.0.

Sampling completed by the Hamlet of Qikiqtarjuaq shall be in accordance with the Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan, which is included in Section 10.0.

Monthly and annual volumetric waste quantities estimated based on number of truck deliveries will be recorded in the official operations logbook on a form similar to that presented in Appendix E.

5.0 Operation and Maintenance of the Solid Waste Disposal Facility

Satellite imagery of the Solid Waste Disposal Facility operated by the Hamlet of Qikiqtarjuaq is provided in Figure 5. This Figure illustrates both the drainage pathway of the area adjacent to the Solid Waste Disposal Facility and the proximity to adjacent water bodies (the Davis Strait).

5.1 Solid Waste Collection Procedures

The following solid waste collection operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq on a daily basis (weather dependant):

- Household and commercial solid waste will be collected daily by Hamlet staff and hauled to the Solid Waste Disposal Facility
- Hazardous waste observed by the collection staff shall be segregated in the Hazardous Waste Segregation Facility for later disposal in an approved facility
- Approximate volumes deposited to the Solid Waste Disposal Facility (and trip counts) shall be recorded on the Waste Placement Form similar to the form included in Appendix F
- In the event of an accident, a spill of solid waste or petroleum products or a fire during solid waste collection operations, Environmental Emergency Contingency Plan detailed in Section 8.0 shall be implemented.

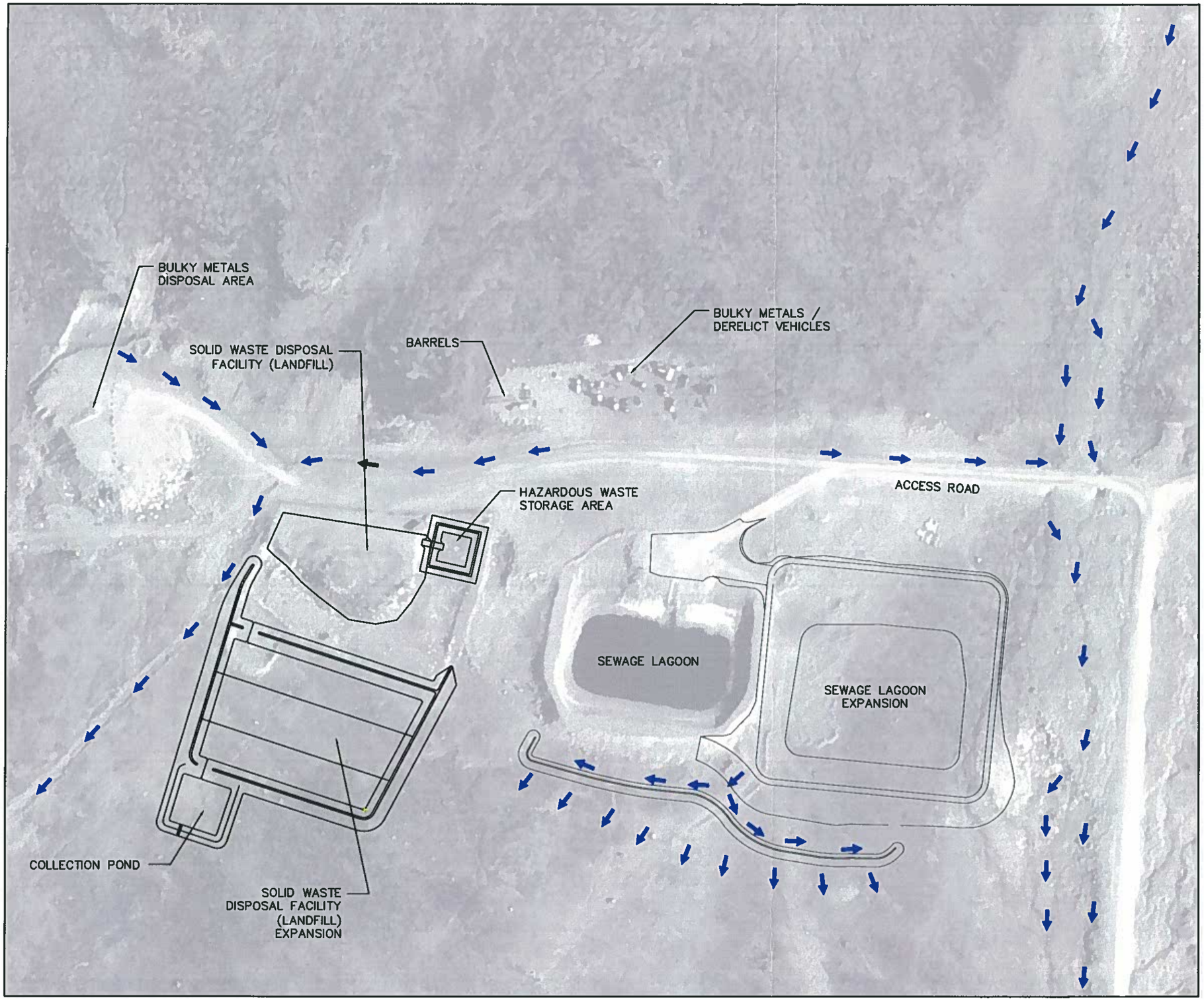


FIGURE 5

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

SOLID WASTE DISPOSAL FACILITY (LANDFILL) SITE PLAN

LEGEND

→ → INTERPRETED SURFACE WATER FLOW DIRECTION

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

N

0 20 40 60 80 100 120 140 160
Metres

1:2,000
August 2010
Project Number: N-O094390

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Darlow

NUNA BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN LANDFILL SP.dwg

Plot Time: Aug 24, 2010-1:27pm

5.2 Landfill Operation

5.2.1 Waste Receiving

The collection vehicles will progress to the tipping area. If possible, wastes should not to be tipped directly onto burning or smoldering waste. Wastes may be tipped or unloaded into the day's burn area as determined by staff (if unlit) or adjacent to the burn area, if lit, smoldering or hot. The staff will perform a cursory inspection of the waste to ensure that it does not contain visible hazardous or bulky waste. If such waste is noted, it will be segregated in the appropriate locations of the approved Hazardous Waste Segregation Facility or the Bulky Waste Disposal Area.

The staff will record the number of trips to the Solid Waste Disposal Facility per day and estimate the approximate quantity in cubic metres on the Waste Placement Form included as Appendix F. If waste is present on site that has been tipped by others, an estimate of the quantity shall be made and recorded. Records are to be delivered to the Hamlet office once per week, where they will be retained on file for inclusion in the Annual Report.

5.2.2 Burning

It has been indicated that the burning of waste is a necessity to prevent odour (since the ability to cover waste is limited due to the short operational season), eliminate flies, and to reduce potential problems with scavengers, such as bears and foxes. In order to minimize the potential for impacts from fires the following rules are to be followed:

- Establish the burn area before each burn and demarcate it with box horses or safety cones. Acceptable burn areas shall be located:
  - At least 15 m away from the hazardous waste segregation area
  - At least 10 m from the fence line, roads and areas that may be visited by the members of the community
  - Not on previously filled areas unless it can be determined that a suitable thickness of cover material is present

- Ensure that the weather is acceptable for burning. The following guidelines are recommended:
  - Wind levels should be checked. If loose paper or debris can be lifted and carried off site (moderate breezes or greater), burning shall be avoided
  - The wind direction should be checked, to ensure that smoke does not drift towards the Hamlet, or workers in the vicinity (i.e., the Sewage Treatment Lagoon)
  - If heavy rain is present, burning should be avoided (as it may result in poor combustion and greater potential to generate by-products).

The site operators shall stay upwind of the fire at all times.

5.3 Landfill Construction and Development

5.3.1 Regular Operation

Prior to waste handling, the equipment operator will confirm that the waste is no longer hot or burning. As required, using a dozer or a loader, the general municipal wastes will be pushed down the landfill slope towards the working face of the landfill, observing the following operating principles:

- All waste shall be removed from the tipping and burn areas
- The waste shall be pushed as close to the intermediate berm or working face as possible, preferably against the intermediate berm or working face. Once the waste is pushed up the intermediate berm, the waste shall become the new working face until a new lift is advanced vertically.

Figures 6 to 12 illustrate the progress for landfill development.

5.3.2 Annual Shaping

Fine shaping of the landfill area will occur once per year, as early in the summer as feasible. During the annual shaping, the surface of the landfill slope will be graded using a dozer and loader so that it has an even grade and the waste will be pushed towards the berm or working face so that the footprint is minimized. The following operating principles should be observed during the annual shaping:

- The waste shall be pushed and packed against the berm and working face
- The waste shall not be pushed any higher than the height of the berm
- The dozer or loader shall make repeated passes down the slope until the landfill slope (i.e., the east slope) is 3:1 or shallower, but not shallower than 10:1 (5%)
- The surface drainage shall remain generally towards the northeast.

Once the final grades of the waste are established, interim cover will be placed over the waste. This will entail importing sand, gravel and cobbles from any convenient borrow location and placing over the waste to a thickness of 0.2 m. A grader may be used to attain a smoother interim surface.

An invert (opening) is present to ensure that water does not accumulate within the landfill base. As necessary due to filling, this invert may need to be re-cut.

If the operator is having trouble with development the landfill slopes at a 3:1, they may elect to develop an interim berm on top of the lift to assist in vertical development (refer to Figures 6 through 12). In areas where the intermediate berm is located on top of an existing lift of waste, the new berm shall be offset from the outside edge of the lower lift by at least 1 m. However, it would be preferable if vertical lifts where avoided, in that they will consume landfill space.

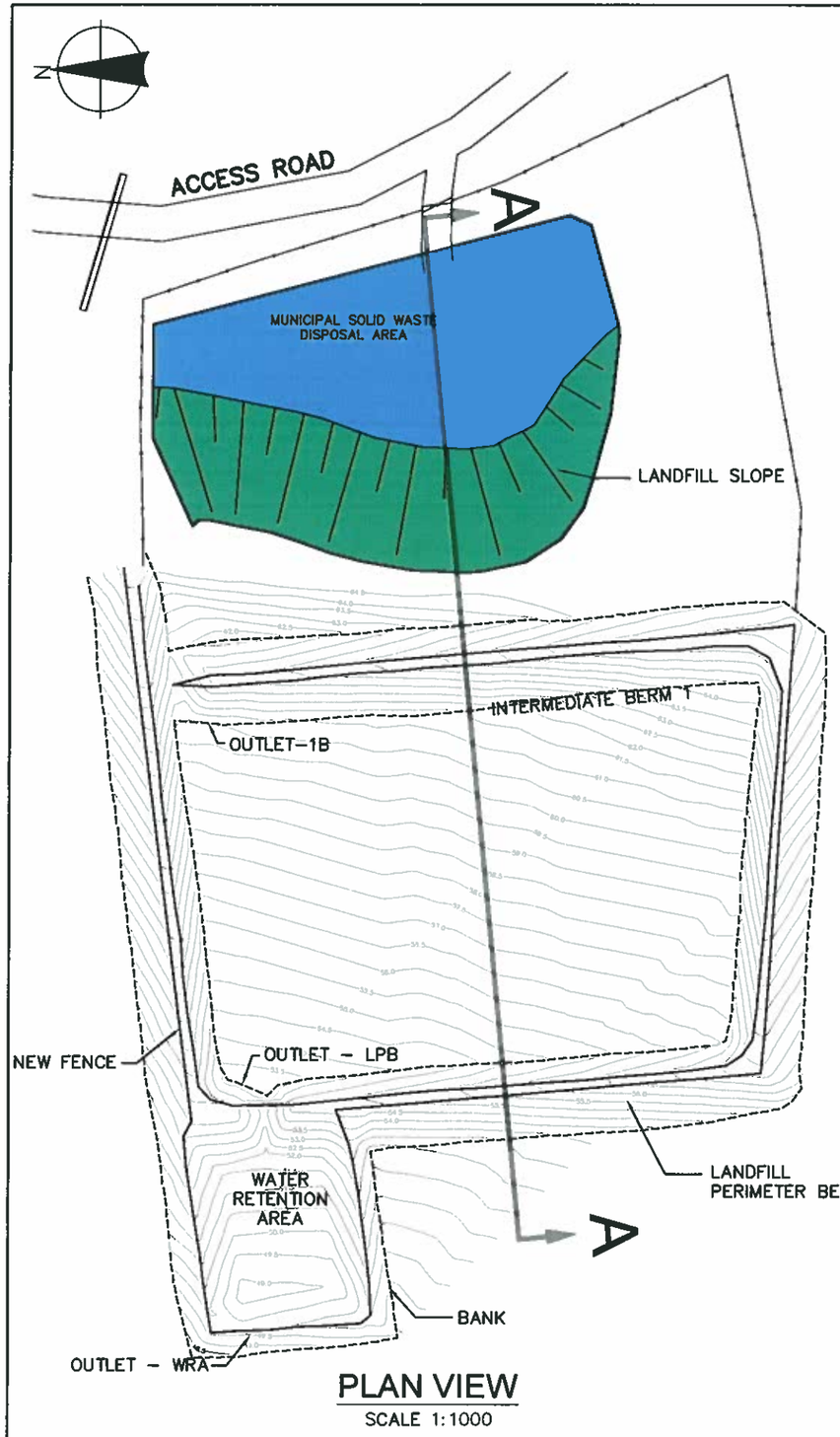
When the waste is at the top of the berm and the landfill slope is 3:1 or shallower, then a new intermediate berm will be constructed approximately 30 m from the toe of the previous intermediate berm. This new berm will form the working face for the next phase of waste placement. As before, the intermediate berm will be constructed using sand, gravel and cobble material from any convenient borrow source. The top of the intermediate berm will be 1 m wide, and the inside slope (landfill side) will be at 2:1, while the outside slope is at a 3:1.

The final configuration of the landfill is shown on Figure 12.

If during the operation, there is a complaint (i.e., odours, smoke in the community), actions will be taken to assess and mitigate the problem. As every situation may be unique, it is important to consider the complaint and address it to the extent possible. Some examples include:

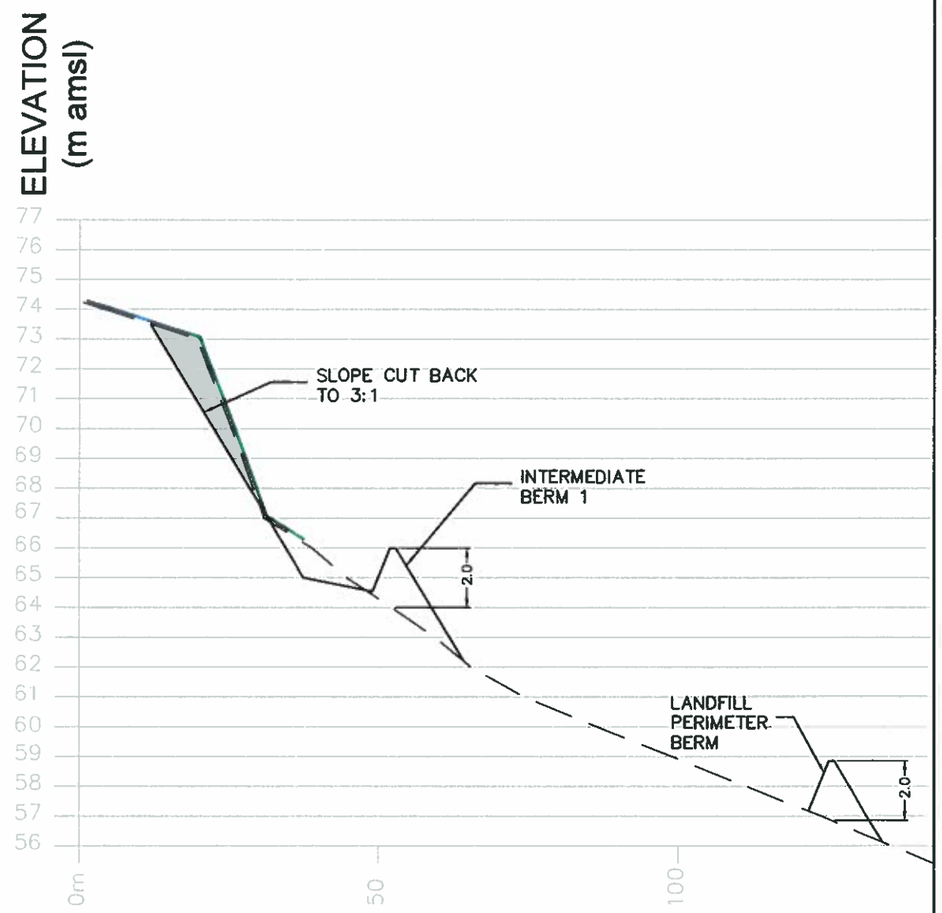
- In the case of odours, cover may need to be applied
- If smoke is drifting towards the community or people in the area, the fire should be extinguished (if possible) and relit when the wind conditions are more favourable
- If leachate is running off the site, it must be contained within the Water Retention Area.

All complaints should be logged and included in the annual report.



PLAN VIEW

SCALE 1:1000



EAST

CROSS SECTION A-A

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

WEST

FIGURE 6

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 1
INITIAL SITE REDEVELOPMENT

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE

0 10 20 30 40 50 60 70 80
Metres

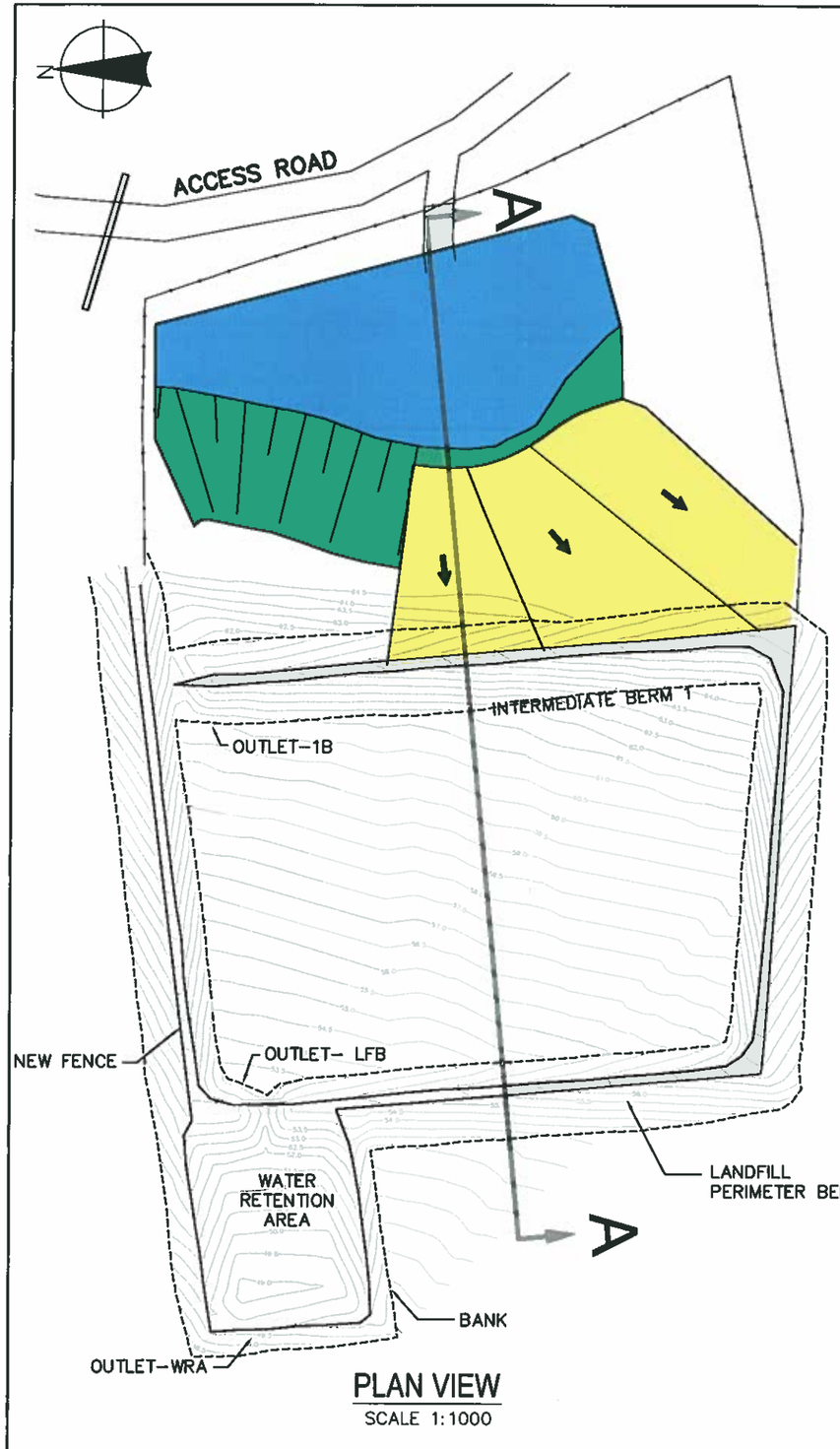
1:1,000
August 2010
Project Number: N-O094390

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

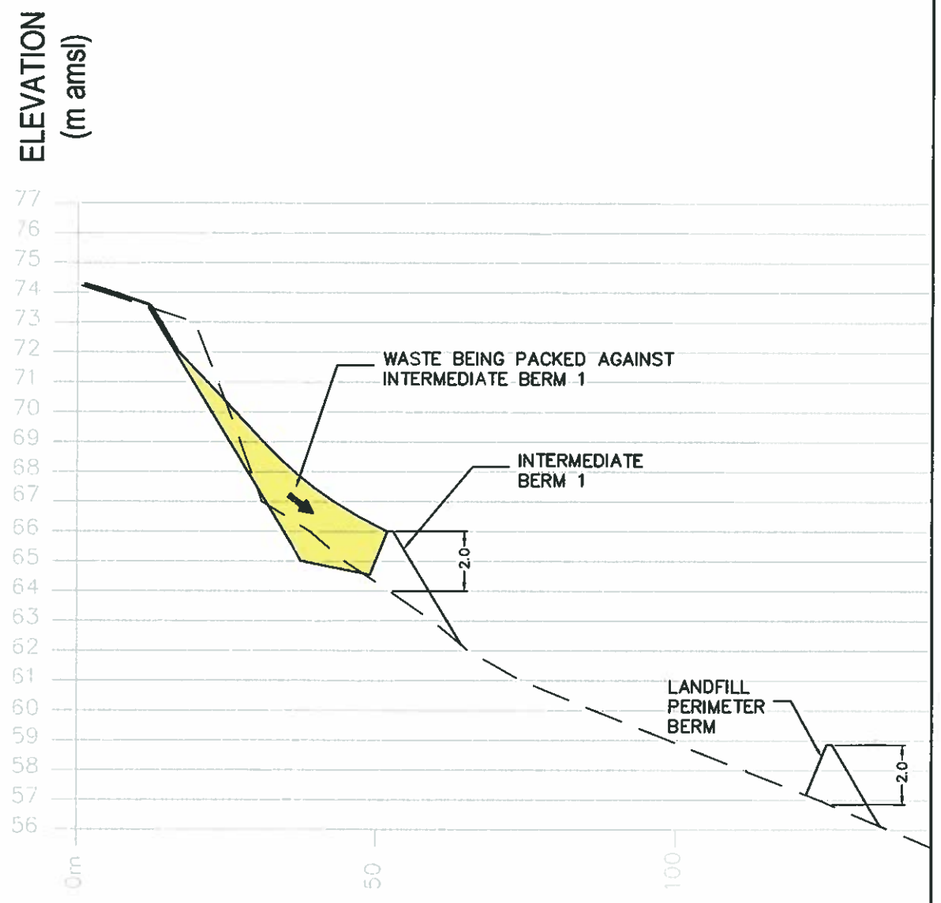
BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 1.dwg

Plot Time: Aug 23, 2010-3:52pm



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 7

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 2
FILL TO INTERMEDIATE BERM 1

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1

0 10 20 30 40 50 60 70 80
Metres

1:1,000
August 2010
Project Number: N-O094390

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

BURNSIDE

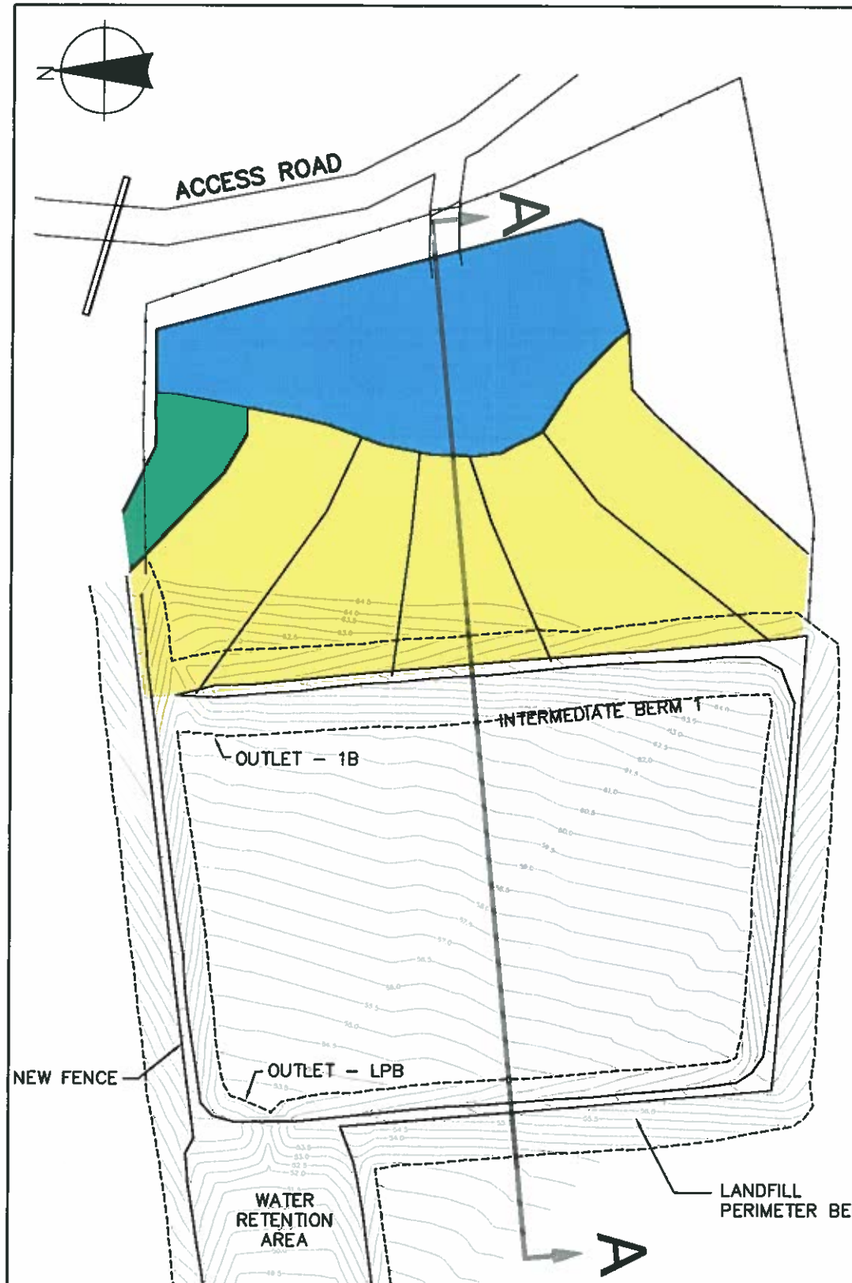
N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 2.dwg

Plot Time: Aug 24, 2010-9:15am

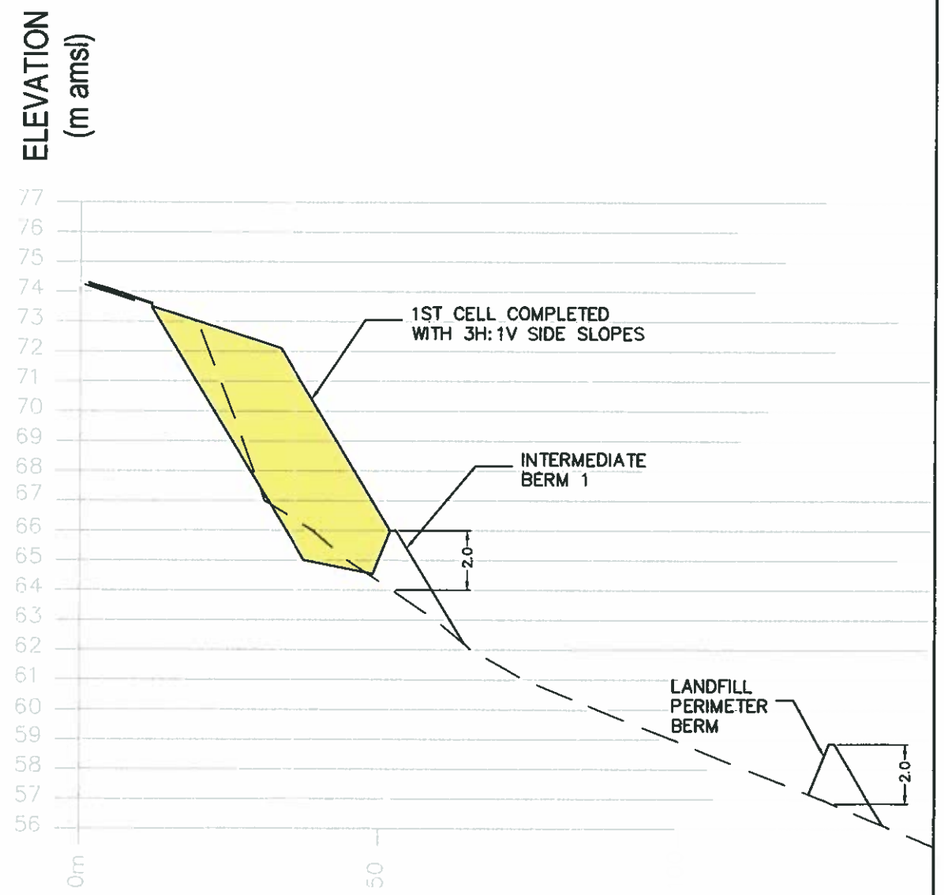
FIGURE 8

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 3
1st WASTE CELL COMPLETED



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1

0 10 20 30 40 50 60 70 80
Metres

1:1,000
August 2010
Project Number: N-O094390

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

BURNSIDE

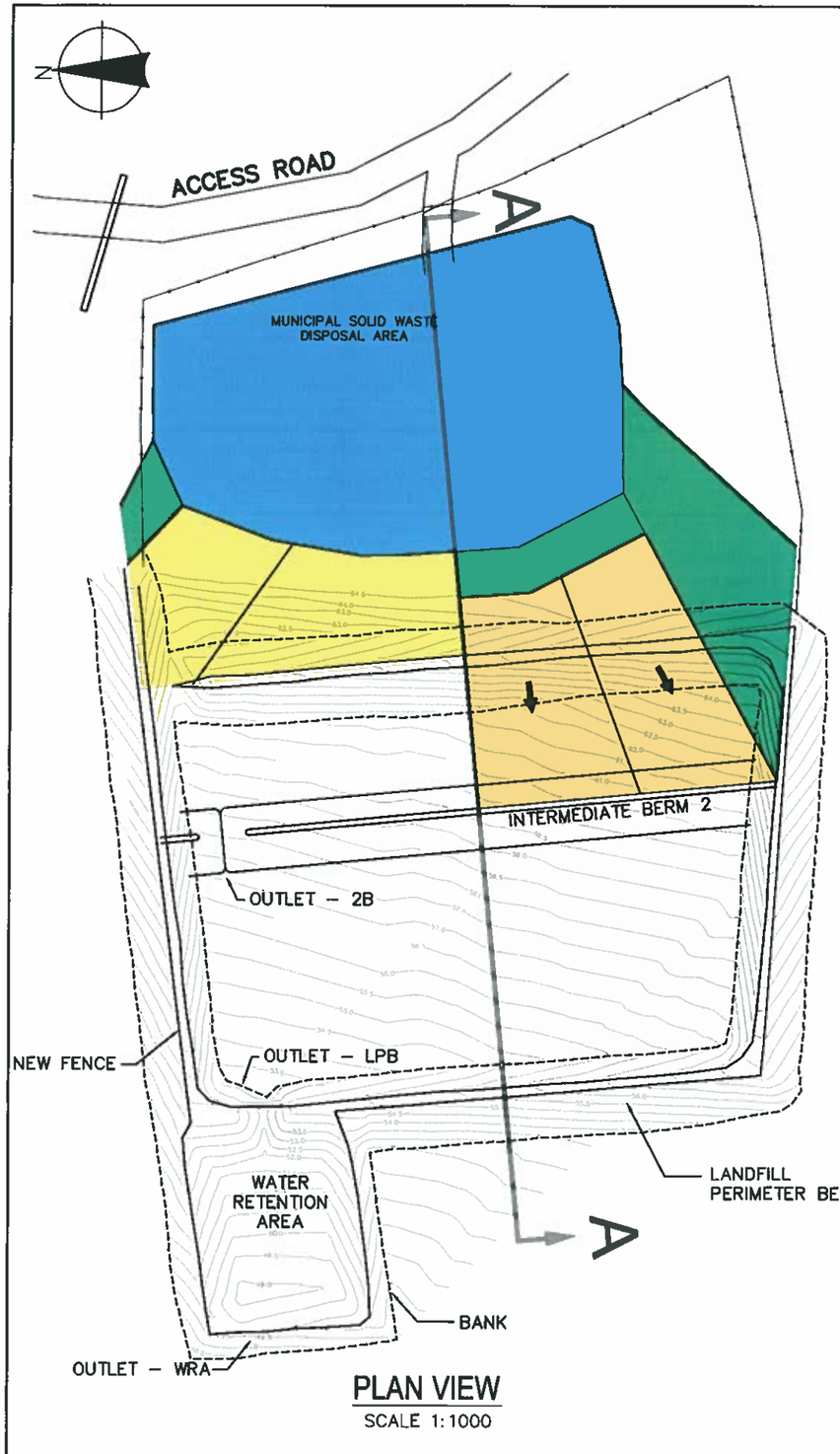
N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 3.dwg

Plot Time: Aug 24, 2010 - 9:26am

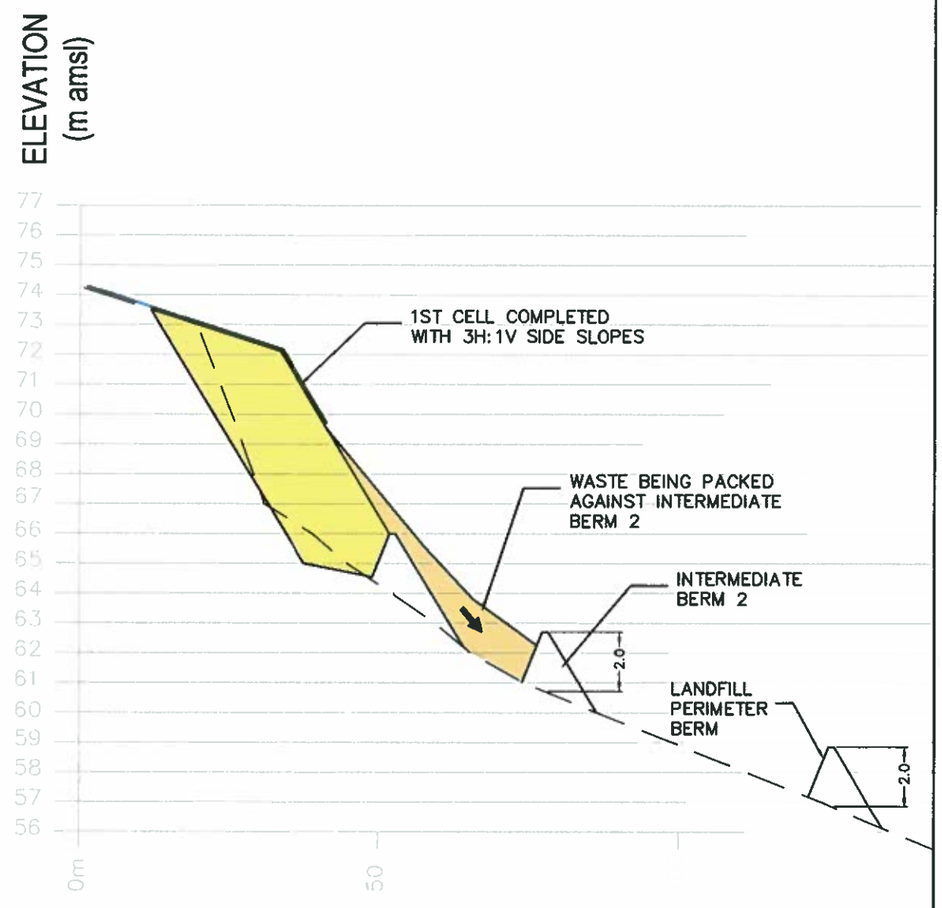
FIGURE 9

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 4
BEGIN FILLING TO INTERMEDIATE BERM 2



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2

0 10 20 30 40 50 60 70 80
Metres

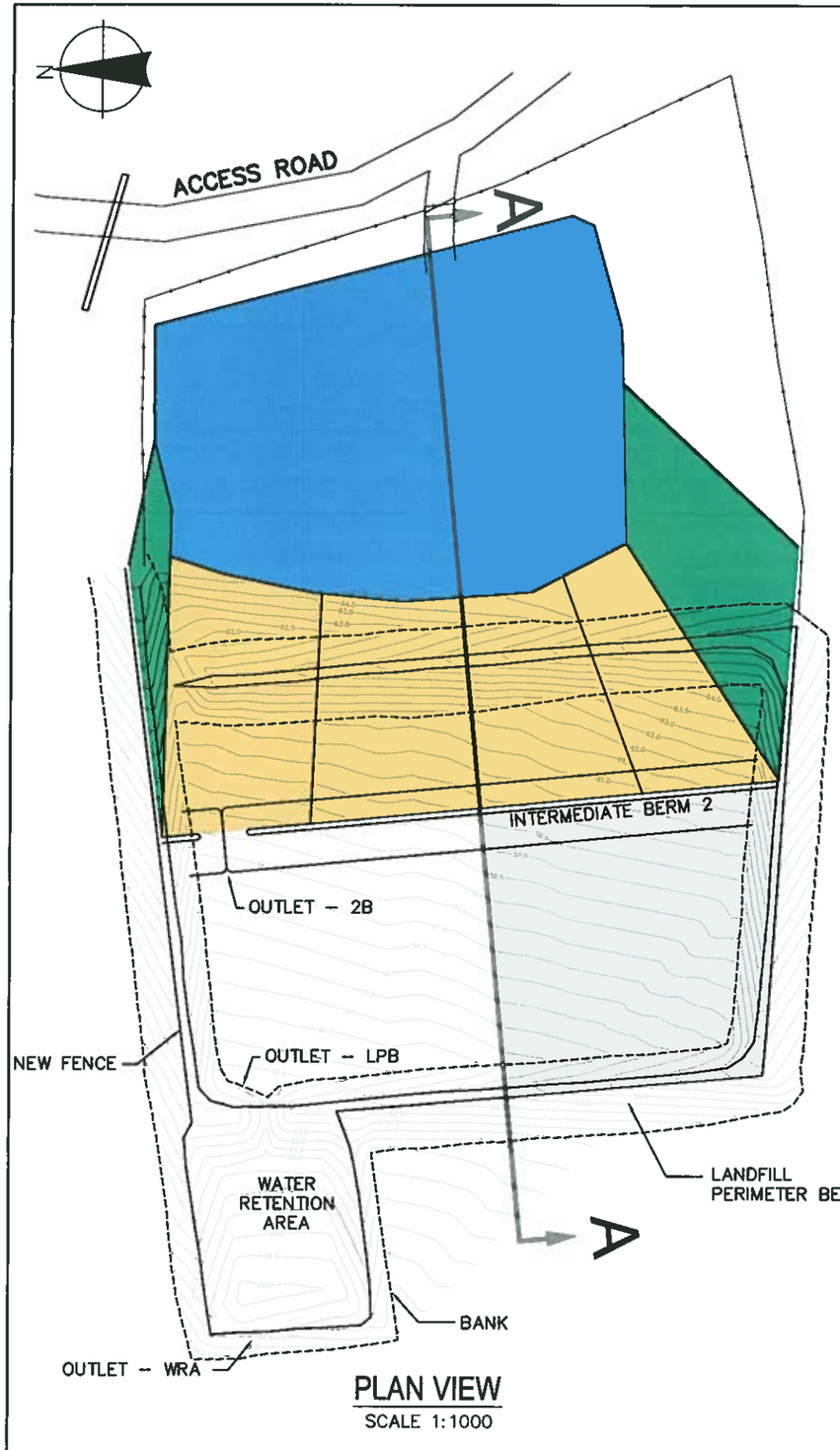
1:1,000
August 2010
Project Number: N-O094390

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

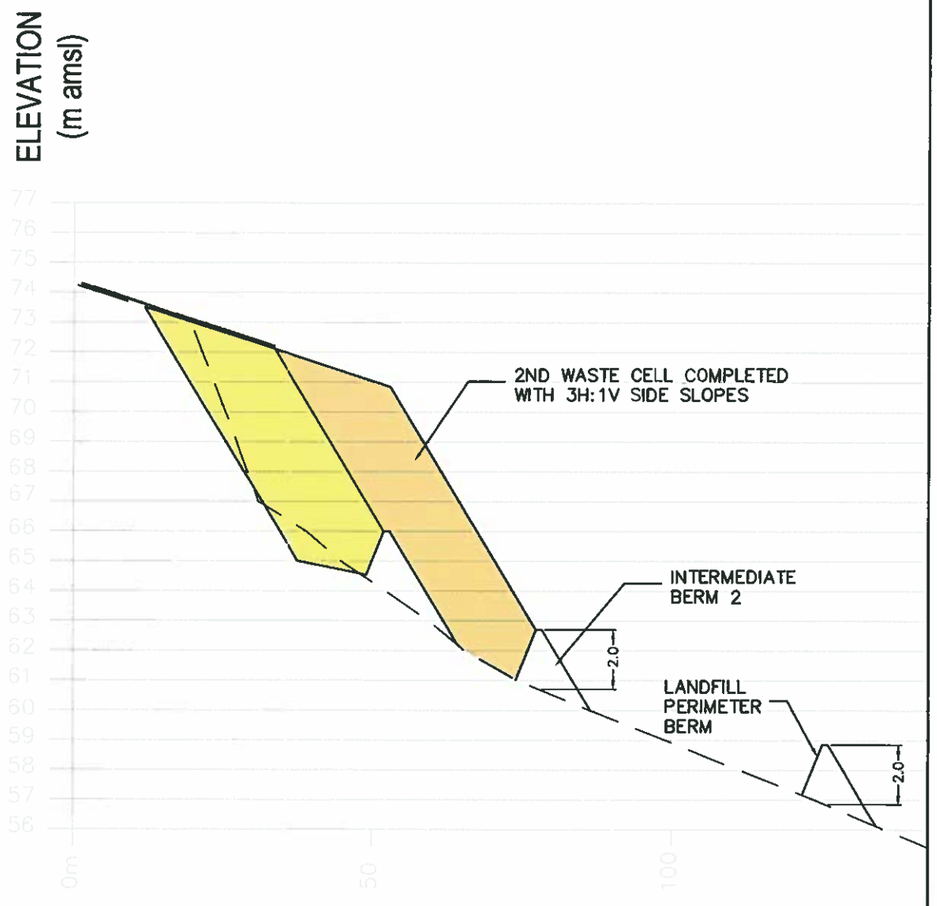
BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 4.dwg

Plot Time: Aug 24, 2010-9:30am



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 10

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 5
2nd WASTE CELL COMPLETED

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2

0 10 20 30 40 50 60 70 80
Metres

1:1,000
August 2010
Project Number: N-O094390

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

BURNSIDE

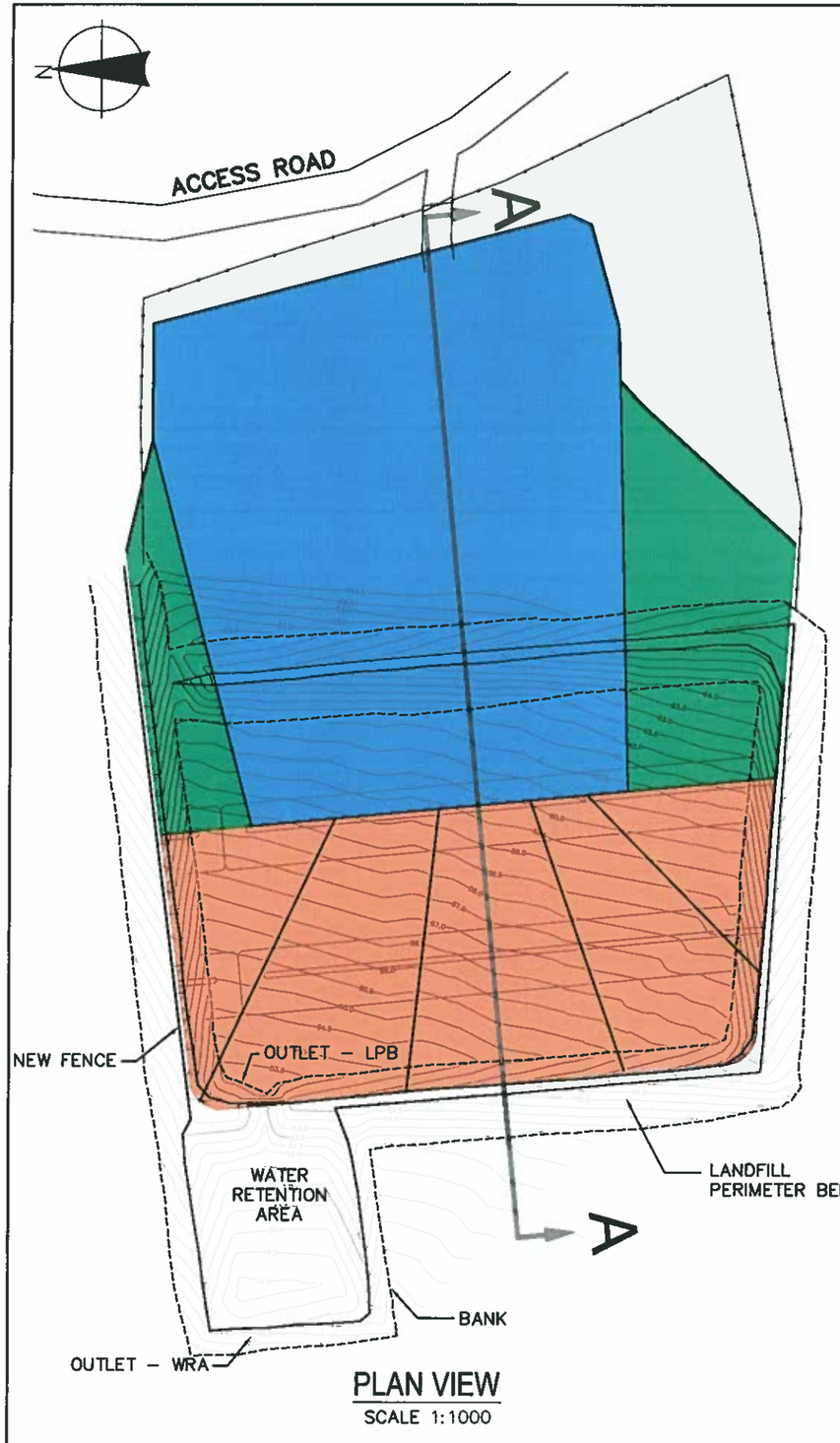
N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 5.dwg

Plot Time: Aug 24, 2010-9:47am

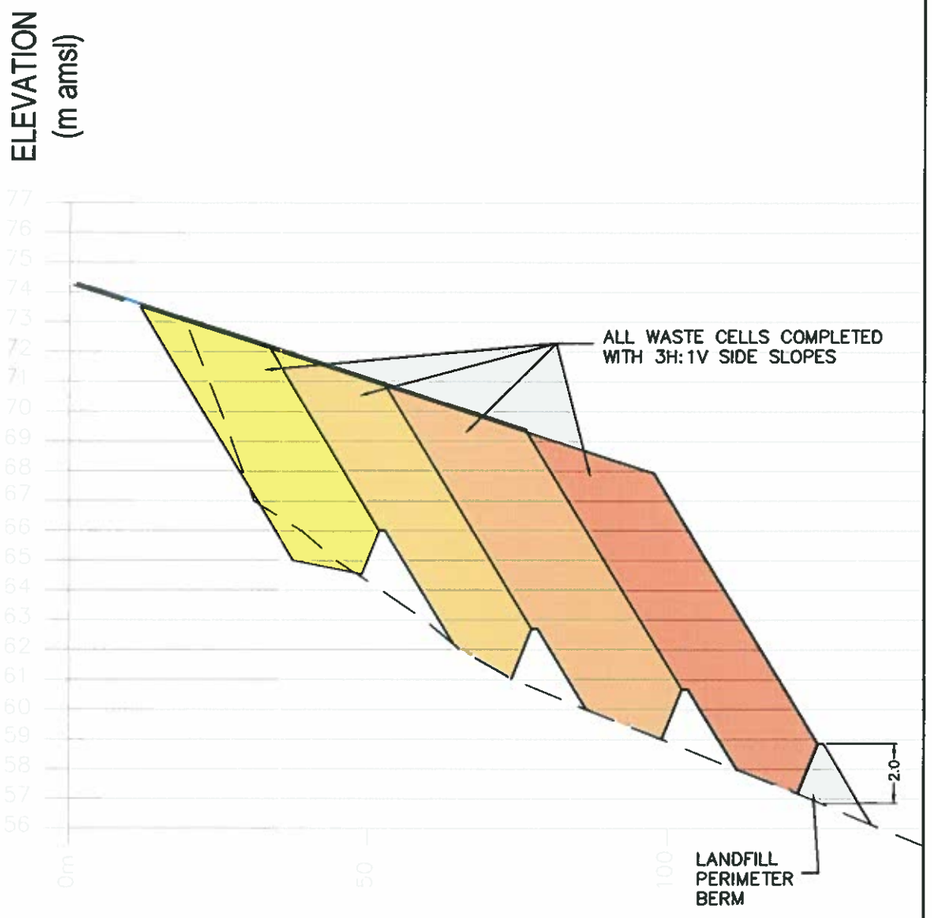
FIGURE 11

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 6
ALL WASTE CELLS COMPLETED



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2
- WASTE CELLS No. 3
- WASTE CELLS No. 4

0 10 20 30 40 50 60 70 80
Metres

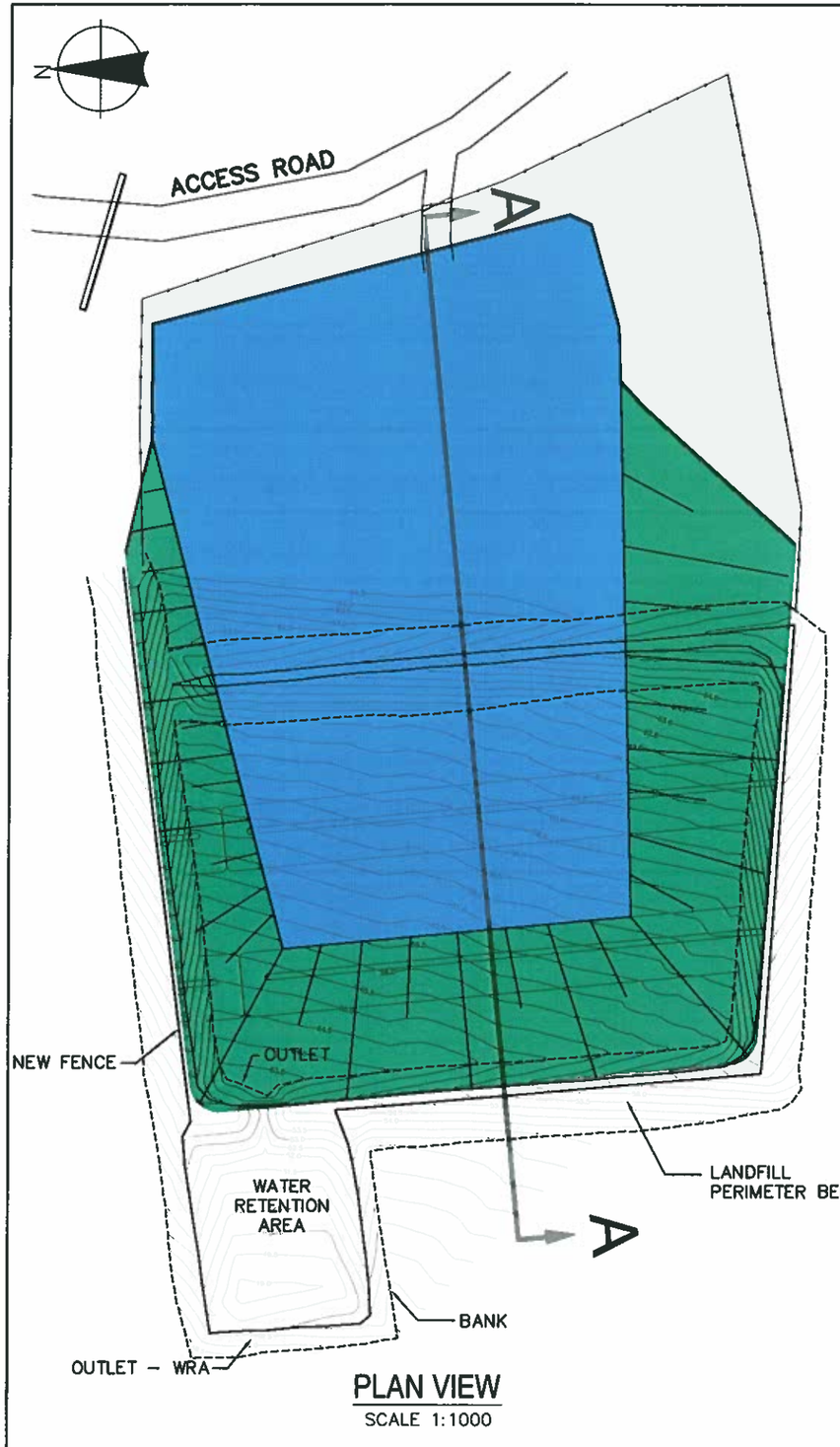
1:1,000
August 2010
Project Number: N-O094390

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

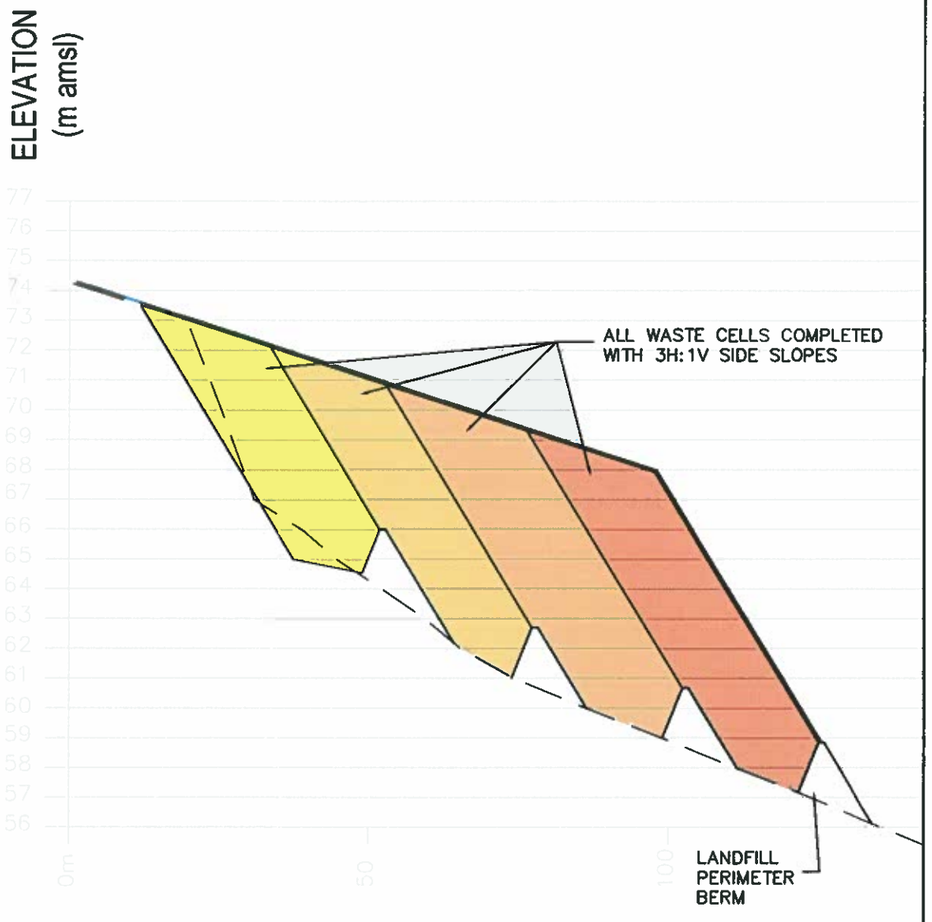
BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 6.dwg

Plot Time: Aug 24, 2010 - 9:50am



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 12

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

LANDFILL DEVELOPMENT 7
FINAL SITE CONFIGURATION

LEGEND

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2
- WASTE CELLS No. 3
- WASTE CELLS No. 4

0 10 20 30 40 50 60 70 80
Metres

1:1,000
August 2010
Project Number: N-O094390

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

NUNA BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN DEVELOPMENT 7.dwg

Plot Time: Aug 24, 2010-9:54am

5.4 Bulky Metals Disposal Area Construction and Development

Periodically metals shall be relocated from the 'scrap yard' and tipped into the Bulky Metals Disposal Area. All bulky metals should be inspected to ensure that they contain no liquids (i.e., gasoline, radiator fluid) or hazardous substances (i.e., batteries). These shall be removed and relocated to the hazardous waste storage area. It is generally recommended that the materials be placed at the bottom of the cell using the access road, instead of tipped over the edge to minimize the potential for damage. As the material accumulates, tipping may be necessary. In this case staff must ensure that all personnel are out of the way, access to any roads along the bottom of the cells should be blocked and the materials shall be carefully pushed over the tip. Wastes should never be tipped directly over the edge, as serious injury may result if vehicles slip over the edge of the slope.

When warranted, cover shall be placed over the bulky metals. Cover material, comprising sand, gravel, cobbles and any locally available material shall be end dumped near the tip and then pushed over the accumulated wastes. Vehicles should refrain from driving on the surface until the slopes are less than 3:1, at which time the surface can be graded until stable.

5.5 Periodic and Seasonal Maintenance Procedures

The staff shall undertake weekly inspections and repair any items that are noted. A weekly inspection form is included in Appendix F. This will include the following activities:

- The roadway and truck pad shall be maintained by snow clearing in the winter and grading in the summer, and repaired as necessary
- Ditches and drainage channels shall be inspected for erosion, and repaired as necessary
- Site warning signage, which identifies the boundaries of the Solid Waste Disposal Facility (which includes the Municipal Solid Waste Disposal Area, Hazardous Waste Segregation Area and the Bulky Metals Disposal Area) shall be inspected, and repaired or replaced as necessary
- Any airborne litter outside of the litter-control fences (which are located on top of the berms at the Facility) shall be removed, and deposited to the Municipal Solid Waste Disposal Area, or as required
- Litter that has accumulated against the fences shall be removed and placed into the Municipal Solid Waste Disposal Area

- After rain events and following the spring thaw, inspect that site for leachate breakout. Cover the face if possible and ensure that leachate is being contained within the water retention area
- The berms and final cover at the Solid Waste Disposal Facility shall be inspected for erosion and settlement
- The fences at the Solid Waste Disposal Facility shall be inspected for damage, and repaired as necessary.

All details of any repairs shall be reported in the Annual Report.

5.6 Facility Monitoring Procedures

As outlined in the NWB water license, regular monitoring of runoff from the Solid Waste Disposal Facility is required. A detailed Monitoring Plan is included in Section 9.0.

It is recognized that it may take some time for results to be received from the appropriate laboratory. In the event that the water retention area fills to the invert with water, it should be inspected for odours, stain, or signs of visible impact (sheens, floating garbage). The invert may be blocked to facilitate additional water accumulation in this case, until the results are received.

Water sampling completed by the Hamlet of Qikiqtarjuaq shall be in accordance with the Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan which is included in Section 10.0.

Results of analytical testing and monitoring are to be recorded on a regular basis by the 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.

Monthly and annual quantities of solid waste offloaded will be estimated and recorded on the Waste Placement Form (Appendix F).

6.0 Emergency Procedures

The Guidelines for the Preparation of an Operation and Maintenance Manual for Water, Sewage and Solid Waste Disposal Facilities in the Northwest Territories requires that the Operation and Maintenance Report include procedures to respond to emergencies. The following emergency procedures are considered:

Worker injury

In the event of a worker injury:

- Apply first aid
- Seek medical assistance, if necessary
- Report the injury to the employer
- Fill out all necessary forms regarding the necessary.

Spills

In the event of a liquid spill, prevent the flow of wastes to water courses with earthern dykes or other methods. If the spill can be collected (i.e., if pooled) scoop up and store in drums in the hazardous waste disposal area. If the spill has soaked into the ground, attempt to remove stained or impacted soil and store in drums.

Fires

In the event that grass or tundra does catch on fire, assess the situation. Do not attempt to fight a fire if it cannot be done safely. Standard fire fighting equipment available in the Hazardous Waste Depot can manage most small fires. Alternatively, sand and gravel can be thrown onto the fire either by hand, or by using available equipment (i.e., loader). Obtain help as necessary.

7.0 Annual Reporting

An annual report shall be prepared and submitted to the Nunavut Water Board not later than March 31st each year, in compliance with Part B, Condition 1, of the Hamlet's Water License. The report shall include:

- analytical test results from monitoring program
- monthly and annual quantities of fresh water obtained from the River
- monthly and annual quantities of all wastewater discharged
- an estimate of the quantity of material received at the solid waste disposal site
- an overall description of the activities that occurred at the facility throughout the year
- a description of any maintenance or improvements that were completed at the site throughout the year
- a list of any complaints and actions taken to address them
- a summary of any abandonment and restoration work completed during the year and any work anticipated for the next year.
- a list of unauthorized discharges and summary of follow-up action taken

An example of the Annual Report is included in Appendix J.

8.0 Environmental Emergency Response Plan

8.1 Introduction

8.1.1 Purpose of Plan

The impacts of spills can be catastrophic and may threaten or damage the environment, especially water resources. As such, the Government of Nunavut (GN) requires contingency plans to be written and fully implemented. The purpose of this Environmental Emergency Contingency Plan is to provide a plan of action for all spills of sewage, solid waste, and petroleum products that may occur as a result of water supply and distribution, sewage collection and treatment, and solid waste collection and disposal operations undertaken within the Hamlet of Qikiqtarjuaq, Nunavut.

This Environmental Emergency Contingency Plan will assist in implementing corrective options quickly to minimize environmental damage. Furthermore, it defines the responsibilities of key personnel and outlines procedures to effectively and efficiently contain and recover spills of sewage, solid waste, and petroleum products arising from water, sewage, and solid waste; collection, transportation, storage, and treatment operations. It will assist the Hamlet in meeting the regulatory requirements related to reporting events to the appropriate authorities within the prescribed time period.

Sewage, solid waste, and petroleum, oil and lubricating (POL) products that currently, or potentially, fall within the Scope of this *Environmental Emergency Contingency Plan* are as follows:

- Sewage (as defined in the Nunavut Water Board (NWB) water license)
- Solid waste (as defined in the Nunavut Water Board (NWB) water license)
- Gasoline
- Diesel fuel
- Hydraulic fluid
- Lubricating oil.

8.1.2 Objectives

The objectives of this Emergency Spill Contingency Plan are to:

- Provide a plan including procedures so that the Hamlet and their Incident Spill Response Team can rapidly respond to a spill situation and minimize injury to individuals and environmental damage
- Comply with all existing regulations

- Cooperate with other groups and agencies
- Be prepared and able to provide an integrated team approach with all involved departments and agencies
- Keep staff, government officials, and Hamlet residents informed.

8.1.3 Hamlet of Qikiqtarjuaq Environmental Policy

It is the policy of the Hamlet of Qikiqtarjuaq to fully comply with all applicable legislation to ensure the protection of the environment of the territory of Nunavut. The legislation includes, but is not limited to, the:

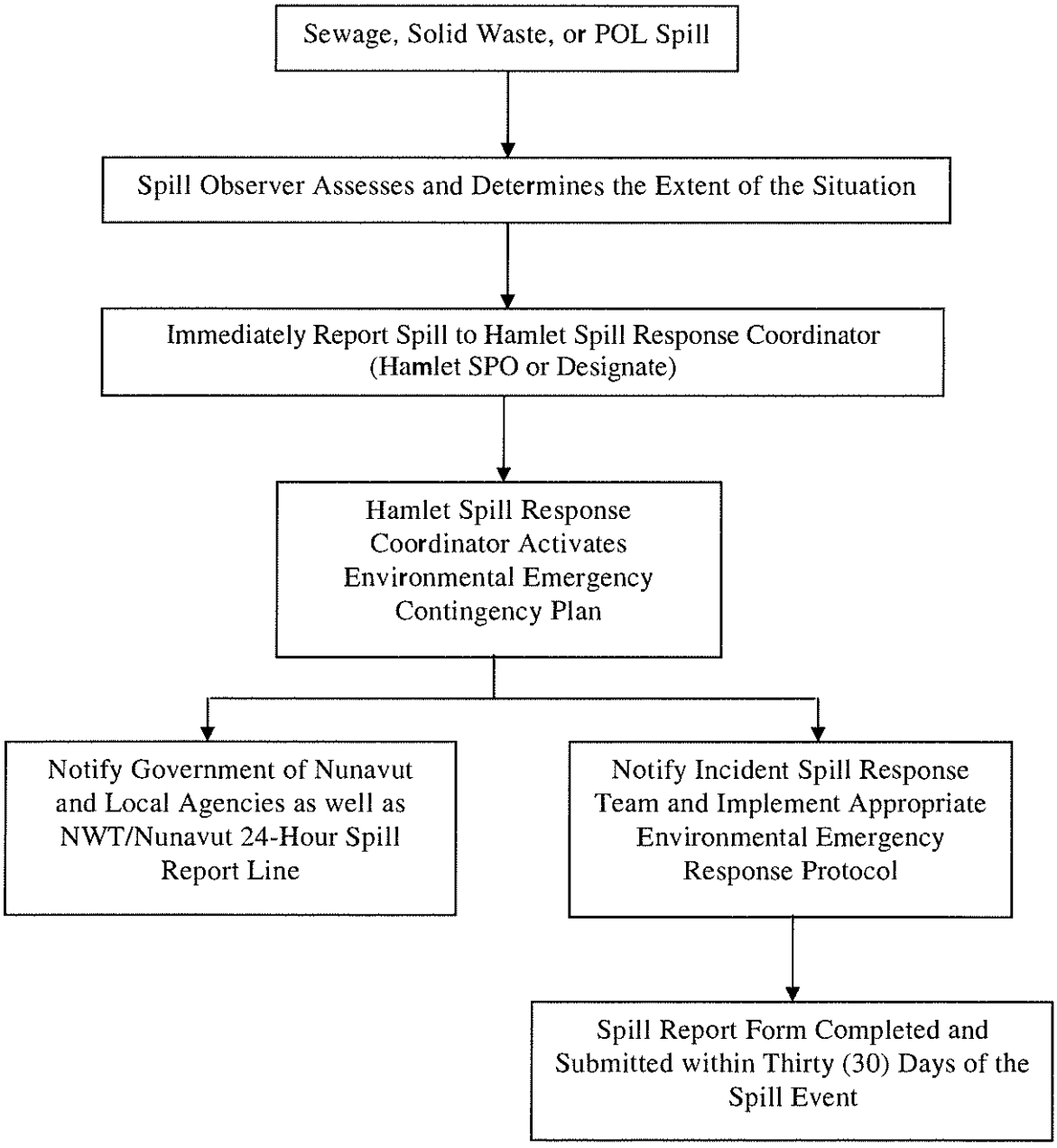
- Environmental Protection Act, Section 34 – Spill Contingency Planning and Reporting Regulations

- Nunavut Waters and Nunavut Surface Rights Tribunal Act.

The Hamlet will cooperate with other groups committed to protecting the environment and shall ensure that Hamlet employees, regulatory authorities, and the public are informed on the policies and procedures developed to help protect the environment and the citizens of the Hamlet of Qikiqtarjuaq.

8.2 Spill Response Organization

The following is a flow chart to illustrate the sequence of events that must be followed in the event of a sewage, solid waste, or POL spill occurring during supply, distribution, collection, transportation, storage, and treatment operations:



Emergency Response Flow Chart

8.2.1 Incident Spill Response Team

The Hamlet Senior Administrative Officer (SAO) or his/her Designate will serve as the Spill Response Coordinator for the Hamlet in the event of a sewage or POL spill during collection and transport operations. The SAO of the Hamlet of Qikiqtarjuaq will appoint and train appropriate personnel to make up the Incident Spill Response Team, which normally consist of the following personnel:

- Spill Response Coordinator Hamlet SAO (or Designate)
- Hamlet Works Personnel Will generally vary from 3-7 people throughout the year

The responsibilities of the Spill Response Coordinator are as follows:

1. Assume complete authority over the spill scene and coordinate all personnel involved
2. Evaluate the spill situation and develop overall plan of action
3. Activate the *Environmental Emergency Contingency Plan* for the Hamlet of Qikiqtarjuaq
4. Immediately report the spill to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130, and other applicable regulatory or assistance agencies
5. Provide regulatory agencies with information regarding the status of the clean-up activities
6. Act as a spokesperson on behalf of the Hamlet of Qikiqtarjuaq with regulatory agencies, the public, and the media
7. Prepare and submit a report on the spill incident to regulatory agencies within 30 days of the event.

8.2.3 Contact Information

A complete listing of contact information, including telephone numbers of standard regulatory agencies, Hamlet personnel, and assistance agencies who may be contacted to supply resources, expertise, and advice needed to deal with a spill emergency is included in Appendix G.

8.3 Spill Reporting Procedure

The Spill Response Coordinator must be notified immediately by any individual who is aware of any spill either by phone, radio, or in person.

The following is the incident reporting procedures once the Spill Response Coordinator activates this Environmental Emergency Spill Contingency Plan:

1. Report spill immediately to the 24-Hour NWT/Nunavut Spill Report Line Phone (867) 920-8130 (Section 4.1)
2. Report immediately to the INAC Manager, Water Resources in Iqaluit at (867) 975-4550
3. Notify Hamlet of Qikiqtarjuaq Fire Department
4. Fill out the NWT/Nunavut Spill Report Form (Appendix H) within thirty (30) days of the spill event occurring.

8.3.1 NWT/Nunavut Spill Report Line

All spills as defined in this document must be reported immediately to the 24-hour NWT/Nunavut Spill Report Line. Gather the following information prior to making the call:

- Date and time of spill (if known)
- Location and map coordinates (if known) and direction of flow of spill materials if moving
- Party responsible for spill
- Product/material spilled and estimate of the quantity
- Cause of spill
- If the spill has been stopped or if it is continuing
- Extent of contaminated area
- Factors affecting spill or recovery, such as weather conditions or terrain
- If containment of spill is available
- Action taken or proposed
- If assistance is required
- Possible hazards to person, property or environment (e.g. fire, drinking water, fish, wildlife, etc.).

The information collected should be brief, and quick estimates made so the Spill Report Line and the Spill Response Coordinator can assess the situation. The information is similar to that required in boxes B, D, E, F, G, H, I, J, K, L, M, N, O, and P on the spill report form that must be completely fill out in thirty days, and available in Appendix H.

8.4 Action Plans

8.4.1 Initial Action

The instructions to be followed by the first person on the spill scene are as follows:

1. Always be alert and consider your safety first

2. If possible, estimate the volume of material that has been spilled
3. Assess the hazard of people in the vicinity of the spill
4. If possible, and safety permits, attempt to stop the release of product to minimize potential for environmental impacts
5. Immediately report the spill to the Spill Response Coordinator
6. Resume any effective action to contain, mitigate, or terminate the flow of the spilled material.

8.4.2 Environmental Health Protection and Mitigation Measures

The environmental protection and mitigation measures outlined in the following sections are to be taken by all personnel responding to a spill event and to reduce the chance of environmental impairment and health hazards due to spill, release, or other incident.

8.4.3 General Procedures

The following general clean-up procedures shall apply for all spill areas within the Hamlet:

- Always wear personnel protective equipment (PPE)
- Smoking is prohibited during all spill response activities
- Eliminate all ignition sources
- Contain spills on soil or rock by construction of earthen dykes using available material. If soil is not available, place sorbent materials or a boom in the path of the spill. As the sorbent barrier becomes saturated, continually replace it. Fuel or other liquids lying in pools, or trenches are to be removed with pumps, buckets, or skimmers
- If the ground is snow covered, create snow dykes, and line with a chemically-compatible liner for containment and recover of liquid
- For fuels on water, deploy containment booms, and recovery as much fuel as possible with a work boat and skimmer if the area has less than $1/10^{th}$ ice cover. If the area is ice infested, burn any fuel spills using igniters
- Apply sorbets, if necessary
- Assess potential for disturbance of wildlife, fish, and archaeological sites by spill or clean-up operations
- Notify environmental authorizes to discuss available and feasible disposal and clean-up options
- Conduct required clean-up operations
- Assess and appropriately treat any areas disturbed by clean-up activities with laboratory testing
- Ensure the site has been completely restored and cease operations, only when all work is finalized and laboratory testing confirmed.

Specific procedures relating to mitigating measures for specific contaminants following below:

8.4.4 Mitigative Measures: Gasoline, Diesel Fuel, Hydraulic Fluid, Lubricating Oil and Aviation Fuel

If possible, and safety permits, stop the flow of product, which is occurring, and eliminate all ignition sources. ***Smoking is prohibited during all spill response activities.***

POL Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill after all vapors have dissipated
- Remove the spill by using absorbent pads or excavating the soil, gravel or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

POL Spill On Water

- Use containment boom to capture spill for recovery after vapors have dissipated
- Use absorbent pads to capture small spills
- Use a petroleum skimmer for larger spills.

POL Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using absorbent pads or particulate sorbent material
- The contaminated ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

POL-Contaminated Material Storage and Transfer

- All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

8.4.5 Mitigative Measures: Ethylene Glycol Antifreeze

If possible, and safety permits, stop the flow of product, which is occurring.

Ethylene Glycol Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill
- Remove the spill by using absorbent pads or excavating the soil, gravel, or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

Ethylene Glycol Spill on Water

- Use containment boom to capture spill, and pump contaminated water into 205 L drums.

Ethylene Glycol Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using particulate sorbent material
- The contaminated sorbent material, ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

Ethylene Glycol Storage and Transfer

- All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

8.4.6 Mitigative Measures: Sewage

If possible, and safety permits, stop the flow of product, which is occurring.

Sewage Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill, and to prevent sewage from entering any water body

- Remove the spill by using vacuum trucks or excavating the soil, gravel, or snow
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

Sewage Spill into Water

- Use containment boom to capture spill, and pump contaminated water into vacuum trucks
- Deposit contaminated water to the Hamlet sewage lagoon
- Monitor the affected water body sampling at a minimum for Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), ammonia (NH_3), and faecal coliforms (FC).

Sewage Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spilled sewage and contaminated snow and ice to the Hamlet sewage lagoon.

Sewage Storage and Transfer

- All contaminated water, ice, snow, soil, and clean-up supplies will be deposited to the Hamlet sewage lagoon or landfill facility, as appropriate.

8.4.7 Mitigative Measures: Solid Waste

Solid Waste Spill on Soil, Gravel, Rock, or Vegetation

- Physically remove the spilled solid waste from the waste, and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

Solid Waste Spill into Water

- Use containment boom to capture soil for recovery
- Physically remove the spilled solid waste from the water, and deposit to the approved Hamlet Solid Waste Disposal Facility
- Capture any sheen from the water using absorbent pads or skimmer, and deposit any used absorbent pads to the approved Hamlet Solid waste Disposal facility.

Solid Waste Spill on Ice and Snow

- Build a containment berm around spill using snow
- Physically remove the spilled solid waste and deposit to the approved Hamlet Solid Waste Disposal Facility

- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

Disposal
Any solid waste shall be removed to the approved Hamlet Solid Waste Disposal Facility.

8.4.8 Spill Recovery Assessment

In order to determine whether a spill has been successfully remediated, samples of the soil and/or water within the spill containment area and surrounding the area, are to be collected and sent to an accredited Canadian Association of Environmental Analytic Laboratories (CAEAL) laboratory to be analyzed for the chemical parameters contained in the spill material. If concentrations of the spill chemicals are not detected, or are at concentrations below the applicable Territorial, Federal, or CCME regulations/criteria, the spill clean-up will be determined a success. Clean-up operations may then cease.

8.5 Spill Response Resource Inventory

8.5.1 Additional Personnel Available

In addition to Hamlet staff, approximately 10 people are available from the Qikiqtarjuaq Fire Department, to assist in spill response and clean-up activities. Personnel from the local RCMP Detachment will be available for securing the site form unauthorized individuals, closing roads, etc. The Community Health Centre have personnel to assist in the treatment of anyone injured during the emergency.

8.5.2 Spill Response Equipment Inventory

Equipment available within the community to assist in responding to a hazardous materials spill includes heavy equipment (i.e. vacuum trucks, dozer, front end loader, and grader), as well as various hand held tools including shovels. In addition, three spill kits should be available on site during spill incident response operations. Each spill kit should contain the following supplies.

Composition of Spill Kit

	Quantity
• 360 litre polyethylene over pack drum	1
• oil sorbent booms (5" X 10')	6
• oil sorbent sheets (16.5" X 20" X 3/8")	100

- drain cover (36" X 36" X 1/16") 1
- Caution tape (3" X 500') 1
- 1 lb plugging compound 1
- Nitrile gloves (pair) 4
- Safety goggles (pair) 4
- Tyvek coveralls (pair) 4
- instruction booklet 1
- printed disposable bags (24" X 48") 10

Sorbent capacity of each spill kit is 240 litres.

All equipment is generally stored at the Hamlet Operations Yard/Garage. Some equipment may be stored in other areas throughout the community while being used to complete tasks.

8.6 Training

All employees working for the Hamlet of Qikiqtarjuaq should be trained in the safe operation of all machinery and tools to help prevent sewage and hazardous material spills. All employees on site should also be trained for initial spill incident response. Annual refresher exercises should be conducted to review the procedures of this Environmental Emergency Contingency Plan, with all individuals involved in the Incident Spill Response Team, including members of the local volunteer fire department, RCMP Detachment, and Community Health Centre.

Incident Spill Response Team training should include the following aspects:

- Spill awareness and prevention
- Methods of detection
- Types of spills and seasonal considerations
- Reporting procedures and initial responses
- Spill response kit familiarization
- Clean-up and site remediation methods
- Occupational health and safety including proper selection and use of PPE's.

8.7 Annual Review of this Environmental Emergency Contingency Plan

As part of the preparation of the Annual Report to the Nunavut Water Board for the Water License, the Hamlet should review and update the information contained within

this plan. The purpose of the update is to ensure all changes to regulations are incorporated into this plan, along with the use of any new technology or method advances, to prevent or stop a spill and to mitigate and/or remediate a spill. This ensures that the plan adapts as the Hamlet grows, to ensure the community is properly prepared in the event of an incident.

Finally, it is recommended that annual refresher training of personnel be completed after any revisions to this document have been approved. This will familiarize personnel with the updated plan, and to provide a rapid and coordinated response.

9.0 Summary of Monitoring Program

9.1 Introduction

The following summarizes the Monitoring Program for the Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility servicing the Hamlet of Qikiqtarjuaq, in Nunavut. The monitoring program is based on the requirements contained in the Nunavut Water Board (NWB) License NWB 3BM-QIK0712, issued on May 9, 2007.

9.2 Monitoring Program Station Locations

The attached Figures 13 and 14 show the monitoring program station locations for the Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility. It should be noted that Station Numbers QIK-4 and QIK-5 have not been included, as these locations are abandoned and "Not Active." Station Numbers QIK-9, QIK-10 and QIK-11 have also not been included since drainage has been revised and there is no drainage swale between the sewage lagoon and solid waste facility. These locations should be identified as "Not Active."

The table below summarizes the GPS coordinates for the monitoring program stations. The coordinates are in NAD83, UTM Zone 20.

Table 9.1: GPS Coordinates of Monitoring Locations

Monitoring Station Number	Easting	Northing
QIK-1	458985	7493360
QIK-2	458744	7493456
QIK-3	458982	7494959
QIK-6	458864	7494925
QIK-7	457997	7495520
QIK-8	458760	7495167
QIK-12	458113	7495337
QIK-13	459020	7495056
QIK-14	458730	7495205
QIK-15	458865	7495307

9.3 Sampling and Testing Requirements

The attached Table 9.2 summarizes the sampling and testing requirements. It should be noted that QIK-6 shall be considered the "final discharge point" until QIK-12 is established (Wetland Treatment Area is commissioned).

Any additional analytical parameters which are identified by an Inspector (as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*) or by a Public Health Inspector (as defined by the *Public Health Act* (1992)) shall also have samples collected and analyzed.

9.4 Effluent Quality Standards

The attached Table 9.3 summarizes the effluent quality standards that need to be met. QIK-12 is currently not active, as wetland treatment has not been confirmed. Effluent discharge criteria for QIK-12 shall apply to QIK-6 until it has been shown that the wetland treatment area is functional.

9.5 Monitoring Well Locations

Monitoring Stations QIK-13, QIK-14 and QIK-15 require the installation of monitoring wells to facilitate the groundwater sampling requirements.

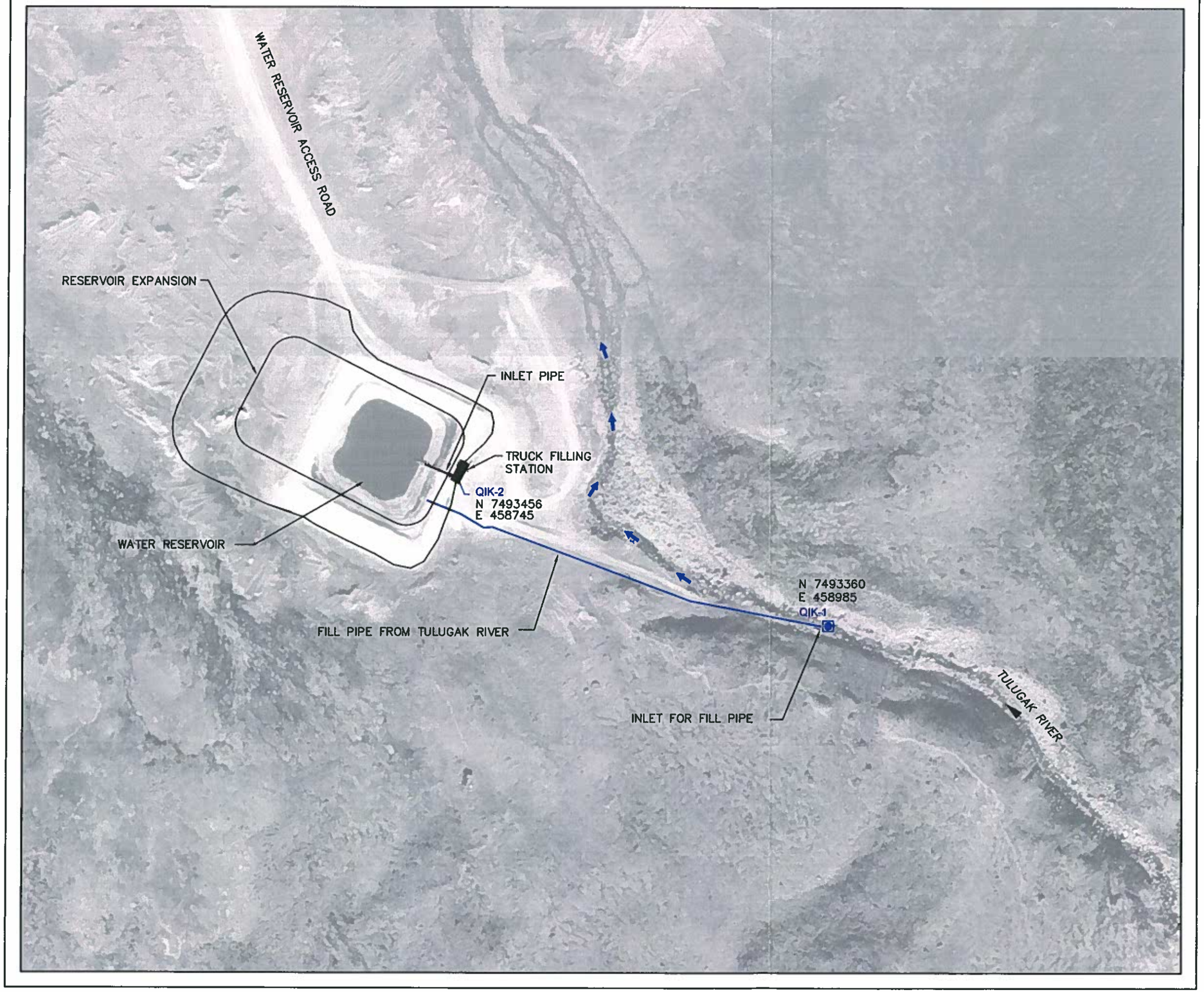


FIGURE 13

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

WATER RESERVOIR MONITORING STATION LOCATIONS

LEGEND

→ → →	INTERPRETED SURFACE WATER FLOW DIRECTION
QIK-2 ◉	VOLUMETRIC MONITORING STATION LOCATION
N 7493360 E 458985	MONITORING LOCATION COORDINATES (Projection: UTM Zone 20, Datum: NAD83)

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

N

0 25 50 75 100 125 150 175 200
Metres

1:2,500
August 2010
Project Number: N-O094390

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Darlow

BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN WATER ML.DWG

Plot Time: Sep 24, 2010 - 2:33pm

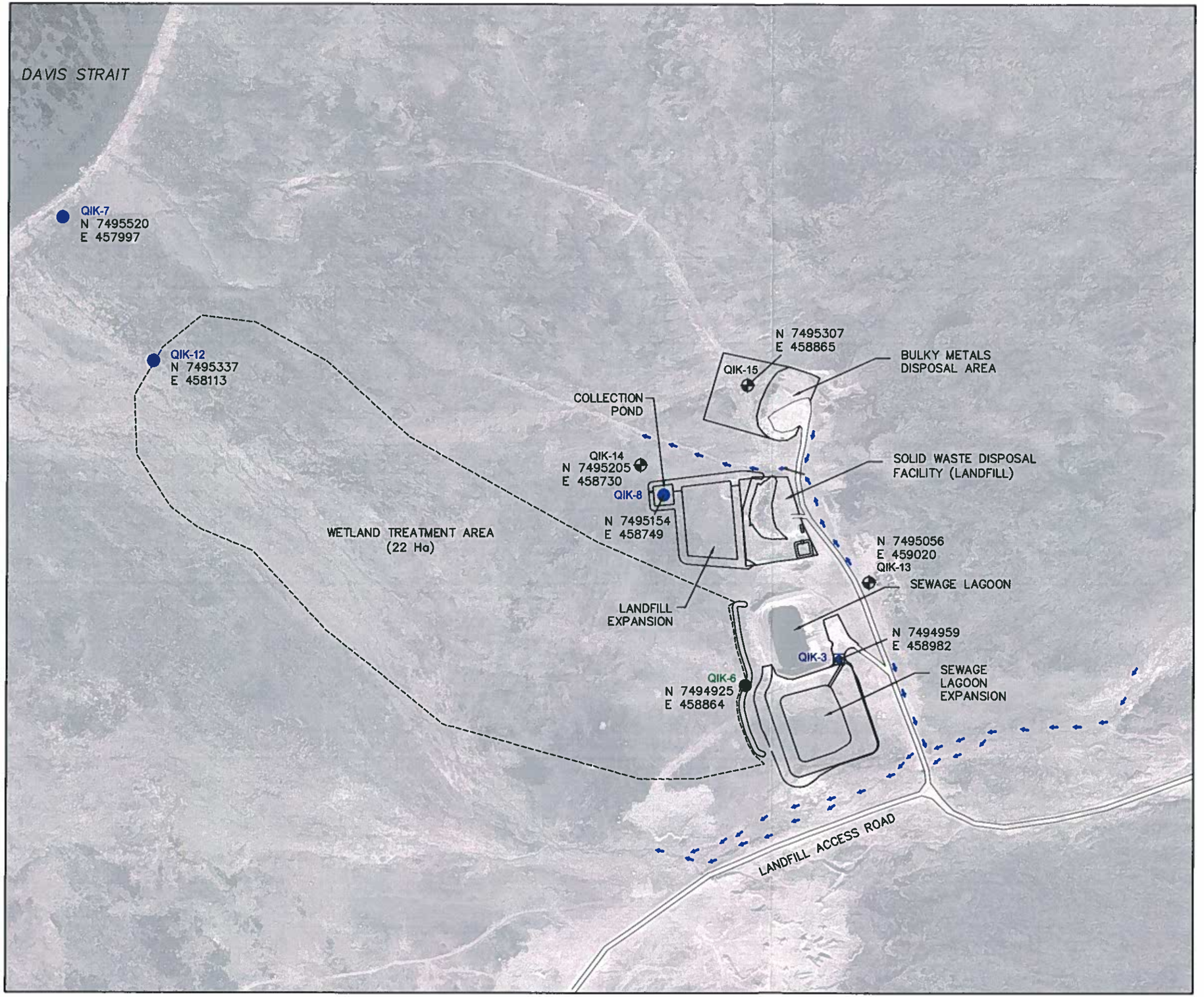


FIGURE 14

THE HAMLET OF QIKIQTARJUAQ
QIKIQTARJUAQ, NUNAVUT
UPDATED O & M PLAN - AUGUST 2010

SEWAGE LAGOON & SOLID WASTE DISPOSAL FACILITY MONITORING STATION LOCATIONS

LEGEND

- INTERPRETED EXISTING SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMIT OF WETLAND AREA
- QIK-15 — MONITORING WELL LOCATION
- QIK-3 — VOLUMETRIC MONITORING STATION LOCATION
- QIK-6 — WATER DISCHARGE MONITORING STATION LOCATION
- QIK-8 — SURFACE WATER SAMPLE LOCATION
- N 7493360 E 458985 — MONITORING LOCATION COORDINATES (Projection: UTM Zone 20, Datum: NAD83)

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

N

0 50 100 150 200 250 300 350 400
Metres

1:5,000
August 2010
Project Number: N-O094390

Projection: UTM Zone 20
Datum: NAD83

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

NUNA BURNSIDE

N-O094390 UPDATED AUG 2010 O&M PLAN SEWAGE ML.DWG

Plot Time: Sep 24, 2010 - 2:38pm

Table 9.2 - Summary of Water/Sewage Quantity and Quality Testing Requirements
Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility
Hamlet of Qikiqtarjuaq, Nunavut

** Requirements based on NWB License No. 3BM-QIK0712**

Station	*Frequency*	*Parameters*
QIK-1, QIK-2	Monthly and annually	Volume in cubic metres
QIK-3	Monthly and annually	Volume in cubic metres
QIK-06, QIK-07, QIK-12	(1) Once at the beginning, middle, and near the end of discharge (2) If discharge at QIK-06 has stopped and restated with more than 48 hour time lapse	Biochemical Oxygen Demand Total Suspended Solids Conductivity Oil & Grease (visual) Magnesium Sodium Chloride Total Hardness Ammonia Nitrogen Total Cadmium Total Cobalt Total Chromium Total Copper Total Aluminum Total Mercury Faecal Coliforms pH Nitrate-Nitrite Total Phenols Calcium Potassium Sulphate Total Alkalinity Total Zinc Total Iron Total Manganese Total Nickel Total Lead Total Arsenic Total Organic Carbon

Table 9.2 - Summary of Water/Sewage Quantity and Quality Testing Requirements
Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility
Hamlet of Qikiqtarjuaq, Nunavut

** Requirements based on NWB License No. 3BM-QIK0712**

Station	Frequency	Parameters
QIK-08	Once prior to any discharge	Biochemical Oxygen Demand pH Nitrate-Nitrite Total Phenols Total Hardness Magnesium Sodium Total Arsenic Total Copper Total Iron Total Mercury Faecal Coliforms Conductivity Suspended Solids Ammonia Nitrogen Oil & Grease Total Alkalinity Calcium Potassium Sulphate Total Cadmium Total Chromium Total Lead Total Nickel
QIK-13, QIK-14, QIK-15	Once annually in summer	Biochemical Oxygen Demand pH Nitrate-Nitrite Total Phenols Total Hardness Magnesium Sodium Total Arsenic Total Copper Total Iron Total Mercury Faecal Coliforms Conductivity Suspended Solids Ammonia Nitrogen Oil & Grease Total Alkalinity Calcium Potassium Sulphate Total Cadmium Total Chromium Total Lead Total Nickel TPH (Total Petroleum Hydrocarbons PAH (Polycyclic Aromatic Hydrocarbons) BTEX (Benzene, Toluene, Ethylbenzene, Xylene)

Table 9.2 - Summary of Water/Sewage Quantity and Quality Testing Requirements
Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility
Hamlet of Qikiqtarjuaq, Nunavut

** Requirements based on NWB License No. 3BM-QIK0712**

Station	Frequency	Parameters
QIK-06 or QIK-12 (Final Discharge Point)	Once annually mid-way through discharge	Acute lethality to Rainbow Trout, Oncorhynchus mykiss (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13)
		Acute lethality to crustacean, Daphnia magna (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14)

Notes:

(1) - QIK-4 and QIK-5 are abandoned and "Not Active."

(2) - QIK-9, QIK-10 and QIK-11 should be identified as "Not Active." Drainage has been revised and there is no drainage swale between the sewage lagoon and solid waste facility.

(3) QIK-06 shall be considered the final discharge point until QIK-12 is established.

Table 9.3 - Summary of Effluent Water Quality Standards Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility Hamlet of Qikiqtarjuaq, Nunavut

** Requirements based on NWB License No. 3BM-QIK0712**

Station	Parameter	Effluent Discharge Criteria (MAC)
QIK-6, QIK-12	Biochemical Oxygen Demand	45 mg/L
	Total Suspended Solids	45 mg/L
	Faecal Coliforms	1 x 10^2 CFU/100 mL
	Oil & Grease	No visible sheen
	pH	between 6 and 9

Notes:
(1) MAC - Maximum Average Concentration

Once it has been shown that flow through the wetland area is occuring as intended and approved by the NWB, the effluent criteria for QIK-6 will become:

Station	Parameter	Effluent Discharge Criteria (MAC)
QIK-6	Biochemical Oxygen Demand	120 mg/L
	Total Suspended Solids	180 mg/L
	Faecal Coliforms	1 x 10^4 CFU/100 mL
	Oil & Grease	No visible sheen
	pH	between 6 and 9

10.0 Quality Assurance/Quality Control Plan

10.1 Purpose

The Quality Assurance/Quality Control (QA/QC) Plan has been prepared to meet the requirements of the Monitoring Program developed for the Hamlet of Qikiqtarjuaq to comply with licensing requirements. QA/QC are vitally important components of environmental management for the community.

10.2 Objectives

The Plan has been developed to achieve the following objectives:

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

This document describes the procedures and controls to be used by Hamlet operations staff when conducting environmental sampling to meet the requirements of the license.

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

10.3 Quality Assurance and Quality Control

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

- Personnel involved in water sampling and analysis are well trained
- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean

- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized BMP
- Laboratory and field instruments are calibrated according to manufacturers recommendations or recognized as good operating practice
- Supplies used in sampling and analysis are of consistent high quality and are not expired
- Quality Control (QC) procedures are development and implemented based on good operating practices to assess quality of analytical data and provide warning of unacceptable errors
- Implement prompt remedial action when deficiencies are identified
- Results of the monitoring program are reported in an annual report as required in the water license. Every year, an annual report is required to be submitted to the NWB by March 31 for the previous calendar year.

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

10.4 Lab Accreditation

All analyses shall be conducted in laboratories, which are accredited by Canadian Association for Laboratory Accreditation Inc. (CALA) [formerly CAEAL], unless otherwise approved by an Analyst. The Contact information for two potential laboratories that have the CALA accreditation is provided in Appendix G.

The following is the contact information for the Laboratory retained by the Hamlet of Qikiqtarjuaq to complete analysis:

Name of Laboratory _____
Address _____
_____
_____
Phone No. _____
Fax No. _____

Prior to sampling being undertaken by representatives of the Hamlet, the Hamlet shall notify the NWB of the Laboratory to be used to perform the analysis. This is required as per the Water License. A Notification of Laboratory Form can be found in Appendix I.

10.5 Field Sampling

10.5.1 Sample Planning

Hamlet personnel must provide a list of sample requirements to the laboratory to obtain sample bottles for submission to the lab for testing. Request that any samples requiring preservatives are prefilled by the laboratory to minimize error in the field.

All of the samples taken will be grab samples. Samples will be taken from:

Sewage Lagoon Facility

- Prior to discharge
- Effluent (QIK-6 and QIK-12)
- Surface drainage near Davis Strait (QIK-7)

Solid Waste Facility

- Monitoring Wells (QIK-13, 14 and 15)
- Collection Pond (QIK-8)

Surface Drainage and Wetland (QIK-6, 7, and 12)

Samples should be collected as close to the middle of the stream where water flows freely and is free of debris. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially filled with the water to be sampled and rinsed with the lid in place at least three times. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed. **Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.**

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

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

Lagoon and Collection Pond (QIK-8)

Operator should obtain a sample from the lagoon and pond using a large bucket that can be tossed into the effluent and retrieved using a rope tied to the handle. The effluent can then be transferred to the sample bottles provided by the lab.

Monitoring Wells (QIK-13, 14 and 15)

The groundwater sample should be obtained using equipment such as PVC Waterra tubing with a foot valve on one end. The tubing is placed down the well so that the foot valve is at the bottom of the well. The water is pumped out of the well by holding one end of the tubing in hand and moving the end of the tubing with the foot valve attached up and down. Prior to collecting the sample, at least 3 litres of water should be removed from the well. After removing the water, wait for a couple of minutes, and then collect the sample in the bottles provided by the laboratory.

10.5.2 Sample Container Selection

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

10.5.3 Field Sampling Log

The individual collecting the water sample shall record the following at the time of sampling:

- Date of sampling
- Time of sampling
- Weather conditions
- Monitoring Station Number (i.e. QIK-2, QIK-3, QIK-4, etc.)
- Results of any Field measurements
- Sampler shall also indicate if sample used preservatives
- Any unusual conditions
- Any deviation from standard procedures.

10.5.4 Sampling Procedures

The sampling procedures described in Table 10.1 shall be used to collect water samples appropriate to the sampling location.

Table 10.1: General Procedures for Sample Collection

	BIOLOGICAL	PHYSICAL	INORGANIC	ORGANIC
Phase 1: *Sample Program Design*	*Step 1:* Choose sample locations, sample frequency, and analytes to be measured *Step 2:* Contact laboratory used for analysis and get advice and information for sampling program *Step 3:* Contact manager of sample location facility; determine all safety requirements *Step 4:* Create sample identication system			
Phase 2: *Sample Program Preparation*	*Step 1:* Obtain sample containers, storage contalners, distilled water, Personal Protective Equipment (PPE), and other required equipment *Step 2:* Create sample labels and apply to sample containers *Step 3:* Plan first sampling event - arrange all transportation and notify laboratory			
	• 1000 mL plastic or glass container for BOD • 300 mL plastic or glass contalner for fecal coliform	• Have equipment needed for any flow or temperature measuraments • 200 mL plastic or glass container for suspended solids	• Electrode meter for dissolved oxygen and pH • 1000 mL nitric acid rinsed container, nitric acid for preservation, and filter for metals • Specific containers and preservatives for nutrients or other analytes	• 1000 mL plastic or glass container, hydrochloric or sulfuric acid, for oil and grease
Phase 3: *Sample Collection*	*Step 1:* Keep sample containers closed until used *Step 2:* Record the date, time, location, geographic position, weather conditlons, and other details in a field notebook at each sample location *Step 3:* Fill out the sample label, including: sample ID, location, date, time, and name of sample collector *Step 4:* Collect sample uslng appropriate container, by filling without rinsing, immediately close and keep cool *Step 5:* Pack all samples and provide a sample information sheet listing all contents in the storage container *Step 6:* Label the storage container with the recipient, WATER SAMPLES, FRAGILE, THIS END UP, and any TDG or WHMIS labels required			
	• BOD - fill container completely and refrigerate, Fecal coliform - leave space at top of container, refrigerate • Maximum storage time: BOD - 24 hrs, Fecal Coliforms - 30 hrs,	• TSS - Refrigerate • Maximum strorage time: TSS - 7 days, temperatrure - 0.25 hrs	• Fill container and leave a small (1% of volume) air space at the top, refrigerate • Maximum storage time: ammonia - 7 days, nitrate and phosphate - 48 hrs, metals - indefinite, DO and pH - 0.25 hrs	• Fill container to top and refrigerate • Maximum storage time: oil and grease - 28 days
Phase 4: *Sample Transportation*	*Step 1:* Fill out the "sampler" portion of the Chain of Custody form *Step 2:* Ensure that all personnel handling the samples fill outs a subsequent section of the Chain of Custody form *Step 3:* Transport the samples to lab for analysis as quickly as possible *Step 4:* Verify that the lab has received the samples and analysis is underway			

Note: Sizes and types of sample collection containers (bottles) are a suggestion only. The laboratory may suggest and use other sizes and types. Follow the suggestions of a CAEAL accredited laboratory.

10.5.5 Sample Identification

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

10.5.6 Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the Laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the Laboratory. **If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical problems with transport aircraft, all samples must be stored in a refrigerator at 4°C.** Samples must not be frozen.

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

For the Hamlet of Qikiqtarjuaq, Table 10.2 provides the appropriate preservation methods for the parameters to be assessed.

Table 10.2: Sample Preservation

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

Note: 1000 mL = 1 Liter

10.5.7 Sample Transportation

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

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

10.6 Quality Control

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

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

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

10.6.1 Replicate or Duplicate Samples

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

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

10.7 Laboratory Analysis/Reporting

The laboratory will perform the analysis of all samples as outlined in the License. The results shall be received by the Hamlet within the time frame agreed to with the laboratory. The results shall be submitted the NWB for review with the Annual report. The results shall contain the limits of Detection used for analysis of each parameter as supplied by the laboratory.

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

10.8 Glossary

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

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

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

11.0 References

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BURNSIDE

Appendix A
Climate Normal Data

Appendix A: Climate Normals for Qikiqtarjuaq, Nunavut

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-24.8	-25.8	-23.5	-17.3	-8.4	-0.4	4.4	3.1	-2.5	-8.1	-15.8	-22.3		D
Standard Deviation	4.4	3.4	2.9	1.9	1.6	2.3	1.7	1.8	1.0	1.8	2.7	3.4		D
Daily Maximum (°C)	-21.9	-22.8	-20.2	-13.8	-5.3	2.4	7.3	5.9	-0.4	-5.9	-13.2	-19.4		D
Daily Minimum (°C)	-27.7	-28.8	-26.7	-20.8	-11.4	-3.1	1.4	0.4	-4.5	-10.4	-18.3	-25.1		D
Extreme Maximum (°C)	3.9	1.1	4.0	7.8	11.1	17.8	18.3	**18.9**	14.4	10.6	7.5	5.0		
Date (yyyy/dd)	1958/23	1960/11	1980/23	1975/29	1991/31	1973/29	1965/22+	**1973/21**	1962/04+	1984/16	1985/03	1967/17		
Extreme Minimum (°C)	-41.7	**-42.8**	-40.7	-34.3	-26.1	-12.2	-8.9	-7.8	-13.9	-24.4	-33.3	-39.2		
Date (yyyy/dd)	1961/11	**1979/16**	1985/01	1984/05	1970/07	1963/03+	1972/03+	1972/22	1972/29	1986/27	1957/16	1982/31		
Precipitation: Precipitation:														
Rainfall (mm)	0.0	0.0	0.0	0.0	0.4	3.4	16.3	15.9	2.9	0.3	0.0	0.0		D
Snowfall (cm)	6.8	6.8	5.7	16.0	31.4	15.2	10.5	10.2	30.0	45.8	37.1	7.3		D
Precipitation (mm)	6.8	6.8	5.7	16.0	31.8	18.6	26.8	26.1	32.9	46.1	37.1	7.3		D
Average Snow Depth (cm)	82	79	77	74	65	32	4	1	8	37	76	85	52	C
Median Snow Depth (cm)	83	79	77	74	66	32	3	1	5	36	78	85	52	C
Snow Depth at Month-end (cm)	79	78	74	71	58	13	3	2	20	56	86	83		D
Extreme Daily Rainfall (mm)	0.0	0.0	0.0	0.0	8.6	**35.6**	15.0	25.4	14.5	5.1	0.0	0.0		
Date (yyyy/dd)	1958/30+	1959/01+	1960/01+	1959/01+	1973/25	**1966/27**	1972/26	1959/07	1971/07	1968/05	1958/01+	1958/01+		
Extreme Daily Snowfall (cm)	31.8	14.0	7.0	22.6	28.2	35.6	17.0	17.8	33.0	**38.4**	33.0	22.4		

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Date (yyyy/dd)	1963/22	1970/15	1977/17	1968/16	1981/27	1973/21	1984/31	1968/07+	1967/18	**1967/25**	1969/05	1967/22		
Extreme Daily Precipitation (mm)	31.8	14.0	7.0	22.6	28.2	35.6	17.0	25.9	33.0	**38.4**	33.0	22.4		
Date (yyyy/dd)	1963/22	1970/15	1977/17	1968/16	1981/27	1966/27+	1984/31	1959/07	1967/18	**1967/25**	1969/05	1967/22		
Extreme Snow Depth (cm)	157.0	146.0	152.0	157.0	164.0	150.0	117.0	25.0	81.0	**178.0**	175.0	157.0		
Date (yyyy/dd)	1965/02+	1988/29	1988/04+	1988/21	1977/06	1970/01+	1973/01	1973/01	1967/19+	**1964/31**	1964/06	1964/27+		
Days with Maximum Temperature: Days with Maximum Temperature:														
<= 0 °C	30.7	28.2	30.8	29.3	26.7	11.2	1.5	3.1	19.2	29.7	29.9	30.9		D
> 0 °C	0.35	0.0	0.24	0.67	4.3	18.9	29.5	27.9	10.8	1.3	0.15	0.11		D
> 10 °C	0.0	0.0	0.0	0.0	0.05	1.5	7.5	5.4	0.47	0.0	0.0	0.0		D
> 20 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
> 30 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
> 35 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Days with Minimum Temperature: Days with Minimum Temperature:														
> 0 °C	0.0	0.0	0.0	0.0	0.25	5.8	18.3	14.2	2.0	0.0	0.0	0.0		D
<= 2 °C	31.0	28.2	31.0	30.0	31.0	27.2	18.2	22.4	29.3	31.0	30.0	31.0		D
<= 0 °C	31.0	28.2	31.0	30.0	30.8	24.2	12.7	16.8	28.0	31.0	30.0	31.0		D
< -2 °C	31.0	28.2	31.0	30.0	30.4	19.5	6.0	9.5	25.0	30.7	30.0	31.0		D
< -10 °C	30.4	28.2	30.7	28.8	19.9	0.67	0.0	0.0	0.72	15.3	28.2	30.7		D
< -20 °C	27.4	27.0	27.5	17.5	0.60	0.0	0.0	0.0	0.0	0.33	10.4	26.2		D
< - 30 °C	10.1	13.3	9.8	0.80	0.0	0.0	0.0	0.0	0.0	0.0	0.11	6.6		D

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Days with Rainfall: Days with Rainfall:														
>= 0.2 mm	0.0	0.0	0.0	0.0	0.05	0.95	5.5	5.6	0.84	0.21	0.0	0.0		D
>= 5 mm	0.0	0.0	0.0	0.0	0.05	0.24	1.1	0.85	0.26	0.0	0.0	0.0		D
>= 10 mm	0.0	0.0	0.0	0.0	0.0	0.05	0.21	0.25	0.05	0.0	0.0	0.0		D
>= 25 mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Days With Snowfall: Days With Snowfall:														
>= 0.2 cm	4.0	3.5	3.2	6.2	9.1	4.9	2.9	3.5	8.6	13.6	9.5	4.3		D
>= 5 cm	0.35	0.30	0.14	1.0	1.8	1.1	0.72	0.65	1.8	3.1	2.5	0.30		D
>= 10 cm	0.05	0.0	0.0	0.19	0.81	0.19	0.22	0.25	0.65	0.84	0.85	0.10		D
>= 25 cm	0.0	0.0	0.0	0.0	0.05	0.05	0.0	0.0	0.0	0.0	0.05	0.0		D
Days with Precipitation: Days with Precipitation:														
>= 0.2 mm	4.0	3.5	3.2	6.2	9.1	5.8	7.7	8.3	9.5	13.7	9.5	4.3		D
>= 5 mm	0.35	0.30	0.14	1.0	1.8	1.3	1.9	1.7	2.0	3.1	2.5	0.30		D
>= 10 mm	0.05	0.0	0.0	0.19	0.86	0.29	0.47	0.50	0.68	0.84	0.85	0.10		D
>= 25 mm	0.0	0.0	0.0	0.0	0.05	0.05	0.0	0.0	0.0	0.0	0.05	0.0		D
Days with Snow Depth: Days with Snow Depth:														
>= 1 cm	31.0	28.2	31.0	30.0	31.0	27.8	11.0	6.3	20.1	31.0	30.0	31.0		D
>= 5 cm	31.0	28.2	31.0	30.0	31.0	25.7	6.2	3.2	13.9	30.7	30.0	31.0		D
>= 10	31.0	28.2	31.0	30.0	31.0	23.2	3.3	1.3	9.2	30.0	30.0	31.0		D

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
>= 20	31.0	28.2	31.0	30.0	30.6	16.9	1.7	0.25	3.9	25.1	29.7	31.0		D
Wind: Wind:														
Maximum Hourly Speed	130.0	122.0	104.0	93.0	77.0	74.0	121.0	74.0	**183.0**	102.0	111.0	92.0		
Date (yyyy/dd)	1988/16	1996/19	1989/29	1998/14	1972/23	1987/27+	1956/22	1984/22	**1997/24**	1989/27	1977/05	1974/01		
Direction of Maximum Hourly Speed	NW	S	NW	SW	W	NW	SW	NW	S	NW	W	W	S	
Degree Days: Degree Days:														
Above 24 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Above 18 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Above 15 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Above 10 °C	0.0	0.0	0.0	0.0	0.0	0.3	4.0	1.7	0.0	0.0	0.0	0.0		D
Above 5 °C	0.0	0.0	0.0	0.0	0.0	5.5	37.5	20.4	1.4	0.0	0.0	0.0		D
Above 0 °C	0.0	0.0	0.0	0.1	2.0	40.8	141.0	100.1	16.5	0.2	0.0	0.0		D
Below 0 °C	759.6	739.9	730.2	520.4	264.9	56.9	6.8	12.3	91.5	258.4	465.5	701.0		D
Below 5 °C	914.6	881.1	885.2	670.3	417.9	171.7	58.3	87.6	226.4	413.2	615.5	856.0		D
Below 10 °C	1069.6	1022.3	1040.2	820.3	572.9	316.4	179.8	223.9	375.0	568.2	765.5	1011.0		D
Below 15 °C	1224.6	1163.4	1195.2	970.3	727.9	466.1	330.8	377.2	525.0	723.2	915.5	1166.0		D
Below 18 °C	1317.6	1248.1	1288.2	1060.3	820.9	556.1	423.8	470.2	615.0	816.2	1005.5	1259.0		D
Humidex: Humidex:														

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Extreme Humidex	1.5	0.0	2.7	6.1	8.6	18.6	**20.7**	19.9	13.6	7.0	3.5	3.9		
Date (yyyy/dd)	1979/27	1963/04	1980/23	1975/29	1991/31	1973/29	**1984/17**	1973/21	1967/04	1984/15	1985/03	1967/17		
Wind Chill: Wind Chill:														
Extreme Wind Chill	**-61.1**	-61.0	-57.1	-49.2	-35.8	-21.1	-18.6	-15.5	-23.9	-32.8	-45.2	-54.2		
Date (yyyy/dd)	**1961/11**	1979/16	1964/13	1997/08	1999/01	1978/01	1972/04	1972/22	1997/24	1986/26	1956/28	1971/27		
Humidity: Humidity:														
Average Relative Humidity - 0600LST (%)	77.6	75.6	76.3	81.2	86.8	86.6	79.0	81.4	90.4	89.0	83.5	78.5		

Appendix A: Summary of 2004 Monthly Climatological Information for the Hamlet of Qikiqtarjuaq, Nunavut

QIKIQTARJUAQ A
NUNAVUT

Latitude: 67° 33' N **Longitude:** 64° 1' W **Elevation:** 06.40 m

Climate ID: 2400572 **WMO ID:** 71338 **TC ID:** YVM

Monthly Data Report for 2004

Month	Mean Max Temp °C	Mean Temp °C	Mean Min Temp °C	Extr Max Temp °C	Extr Min Temp °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow Grnd Last Day cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
Jan	-24.3	-28.7	-33.1	-15.5	-43.2	0.0	4.0	4.0	35		
Feb	-20.2	-24.9E	-29.4	-10.0	-40.2	0.0	5.0	5.0	41		
Mar	-24.3	-29.8	-35.2	-13.4	-45.5	0.0	6.2	6.2	47		
Apr	-11.4	-17.2	-22.9	-4.5	-31.5	0.0	34.0	34.0	61		
May	-1.2	-3.8	-6.4	6.5	-16.5	0.0	3.0	3.0	25		
Jun	4.7	1.8	-1.1	9.9	-7.2	Trace	Trace	Trace	0		
Jul	7.8	4.6	1.4	17.2	-1.7	1.0	6.0	7.0	0		
Aug	8.3	5.6	2.9	17.1	0.0	13.0	0.0	13.0	0		
Sep	4.4	2.0	-0.5	11.0	-11.0	6.0	13.0	19.0	4		
Oct	1.9	-1.0	-3.9	9.0S	-8.0	0.4	7.4	7.8	4		
Nov	-6.6	-10.6	-14.6	3.0	-24.5	0.0	91.0	91.0	54		
Dec	-22.4	-27.5	-32.6	-15.2	-40.8	0.0	2.0	2.0	48		
Sum						**20.4**	**171.6**	**192.0**			
Avg	**-6.9**	**-10.8**	**-14.6**								
Xtrm				**17.2**	**-45.5**						

BURNSIDE

Appendix B
Projected Water Requirements, Sewage Generation Rates and Solid Waste Generation Rates

Appendix B - Projected Sewage and Sludge Generation Rates

Planning Year	Calendar Year	Projected Population	Projected Sewage Generation	Projected Volume		Projected Sludge Volume	Cumulative Sludge Volume	BOD	TSS	$T\text{-}PO_4$	TKN	Fecal Coliforms
			[Lpcd]	[Litres/day]	[Litres/year]	[m^3/year]	[m^3]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[CFU/100 mL]
Schematic	2005	599	102.4	61,337	22,388,071	10.9	10.9	439.5	468.8	22.5	117.2	9.28E+07
Design	2006	611	102.6	62,718	22,891,977	11.2	22.1	438.4	467.6	22.4	116.9	9.25E+07
0	2007	624	102.9	64,220	23,440,330	11.4	33.5	437.2	466.4	22.3	116.6	9.23E+07
	2008	637	103.2	65,729	23,991,238	11.6	45.1	436.1	465.2	22.3	116.3	9.21E+07
	2009	650	103.5	67,246	24,544,699	11.9	57.0	435.0	464.0	22.2	116.0	9.18E+07
	2010	663	103.7	68,769	25,100,714	12.1	69.1	433.8	462.8	22.2	115.7	9.16E+07
	2011	677	104.0	70,417	25,702,355	12.4	81.4	432.6	461.5	22.1	115.4	9.13E+07
5	2012	691	104.3	72,074	26,306,958	12.6	94.0	431.4	460.2	22.1	115.0	9.11E+07
	2013	705	104.6	73,738	26,914,522	12.9	106.9	430.2	458.9	22.0	114.7	9.08E+07
	2014	720	104.9	75,531	27,568,771	13.1	120.0	429.0	457.6	21.9	114.4	9.06E+07
	2015	735	105.2	77,333	28,226,420	13.4	133.4	427.7	456.2	21.9	114.1	9.03E+07
	2016	750	105.5	79,144	28,887,469	13.7	147.1	426.4	454.9	21.8	113.7	9.00E+07
10	2017	765	105.8	80,964	29,551,917	14.0	161.1	425.2	453.5	21.7	113.4	8.98E+07
	2018	781	106.2	82,916	30,264,410	14.3	175.3	423.9	452.1	21.7	113.0	8.95E+07
	2019	797	106.5	84,879	30,980,772	14.5	189.9	422.5	450.7	21.6	112.7	8.92E+07
	2020	813	106.8	86,852	31,701,001	14.8	204.7	421.2	449.3	21.5	112.3	8.89E+07
	2021	830	107.2	88,960	32,470,484	15.1	219.9	419.9	447.8	21.5	112.0	8.86E+07
15	2022	847	107.5	91,080	33,244,334	15.5	235.3	418.5	446.4	21.4	111.6	8.83E+07
	2023	864	107.9	93,212	34,022,551	15.8	251.1	417.1	444.9	21.3	111.2	8.81E+07
	2024	882	108.3	95,483	34,851,305	16.1	267.2	415.7	443.4	21.2	110.8	8.78E+07
	2025	900	108.6	97,767	35,684,955	16.4	283.6	414.3	441.9	21.2	110.5	8.75E+07
	2026	918	109.0	100,064	36,523,501	16.8	300.4	412.8	440.4	21.1	110.1	8.72E+07
20	2027	937	109.4	102,504	37,413,945	17.1	317.5	411.3	438.8	21.0	109.7	8.68E+07

Appendix B
Waste Quantity Calculations

Planning Year	Calendar Year	Projected Population [people[	Annual Volume of Solid Waste [m^3[	Cumulative Volume of Solid Waste [m^3[	Annual Volume of Combustible Solid Waste [m^3[	Annual Volume of Combustible Solid Waste After Burning [m^3[	Annual Volume of Uncombustible Solid Waste [m^3[	Total Annual Volume of Uncombustible and Combusted (Burned) Solid Waste [m^3]	Annual Volume of Compacted Waste [m^3[	Annual Volume of Cover Material [m^3[	Total Annual Volume of Compacted Waste and Cover Material [m^3[	Cumulative Landfill Volume {m3}
0	2006	599	3060.9	3060.9	2571.1	1542.7	489.7	2032.4	1524.3	304.9	1829.2	1,829.19
	2007	611	3122.2	6183.1	2622.7	1573.6	499.6	2073.1	1554.9	311.0	1865.8	3,695.02
	2008	624	3188.6	9371.7	2678.5	1607.1	510.2	2117.3	1587.9	317.6	1905.5	5,600.55
	2009	637	3255.1	12626.8	2734.3	1640.6	520.8	2161.4	1621.0	324.2	1945.2	7,545.78
	2010	650	3321.5	15948.3	2790.1	1674.0	531.4	2205.5	1654.1	330.8	1984.9	9,530.71
5	2011	663	3387.9	19336.2	2845.9	1707.5	542.1	2249.6	1687.2	337.4	2024.6	11,555.34
	2012	677	3459.5	22795.7	2906.0	1743.6	553.5	2297.1	1722.8	344.6	2067.4	13,622.72
	2013	691	3531.0	26326.7	2966.0	1779.6	565.0	2344.6	1758.4	351.7	2110.1	15,732.85
	2014	705	3602.6	29929.3	3026.1	1815.7	576.4	2392.1	1794.1	358.8	2152.9	17,885.73
	2015	720	3679.2	33608.5	3090.5	1854.3	588.7	2443.0	1832.2	366.4	2198.7	20,084.42
10	2016	735	3755.9	37364.3	3154.9	1892.9	600.9	2493.9	1870.4	374.1	2244.5	22,328.92
	2017	750	3832.5	41196.8	3219.3	1931.6	613.2	2544.8	1908.6	381.7	2290.3	24,619.22
	2018	765	3909.2	45106.0	3283.7	1970.2	625.5	2595.7	1946.8	389.4	2336.1	26,955.33
	2019	781	3990.9	49096.9	3352.4	2011.4	638.5	2650.0	1987.5	397.5	2385.0	29,340.30
	2020	797	4072.7	53169.6	3421.0	2052.6	651.6	2704.3	2028.2	405.6	2433.8	31,774.12
15	2021	813	4154.4	57324.0	3489.7	2093.8	664.7	2758.5	2068.9	413.8	2482.7	34,256.81
	2022	830	4241.3	61565.3	3562.7	2137.6	678.6	2816.2	2112.2	422.4	2534.6	36,791.41
	2023	847	4328.2	65893.5	3635.7	2181.4	692.5	2873.9	2155.4	431.1	2586.5	39,377.93
	2024	864	4415.0	70308.5	3708.6	2225.2	706.4	2931.6	2198.7	439.7	2638.4	42,016.35
	2025	882	4507.0	74815.5	3785.9	2271.5	721.1	2992.7	2244.5	448.9	2693.4	44,709.75
20	2026	900	4599.0	79414.5	3863.2	2317.9	735.8	3053.7	2290.3	458.1	2748.4	47,458.11
	2027	918	4691.0	84105.5	3940.4	2364.3	750.6	3114.8	2336.1	467.2	2803.3	50,261.44
	2028	937	4788.1	88893.6	4022.0	2413.2	766.1	3179.3	2384.5	476.9	2861.4	53,122.79
	2029	956	4885.2	93778.7	4103.5	2462.1	781.6	3243.7	2432.8	486.6	2919.4	56,042.16
Design criteria	2030	976	4987.4	98766.1	4189.4	2513.6	798.0	3311.6	2483.7	496.7	2980.4	59,022.61

percentage remaining after burning 0.6

BURNSIDE

Appendix C
Nunavut Water Board License

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
OFFICE DES EAUX DU NUNAVUT

DECISION

LICENCE NUMBER: 3BM-QIK0712

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence renewal received May 1, 2006, made by:

Hamlet of Qikiqtarjuaq

to allow for the use of water and disposal of waste for the Hamlet of Qikiqtarjuaq, 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 full 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 determined that:

Licence Number 3BM-QIK0712 be issued subject to the terms and conditions contained therein. (Motion #: 2007-02-08)

SIGNED this 9th day of May, 2007 at Gjoa Haven, NU.

Original signed by:

Thomas Kabloona
Acting Chief Executive Officer

TABLE OF CONTENTS

I. BACKGROUND

The Hamlet of Qikiqtarjuaq is located at 67° 33'N latitude and 64° 02' W longitude, on the eastern coast of Baffin Island and on an island known as Broughton Island. It is 470 air km northeast of the City of Iqaluit. Qikiqtarjuaq is located within the continuous permafrost zone with a maximal local depth of annual thaw of the active layer up to 1.6 metres depending on the nature of the surface cover. The region sits on glacial drift primarily composed of silty sand and gravels mixed with boulders.

Vegetation is typical of that evidenced on the Arctic tundra with hardy grasses, mosses and lichens in a thin organic layer on the surface. Annual rainfall averages 39mm and snowfall of 223mm per annum. July mean high and low temperatures are 7°C and 1°C, respectively and January mean high and low temperatures are -21°C and -28° C, respectively. Prevailing winds are generally north-northeast with an annual average velocity of 8.3 km/h.

II. PROCEDURAL HISTORY

On May 1, 2006, an application for the renewal of water licence NWB3QIK0106 was received as filed by Nuna Burnside Engineering and Environmental Ltd. (Rankin Inlet) on behalf of the Hamlet of Qikiqtarjuaq. The previous licence NWB3QIK0106, was issued by the Board on November 28, 2000 with an expiry date of December 31, 2006. 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 August 23, 2006. An assessment of the Hamlet's request for renewal of the 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. The scope of the application included the planned upgrades to the water storage reservoir, sewage disposal facilities and the solid waste disposal facilities. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. Taking into account the comments received and an internal technical assessment, a request for additional information and clarification was made by the NWB on October 19, 2006. A response was received on March 8, 2007 from the Department of Community and Government Services, Government of Nunavut on behalf of the Hamlet, containing information prepared by Nuna Burnside and AMEC Earth and Environmental, which included the following documents:

i. Report on Responses to Questions From the Nunavut Water Board;
ii. a revised Detailed Design Report for the Improvements to the Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility;
iii. Technical Summary Report for the Improvements to the Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility;

iv. Sewage Lagoon and Solid Waste Disposal Facility Geotechnical Services, Qikiqtarjuaq, Nunavut; and
v. Revised Sewage Treatment Facility Operation and Maintenance (O&M) Plan;

As no public concern was expressed, the NWB waived the requirement to hold a public hearing and proceeded with the application process.

Based upon the results of the detailed assessment, including consideration of any potential accidents, malfunctions, or cumulative environmental effects that the overall project might have in the area, the Board approved the application and issued Licence NWB3QIK0106.

III. ISSUES

Reporting, Plan Submission and 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 Department of Indian Affairs and Northern Development (INAC) site inspections and the compliance record of the Applicant. In review of the previous water licence NWB3QIK0106, it was noted that there were several issues of non-compliance with conditions contained therein. The issues varied throughout the duration of the Licence, however re-occurring items were significant and as follows:

i. The Licensee did not include in Annual Reports, the water quality results for monitoring under Schedule 1: Surveillance Network Program;
ii. The Licensee did not submit an Operations and Maintenance Plan during the Licence term; and
iii. Effluent standards regarding Biochemical Oxygen Demand and Fecal Coliform were not met based on Inspectors sampling results.

The NWB has imposed, on the Licensee, 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 interested parties upon request. A *"Standardized Form for Annual Reporting"* is to be used by the Licensee and is available from the NWB file transfer protocol (FTP) site under the Public Registry at the NWB Website.

The NWB recognizes the efforts put forward by the Licensee within the renewal/amendment application with respect to providing the Plans required under the previous License. The Plans were very detailed and provided the information to satisfy the Licence. These Plans however, will require minor changes due to the additional information received in response to issues raised during the

review process and to comply with conditions of the License and the variation from the assumptions provided in the Application. As well, all upgrades to the facilities may not be constructed and in use immediately. This License has therefore, included the requirement to review and update the following Plans as identified within the Licence:

i. Water Storage Operation and Maintenance (O&M) Plan;
ii. Sewage Treatment Facility Operation and Maintenance (O&M) Plan;
iii. Solid Waste Facility Operation and Maintenance (O&M) Plan;
iv. Environmental Emergency Contingency Plan For Water, Sewage and Solid Waste Operations in the Hamlet of Qikiqtarjuaq, Nunavut; and the
v. Monitoring Program Quality Assurance/Quality Control Plan

The purpose of the Operation and Maintenance Manuals is to assist Hamlet staff in the proper operation and maintenance of their water storage and waste disposal facilities. The manuals should demonstrate to the Nunavut Water Board that the Hamlet is capable of operating and maintaining the infrastructure related to water use and waste disposal adequately. The Plans should be based, at a minimum on the various guidelines available (i.e. *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).

The purpose of the Monitoring Program Quality Assurance/Quality Control (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 sampling requirements have been imposed, additional sampling may be requested by an Inspector.

Finally, the NWB has imposed on the Licensee the requirement to produce an Abandonment and Restoration Plan for their sewage and solid waste facilities. To ensure that all future abandoned facilities and sites are reclaimed in an appropriate manner, the NWB requires Licensees to submit an Abandonment and Restoration Plan. The requirements of the Licensee in this regard are outlined in Part G of this License. The NWB encourages the Licensee to undertake progressive reclamation on sites where possible.

In review of the application and the comments received from interested persons, there were no objections to the Applicants request for a term of five (5) years for the Licence renewal. The NWB concurs 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. Appropriate Plans have been developed to the satisfaction of the NWB for the operation and maintenance of the facilities as well as for the protection of the environment with regard to potential spills through day-to-day operations.

Water Use

The Hamlet of Qikiqtarjuaq currently replenishes the Water Storage Reservoir from the Tulugak River which flows seasonally in a northwest direction toward Davis Strait. Water is conveyed via gravity fill pipe. Water for the community is pumped directly from the river during the summer months and then from the reservoir during the remainder of the year. The Reservoir is to be expanded in 2007 to provide a 10-month storage capacity with a dimension of 90m x 156m and a volume of 31,500 m^3.

A truck fill station is located at the Water Storage and Treatment Facility where water is transferred by submersible pump to the distribution vehicles. The water receives chlorine treatment and is then distributed to the community by truck. Water consumption in 2006 was reported to be 20,678 m^3 and is projected to reach 37,414 m^3 *per annum* by the year 2027 (20 year forecast).

No concerns were raised by the parties in their written submissions as to the amount of water required by the Applicant, the manner in which it is obtained or in the manner in which this water will be used. The NWB has determined that the minimal increase in water use volume requested within this application will not substantially affect the quality, quantity or flow of waters.

A Water Storage and Treatment Facility Operation and Maintenance (O&M) Plan has been prepared and was submitted with the Application. This Plan has met the requirements of the NWB and will become effective upon commissioning of the expanded facility.

Deposit of Waste

Sewage

The Hamlet of Qikiqtarjuaq currently provides trucked sewage services for the Community's residents, businesses and institutions.

The Sewage Treatment Facility, operated by the Hamlet of Qikiqtarjuaq is located approximately 2.3 km from the Hamlet. Sewage is collected by vacuum 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 and adjacent to the solid waste disposal facility. The Hamlet currently utilizes a facultative lagoon that was originally designed as two independent cells, however when constructed in 1992, only one of the two cells was completed. It currently has a capacity of 10,558 m^3 and is not sufficient to provide the proper storage and treatment of sewage generated by the Hamlet.

The use of a second lagoon cell has been applied for with this renewal application to provide sewage retention for the projected 20-year design population. This double-celled lagoon system will have a combined working capacity of 38,850m^3. Sewage effluent from the lagoon will be discharged overland, annually, via engineered facilities, through a large Wetland Treatment Area to the Final

Discharge Point located approximately one kilometer from the discharge point of the Sewage Disposal Facility. This Final Discharge Point eventually discharges into the Davis Strait. Discharge from this upgraded facility is planned to take place annually, weather dependent, from June until October, to provide additional storage and treatment that is available with the Wetland Treatment Area.
Specific comments relevant to sewage disposal operations in the Hamlet were provided by GN-DOE, INAC and Environment Canada. Environment Canada was agreement with the proposed final effluent quality recommendations presented by the proponent and imposing these effluent quality limits on the Wetland Treatment Facility. Environment Canada also indicated that it was a significant improvement over the guidelines for marine embayed areas that are currently being followed in Nunavut and those currently in place for the discharge from the Sewage Treatment Facilities. Monitoring of the Sewage Lagoon effluent (Sewage Disposal Facility) was also requested in order to assess the treatment efficiency and verify the accuracy of the models being used to predict effluent quality within the wetland treatment. The NWB concurs with this and has included monitoring requirements for the Sewage Lagoon. The Sewage Lagoon effluent will remain as the point of control for compliance purposes until such a time as construction has been completed and the sewage effluent is being routed through the designed flow control structure to achieve the desired sheet flow pattern (exfiltration berm and perforated drainage pipe). This requirement is reflected in the Effluent Quality Criteria as shown in Part D, Items 3 and 9. The Licensee will be required to provide notification to the Board and an Inspector of the intent to utilize the Wetland Treatment Area for further treatment and use of the Final Discharge Point for compliance with the Licence.

In addition to the Effluent Quality Criteria of Part D, Environment Canada emphasized that there remained the concern for meeting the requirements of the Fisheries Act, Section 36(3) and the importance of the Licensee to comply with all other legislation when discharging effluent of any type including effluent from the Sewage Disposal Facility. In order to effectively monitor these effluents for compliance purposes, the NWB has imposed acute toxicity testing as a licence requirement under Part D, Item 10.

Environment Canada recommendations included the need to determine the treatment efficiencies of the wetland treatment over a suggested period of 1-5 years, 5-10 years, 10-15 years and 15-20 years. In order to provide the additional design data required to adequately assess the system, a Wetland Treatment Area Assessment Report is to be developed that will provide the criteria needed in order to properly assess the efficiency of the system over time. Verification of assumed sheet flow pattern, residence time and determination of a focal point of release for the Final Discharge Point are all needed in order to demonstrate the effectiveness of the system and the predictive model used in the planning. This requirement is detailed in Part D, Item 7.

In considering that the Licence term has been set to five (5) years, and in allowing for the construction of the facilities, the Board has determined that the treatment efficiency of the Wetland

Treatment Area be assessed in year 3 of this Licence. Further assessment as recommended by EC may be considered by the Board in an application for Licence renewal.

Further, the NWB has included a requirement to provide a follow-up report on the Wetland Treatment Area, Treatment Assessment which is to be provided to the NWB within sixty (60) days of the completion of the third season (2010) of discharge to the Facility from the Sewage Lagoon system. This report will describe the progress to date and provide an assessment of the treatment efficiency of the Wetland Treatment Area along with recommendations and predictions for future treatment by the Facility. This requirement is detailed in Part D, Item 8.

A Sewage Treatment Facility Operation and Maintenance (O&M) Plan has been prepared and was submitted with the Application. This Plan has met the requirements of the NWB and will become effective upon commissioning of the expanded facility. Additional review and revision are required to update the Plan with current operational procedures and Licence requirements.

Solid Waste

The Hamlet's Solid Waste Facility is located approximately 2.3 km east of the community, north of the DEW Line Access Road. Waste is collected by the Hamlet and transported to the waste disposal facility. Specific areas for the segregation of hazardous and bulky waste (Hazardous Waste Segregation Facility and the Bulky Waste Disposal Area) are provided. Hazardous waste is located within the fenced area of at the landfill whereas the bulky disposal area is located in an adjacent, but unfenced area.

A Solid Waste Facility Operation and Maintenance (O&M) Plan has been prepared and was submitted with the Application. This Plan has met the requirements of the NWB and will become effective upon commissioning of the expanded facility. A revision of the Plan has been requested under Part F, Item 1 to ensure the Plan is current and takes into consideration concerns presented during the review of the Application, including any incineration planned at the Solid Waste Facility.

For the storage of solid wastes, Environment Canada has recommends that groundwater monitoring wells be installed downstream of the solid waste landfill and the existing metals dump area. It is understood that diversion ditches will be installed around the landfill to redirect surface runoff, however groundwater monitoring wells will help verify that historical contaminants that may be present in the landfill or metals dump are not migrating off site as a result of precipitation or snowmelt. Monitoring of these wells is therefore included as a requirement of the Licence as presented in Part H, Items 7 and 8.

Change to Monitoring Program Station Identifications

Prior to the issuance of the previous Licence for the Hamlet of Qikiqtarjuaq, the Hamlet operated under a Licence issued by the Northwest Territories Water Board, N4L3-0640. Designated under

this Licence were several monitoring stations. These stations were carried forward into the Licence renewal by the NWB under Licence NWB3QIK0106. Additional monitoring stations were added under the Licence renewal.

Additional monitoring parameters have been incorporated into the Licence to provide for an assessment of the facilities and to identify potential contaminants of concern. This monitoring follows closely the proposed monitoring as presented in the Application supporting: "Sewage Treatment Facility Operation and Maintenance (O&M) Plan" and the "Solid Waste Facility Operation and Maintenance (O&M) Plan". These monitoring requirements are presented in Part H, Items 2 and 4.

With the issuance of a renewal for Licence NWB3QIK0106, the NWB has adopted a new licence number system as well as requiring a change to the numbering system for the monitoring stations. The summary included in the Monitoring Program lists the previous monitoring stations with their associated number, their description, status and the new numbers that have been adopted under Part H, Item 1 of this Licence.

Abandonment and Restoration

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 six (6) months prior to final closure or upon submission of the final design drawings for the construction of new facilities to replace existing ones.

LICENCE 3BM-QIK0712

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 QIKIQTARJUAQ

(Licensee)

of **P.O. BOX 4, QIKIQTARJUAQ, NUNAVUT X0A 0B0**

(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 **3BM-QIK0712**

Water Management Area **NUNAVUT 04**

Location **QIKIQTARJUAQ, NUNAVUT**
Latitude 67°33' and Longitude 64°02'

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to Exceed **37,500 CUBIC METRES ANNUALLY**

Date of Licence **May 9, 2007**

Expiry Date of Licence **May 31, 2012**

Dated this 9th of May 2007 at Gjoa Haven, NU.

Original signed by:

Thomas Kabloona
Acting Chief Executive 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 Qikiqtarjuaq, Nunavut (67°33' N, 64°02'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: **3BM-QIK0712**

"**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;

"**Engineer**" means a professional engineer registered to practice in Nunavut in accordance with the *Engineering, Geological and Geophysical Act (Nunavut)* S.N.W.T. 1998, c.38, s.5;

"**Final Discharge Point**" means the discharge location at the Sewage Disposal Facility as described in the Final Design Report, to be confirmed through on-site investigation and approval by an Inspector. Part D, Item 7;

"**Freeboard**" means the vertical distance between water line and crest on a dam or dyke's upstream slope;

"**Geotechnical Engineer**" means a professional engineer registered with the Association of Professional Engineers, Geologist and Geophysicists of Nunavut and whose principal field of specialization with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments;

"**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 engineered lagoon and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on April 20, 2006 and illustrated in Project N-O 09439 Drawing No. 8, 9 and 10;

"**Solid Waste Disposal Facilities**" means the facilities designated for the disposal of solid waste, as described in the Application for Water Licence filed by the Licensee on April 20, 2006 and illustrated in Project N-O 09439 Drawing No. 13 and14;

"**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 Facilities**" comprises the area and associated intake infrastructure at the Tulugak River, as described in the Application for Water Licence filed by the Licensee on April 20, 2006 and illustrated in Project N-O 09439 Drawing No. 1 through 7;

"Wetland Treatment Area" comprises approximately 22 hectares of land immediately downstream of the Sewage Lagoon, for approximately 1 kilometre and includes the constructed exfiltration berm and perforated drainage pipe as described in the Application for Water Licence filed by the Applicant on April 20, 2006 and partially illustrated in Project N-O 09439 Drawing No. 8 and 9.

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 (i.e., Operations and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to water use and waste disposal 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 by the Inspector following issuance of this Licence, 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. Any communication with respect to this Licence shall be made in writing to the attention of:

(i) Manager of Licensing:

Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: licensing@nunavutwaterboard.org

(ii) Inspector Contact:

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4295
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.

9. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the Board is received and acknowledged by the Manager of Licensing.

10. This Licence is not assignable except as provided in Section 44 of the Act.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from the Tulugak River 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 37,500 cubic metres.

3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.

4. The Licensee shall equip all water intake hoses with a screen of an appropriate mesh size to ensure that fish are not entrained and shall withdraw water at a rate such that fish do not become impinged on the screen.

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. The Licensee shall provide notice to an Inspector at least ten (10) days prior to initiating any decant of the Sewage Disposal Facilities.

3. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Program Station QIK-6 shall meet the following effluent quality standards until commissioning and use of the Wetland Treatment Area:

Parameter	Maximum Average Concentration
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Faecal Coliforms	1×10^4 CFU/100mL
Oil and grease	No visible sheen
pH	between 6 and 9

4. The Licensee shall maintain at all times, a freeboard of at least 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, for all dams, dykes or other structures intended to contain, withhold, divert or retain water or wastes.

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 provide to the Board for approval, a Sewage Sludge Management Plan, at least sixty (60) days prior to the removal of sludge from the Sewage Disposal Facility and as required under Part F, Item 1.

7. The Licensee shall provide to the Board for approval, prior to the commissioning of the Wetland Treatment Area as an integral component of the sewage treatment, a Wetland Treatment Area assessment that includes, but is not limited to:

   i. Final, as built plans/drawings that have been signed, stamped and sealed by an Engineer, of the Wetland Treatment Area that include but are not limited to a topographical map, cross and longitudinal sections of the treatment area indicating anticipated flow patterns;

   ii. Identify the Final Discharge Point as required to complete monitoring requirements under Part D, Item 9;

iii. An ecological/vegetative assessment of the area to be used, including a prediction of the time required to achieve the effluent quality as described in the Application for Water Licence renewal filed by the Licensee on April 20, 2006, within ninety (90) days of completion; and

iv. A Description of the gradient, holding capacity, and verification of the total area utilized which has been predicted as required to attain the proposed effluent quality, describing any discrepancies and the affects it will have on the predictive model outcome along with contingencies.

v. Provide an assessment of the potential effects of the release of any leachate from the Solid Waste Disposal Facilities to the Wetland Treatment Area, as well as any migration measures that may be required.

8. The Licensee shall notify the Board and the Inspector, at least sixty (60) days prior to the commissioning of the Wetland Treatment Area for sewage treatment.

9. Upon commissioning of the Wetland Treatment Area, effluent quality standards under Part D, Item 2 shall cease to apply and all effluent discharges from the Wetland Treatment Area at the Final Discharge Point, Monitoring Program Station QIK-12 shall meet the following effluent quality standards:

Parameter	**Maximum Average Concentration**
BOD_5	45 mg/L
Total Suspended Solids	45 mg/L
Faecal Coliforms	(2×10^2 CFU/100ml)
Oil and grease	No visible sheen
pH	between 6 and 9

10. All Effluent discharged from the Sewage Treatment Facility, Monitoring Station QIK-6 or the Wetland Treatment Area, Monitoring Station QIK-11 as determined to be the Final Discharge Point, shall be demonstrated to be Not Acutely Toxic under the following tests to be conducted once annually approximately mid-way through discharge:

i. Acute lethality to Rainbow Trout, Oncorhynchus mykiss (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13); and

ii. Acute lethality to the crustacean, Daphnia magna (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14).

11. The Licensee shall dispose of and contain all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Board.

12. The Licensee shall segregate and store all hazardous materials and/or hazardous waste within the Solid Waste Disposal Facility in a manner as to prevent the deposit of deleterious substances into any water until such a time as proper disposal arrangements are made.

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. these 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. The Licensee shall provide as-built plans and drawings of the Modifications referred to in this Licence within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

4. All activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage

5. The Licensee shall ensure that sediment and erosion control measures are implemented prior to and maintained during the operation to prevent the release of sediment and minimize erosion during excavation for the expansion of the reservoir.

6. The Licensee shall designate an area for the deposition of excavated and stockpiled materials that is at least thirty (30) metres above the ordinary high water mark of any water body and in such a manner as to prevent sediment from entering any surrounding water body.

7. All activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage.

8. The Licensee shall ensure that all fill material used in construction and that the ground to be constructed upon, is free of contaminants. If contaminated soils are identified, notification shall be made in the Licensee's annual report. All contaminated soils shall be treated and disposed of as approved by the Board.

9. The Licensee shall provide a final construction report, within ninety (90) days of completion of the construction, outlining any alteration or deviation from the Final Design and Specifications, which will include, but not be limited to, as built plans/drawings that have been signed, stamped and sealed by an Engineer, of the improvements to the Water Reservoir, Sewage Disposal Facilities and Solid Waste Disposal Facilities as described in the Application for Water Licence renewal filed by the Licensee on April 20, 2006.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall submit to the Board for approval within ninety (90) days of issuance of the Licence, a revised

   i "Water Storage Operation and Maintenance (O&M) Plan, February 2006";

   ii "Sewage Treatment Facility Operation and Maintenance (O&M) Plan, February 2007". This Plan shall specifically address, but not be limited to, characterization of the sludge, identifying the chemical composition of the sludge and how the sludge will be stored, treated and eventually disposed of. This Plan is to be included within the Sewage Treatment Facility O&M Plan as an appendix; and

   iii "Solid Waste Facility Operation and Maintenance (O&M) Plan, February 2006" .

The Plan revisions shall take into consideration, at a minimum, the comments received during the Application review process and any necessary changes to be consistent with this Licence.

2. If the revised Plans referred to in Part F, Item 1 are not approved, the Licensee shall make the necessary revisions and resubmit the Plan(s) within thirty (30) days following notification from the Board.

3. The Licensee shall implement the Plans specified in Part F, Item 1 as and when approved by the Board.

4. An inspection of all engineered facilities related to the management of water and waste shall be carried out annually in July by a Geotechnical Engineer. The engineer's report shall be submitted to the Board within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan addressing each of the Engineer's recommendations.

5. The Licensee shall perform more frequent inspections of the engineered facilities at the request of an Inspector.

6. The Licensee shall submit to the Board for approval within ninety (90) days of issuance of the Licence, a revised "Environmental Emergency Contingency Plan For Water, Sewage and Solid Waste Operations in the Hamlet of Qikiqtarjuaq, Nunavut", taking into consideration at a minimum, the comments received during the Application review process and any necessary changes to be consistent with this Licence.

7. If the revised Plan referred to in Part F, Item 6 is not approved, the Licensee shall make the necessary revisions and resubmit the Plan within thirty (30) days following notification from the Board.

8. The Licensee shall implement the Plan specified in Part F, Item 6 as and when approved by the Board.

9. The Licensee shall review the Plans referred to in this Part as required by changes in operation and/or technology and modify the Plan accordingly. Revisions to the Plan are to be submitted in the form of an Addendum to be included with the Annual Report, unless directed otherwise by an Inspector.

10. 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 the Inspector at (867) 975-4295; and
iii. submit to the Inspector, a detailed report on each occurrence, not later than thirty (30) days after initially reporting the event, that provides the necessary information on the location (including the GPS coordinates), initial response action, remediation/clean-up, status of response (ongoing, complete), propose disposal options for dealing with contaminated materials and preventative measures to be implemented.

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. If the Plan referred to in Part G, Item 1 is not approved, the Licensee shall make the necessary revisions and resubmit the Plan within thirty (30) days following notification from the Board.

3. The Licensee shall implement the plan specified in Part G, Item 1 as and when approved by the Board.

4. 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.

5. The Licensee shall revise the Plan referred to in Part G, Item 4 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.

6. 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 Program Stations at the following locations:

New Monitoring Program Station Number	Description	Status	Historical Monitoring Program Station
QIK-1	Raw water supply intake at the Tulugak River	Active (Volume)	0640-1
QIK-2	Raw water supply intake at the Reservoir truck fill station	Active (Volume)	0640-2
QIK-3	Raw Sewage from pump-out truck	Active (Volume)	0640-3
QIK-4	Run-off below the abandoned Sewage disposal area prior to discharge to ocean	Not Active	0640-4
QIK-5	Ocean water five (5) metres from point where effluent enters ocean (abandoned site)	Not Active	0640-5
QIK-6	Discharge from the Sewage Disposal Facilities at the controlled point of release following treatment	Active	0640-6
QIK-7	Current Sewage Disposal Facilities effluent five (5) metres prior to entering the ocean	Active	0640-6A
QIK-8	Run-off from the Solid Waste Disposal Facility that has collected within the constructed collection pond	Active	0640-7
QIK-9	Unnamed stream located between the	Active	0640-8

	Sewage Disposal Facilities and Solid Waste Disposal Facilities		
QIK-10	Unnamed stream located between the Sewage Disposal Facilities and Solid Waste Disposal Facilities; Sample site located **below** the facilities	Active	0640-9
QIK-11	Unnamed stream located between the Sewage Disposal Facilities and Solid Waste Disposal Facilities; Sample site located **abov**e the facilities	Active	0640-10
QIK-12	The Final Discharge Point of the Wetland Treatment Area	Not Active	0640-11
QIK-13	Monitoring well located up gradient of the Solid Waste Disposal Facilities	New	0640-12
QIK-14	Monitoring well located down gradient of the Solid Waste Disposal Facilities	New	0640-13
QIK-15	Monitoring well located down gradient of the metals dump	New	0640-14

2. The Licensee shall sample at Monitoring Program Stations QIK-6, QIK-7 and QIK-12 once at the beginning, middle and near the end of discharge. Samples shall be analyzed for the following parameters:

Biochemical Oxygen Demand - BOD	Faecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease (visual)	Total Phenols
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Total Hardness	Total Alkalinity
Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Cobalt	Total Manganese
Total Chromium	Total Nickel
Total Copper	Total Lead
Total Aluminum	Total Arsenic
Total Mercury	Total Organic Carbon (TOC)

3. If, for whatever reason, the discharge at Station QIK-6 has been suspended and subsequently restarted with more than a 48 hour lapse, the sampling sequence described in Part H, Item 2 of the Monitoring Program shall be repeated.

4. The Licensee shall sample at Monitoring Program Station QIK-8 prior to any discharge. Samples shall be analyzed for the following parameters:

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

5. The Licensee shall report all results of acute toxicity testing as required under Part D, Item 10 within the Annual Report as per Part B, Item 1.

6. Upon completion of construction and prior to any use, the Licensee shall provide a Temperature Monitoring Program and Implementation Plan for the collection of ground temperatures within each berm structure and foundation through the installation of thermistors. This Plan shall take into consideration the following:

   i. The frequency of temperature readings shall be such to allow the determination of the maximum freeze and thaw of the berm and underlying native materials and provide adequate data for thermal modeling of the berms.
   ii. This frequency may be reviewed and adjusted upon collection of adequate data and as recommended by the Geotechnical Engineer in order to assess the berms through thermal modeling and provide an assessment with respect to berm stability and potential seepage.
   iii. This information is to be reported along with the results of the annual geotechnical inspection as required under Part F, Item 6.

7. The Licensee shall install groundwater monitoring wells at the Solid Waste Disposal Facilities. These wells shall be located with at least one located upstream of the facility for background data collection and at least one downstream of the landfill and one downstream of the metals dump.

8. The Licensee shall sample at Monitoring Program Stations QIK-13, QIK-14 and QIK-15 once annually in the summer, giving consideration to adequate ground thaw and obtaining a representative groundwater sample. Samples shall be analyzed, in addition to the parameters identified in Part H, Item 4, for the following:

    TPH (Total Petroleum Hydrocarbons)
    PAH (Polycyclic Aromatic Hydrocarbons)
    BTEX (Benzene, Toluene, Ethylbenzene, Xylene)

9. The Licensee shall measure and record in cubic metres, the monthly and annual quantities of water pumped at Monitoring Program Station QIK-2 and when use is directly from Station QIK-1, for all purposes.

10. The Licensee shall measure and record in cubic metres the monthly and annual quantities of raw sewage offloaded from trucks at Monitoring Program Station QIK-3 for all purposes.

11. Additional sampling and analysis may be requested by an Inspector.

12. The Licensee shall submit to the Board, a revised "Quality Assurance/Quality Control (QA/QC) Plan for the Hamlet Water Reservoir, Sewage Lagoon and Solid Waste Disposal Facility Monitoring Program, February 2006" for approval within (60) days of issuance of the Licence. The Plan shall to take into consideration comments received during the Application review process.

13. If the Plan referred to in Part H, Item 12 is not approved, the Licensee shall make the necessary revisions and resubmit the Plan within thirty (30) days following notification from the Board.

14. The Licensee shall implement the Plan referred to in Part H, Item 12 as and when approved by the Board.

15. 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.

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

17. The Licensee shall measure and record the annual quantities of sewage solids removed from the Sewage Disposal Facility.

18. 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.

BURNSIDE

Appendix D
Water Storage and Treatment Facility Unit Operations

APPENDIX D – Water Facility Detailed Unit Operations

Summary

The Main Headings for the detailed unit operations associated with the Hamlet of Qikiqtarjuaq Water Storage and Treatment Facility are summarized in Table D.1.

Table D.1
Main Headings

A	Raw Water Source
B	Raw Water Handling
C	Raw Water Storage
D	Truck Fill Station
E	Particulate Removal
F	Disinfection
G	Common Utilities

Unit Operation Descriptions for each of the Main Headings are identified in the Unit Operation Descriptors Chart, Table D.2. The descriptors are only used to describe the unit operation when applicable to the individual unit process.

Table D.2
Unit Operation Descriptors

Code Number	Descriptor
10	Functional Overview
20	Unit Operation Description
30	Safety Procedures
40	Normal Operations
50	Bypass Operations
60	Emergency Provisions
70	Flow Control
80	Handling and Storage
90	Monitoring and Reporting
100	Additional References
110	Maintenance

Unit Operation A – Raw Water Source

A.10 Functional Overview

The Tulugak River currently provides the water supply to the Hamlet of Qikiqtarjuaq. The river is located adjacent to the Water Storage Reservoir and Truck Fill Station. The Tulugak River is a seasonal river, which flows during the summer months in a northwest direction towards the Davis Strait.

A.40 Normal Operation

During the summer months when the river water is flowing, the water is conveyed to the water storage reservoir using a gravity intake pipe. The water is stored in the reservoir for the remainder of the year.

A. 90 Monitoring & Reporting

The Hamlet of Qikiqtarjuaq operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB 3BM-QIK0712, dated May 9, 2007. Part B of the NWB License outlines the reporting requirements and Part H outlines the monitoring requirements.

Unit Operation B - Raw Water Handling

B.10 Functional Overview

The raw water supply for the Hamlet of Qikiqtarjuaq flows through an intake located behind a rock check dam in the Tulugak River. The intake pipe conveys raw water by gravity from the intake structure to the water storage reservoir.

B.20 Unit Operation Description

The intake consists of a sluice gate (picture attached) with a coarse screen. The intake pipe is a 300 mm diameter HDPE Series 100 installed from the intake location in the river to the reservoir.

B.40 Normal Operation

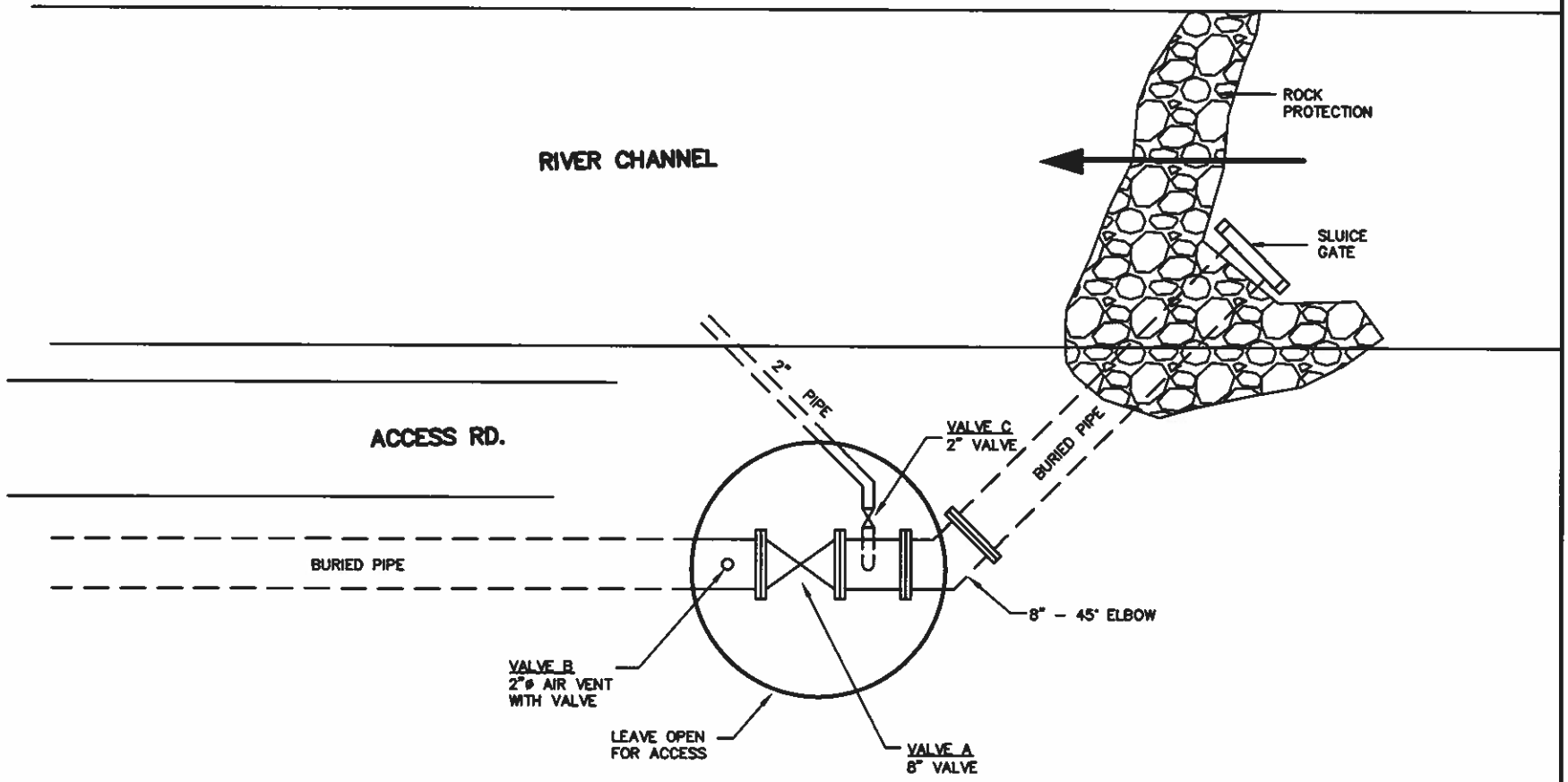
In the spring once the river starts to flow, the valve located on the intake line should be opened to allow the river water to flow through the intake line to the reservoir. Once the reservoir is full the valve should be closed and the intake pipe will drain. See Drawing D1 for intake detail and specific instructions to fill and by-pass reservoir.

B. 90 Monitoring and Reporting

The Operator records the water level in the reservoir prior to filling to calculate volume required to fill reservoir.

B.110 Maintenance

The owner/operator should inspect the intake every spring for damages. Any damages should be repaired prior to start-up. Refer to the manufacturer specifications for further maintenance recommendations and troubleshooting.



TO BY-PASS RESERVOIR

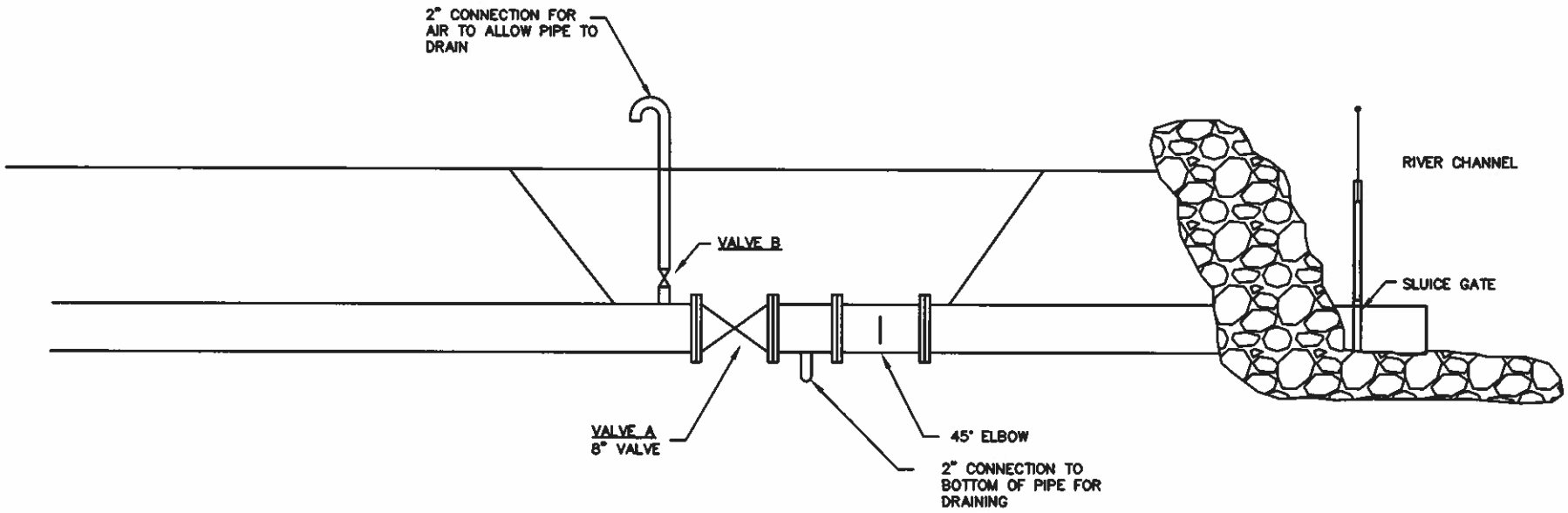
- CLOSE SLUICE GATE
- OPEN VALVE B & C
- CLOSE VALVE A

TO FILL RESERVOIR

- CLOSE VALVE B & C
- OPEN VALVE A
- OPEN SLUICE GATE

Project Title: THE HAMLET OF QIKIQTARJUAQ QIKIQTARJUAQ, NUNAVUT UPDATED O & M PLAN AUGUST 2010	NUNA BURNSIDE		
Drawing Title: WATER RESERVOIR RIVER INTAKE - PLAN	Drawn By: K.R.K.	Checked By: M.O.H.	Drawing No.: APPENDIX D1
	Scale: N.T.S.	Project No.: N-009439	

File Name: N-009439 UPDATED AUG 2010 O&M PLAN RIVER INTAKE DETAILS.dwg
Date Plotted: Aug 26, 2010 - 2:03pm



Project Title: THE HAMLET OF QIKIQTARJUAQ QIKIQTARJUAQ, NUNAVUT UPDATED O & M PLAN AUGUST 2010	NUNA BURNSIDE		
Drawing Title: WATER RESERVOIR RIVER INTAKE – PROFILE	Drawn By: K.R.K.	Checked By: M.O.H.	Drawing No.: APPENDIX D2
	Scale: N.T.S.	Project No.: N-009439	

File Name: N-009439 UPDATED AUG 2010 O&M PLAN RIVER INTAKE DETAILS.dwg
Date Plotted: Aug 26, 2010 - 2:04pm

Unit Operation C - Raw Water Storage

C.10 Functional Overview

The reservoir provides water storage for the Hamlet throughout the year, especially during winter when the river does not flow. The reservoir is located east of the Hamlet. The reservoir is an in-ground reservoir with a liner system.

C.20 Unit Operation Description

The reservoir was expanded in 2007 to provide a 10-month storage capacity with dimensions of 90 m x 156 m and a total volume of 31,500 m^3. The specifications of the reservoir are summarized in the table below.

Table D.3

Water Storage Reservoir Specifications

Length:	156 m
Width:	90 m
Total depth:	9 m
Required free board allowance:	1.0 m
Allowance for ice:	1.5 m
Intake allowance:	1.5 m
Slope of berms inside of the reservoir:	3:1
Top width of berm:	4.5 m

The liner system consists of a geotextile, crushed stone and a polypropylene liner.

C.40 Normal Operations

The reservoir is designed to ensure sufficient water is available to supply demands and emergency supply to the community for 10 months of the year. The level in the reservoir can change based on if the reservoir is filling (during the summer months) and if the truck fill pumps are running.

C.110 Maintenance

The required level of maintenance for the reservoir is outlined below.

Monthly:

1. make sure the site is clean, secure and accessible

Yearly:

1. Check berms for signs of erosion.
2. Check liner for damage
3. Check for foreign materials in reservoir/clean as required

Unit Operation D - Truck Fill Station

D.10 Functional Overview

The water from the storage reservoir is delivered to the Hamlet of Qikiqtarjuaq via water trucks. The water from the reservoir is pumped using two submersible truck fill pumps located in the reservoir. The water is pumped to the Truck Fill Building through a 100 mm diameter discharge pipe, through a treatment process and then to the truck fill outlet. The truck fill station is situated directly adjacent to the reservoir.

D.20 Unit Operation Description

The Specifications and details for the truck fill pumps are shown in Table D.4 below.

Table D.4

Truck Fill Pump Specifications

Capacity:	1,000 L/min
Pump Type:	Submersible
Manufacturer:	Grundfos
Pump Model:	230S120-4 (12.5 Hp)
Incoming Voltage:	208V/3PH/60 Hz

D.40 Normal Operations

The truck fill pumps are controlled manually, when a truck comes to fill up the Operator hooks up to the quick connect and manually turns the pumps on using the control panel. Starting the system automatically starts one of the two pumps. Only one pump runs at a time, there is a switch that allows the Operator to change to the other pump. When the selected amount of water has been pumped, the pumps shut down automatically. The water from the reservoir is treated prior to filling the tanker truck.

D.60 Emergency Provisions

When the Motor Control Centre (MCC) or pump starter picks up a pump failure an alarm signal is issued and the operator is notified.

For detailed information on the pumps the manufacturer's literature should be consulted.

D. 70 Flow Control

A flow meter, located on the truck fill discharge pipe monitors the instantaneous and total flow as it leaves the truck fill station. The flows are digitally displayed on a wall-mounted signal converter.

Table D.5 below provides the specifications for the flow meter.

Table D.5

Flow Meter Specifications

Manufacturer:	McCrometer (Propeller type)
Model Number:	MW500
Diameter:	100 mm

D. 90 Monitoring and Reporting

The NWB License requires that the annual monitoring report include monthly and annual quantities in cubic metres of raw water obtained. Therefore, the total flow measured by the flow meter should be recorded.

D.110 Maintenance

The truck fill pumps require minimal regular maintenance. Pump flow and head should be recorded weekly. Refer to the manufacturer's maintenance schedule for further details.

Periodically, amperage draws for the pump motor should be measured using a "clamp on" type amp-meter and compared to the manufacturer's nameplate data. Amperage draws close to or exceeding this nameplate rating are indicators that the motor is being overloaded. Once alerted, the operator can schedule an appropriate time (normally during non summer months to remove the pump for examination and repair).

Pump operation should be confirmed each spring in the following manner:

- place the pump selector switch for the pump to be tested in the manual position
- read the pressure gauge in kPa on the upstream side of the check valve for the pump being tested
- divide the pressure reading by 9.81 to convert to an equivalent number of metres of head of water. Add to this, the elevation difference between the pressure gauge and the pumping level in the reservoir.

- consult the applicable pump curve shown in the manufacturer's literature. Establish the intersection point of the two values. This point should be slightly below the pump curve
- measure the amperage draw on all three leads of the pump being tested and compare to the manufacturer's data
- using the keypad on the MCC or using a portable voltage meter record the line voltages for the pump being tested and compare to the manufacturers data
- if the operating point is found to be significantly under the pump curve line, and the amperage draws are significantly different than those indicated in the manufacturer's data (using the measured voltage) the pump should be inspected by a manufacturer's representative.

Unit Operation E- Particulate Removal

E.10 Functional Overview

Raw water treatment includes 1-micron cartridge filtration to remove particles larger than 1-micron from the water.

E.20 Unit Operation Description

The filtration system consists of two Harmsco filter housings, each complete with a 1-micron cartridge filter. The water flow is split equally between two filters housings. The filter media consists of pleated polyester cartridges. To maintain the integrity of the filter cartridges, they must be removed periodically for cleaning or changing. Filters are equipped with individual isolating valves, pressure gauges both up and down stream, and independent drains.

The specifications for the filter system are listed in Table D.6.

Table D.6

Filter System Specifications

	Each Filter Housing
Manufacturer:	Harmsco
Model Number:	Housing: HUR 1x170HP Cartridge Filter: PP-HC/170-1
Dimensions:	121.9 cm height
Flow Capacity:	Up to 568 L/min

E.30 Safety Procedures

Ensure that the pressure within the filter is relieved prior to opening the filter to complete any maintenance.

E.40 Normal Operations

During normal operation, the filter runs automatically. As water passes through the filter, the suspended particulate remains in the filter, until maintenance procedures are performed. Liquid enters the filter's outer chamber tangentially, producing a rotational flow. This flow pattern creates a centrifugal force that is used to separate dense particles such as sand and grit from the water. Heavy particles drop to the bottom of the filter's

outer chamber where they are discharged. With the dense particles removed, liquid and light solids rise up, over and into an inner chamber where the rotational flow is continued. The filtered water exits the filter at the highest point, as it is filtered.

E.80 Handling & Storage

Spare filter cartridges should be stored in original packaging and in a dry place.

E.110 Maintenance

The filters require regular maintenance. The filtration units contain reusable, cleanable polyester - pleat cartridges that must be removed and cleaned on a regular basis.

It is recommended that the cartridge be cleaned when the pressure differential is 12 psi above start up differential. To remove the filter cartridge, one must first drain the filter housing. Hold the cross-bar in the retainer nut and pull upward to remove filter cartridge and top plate from filter housing. For best results, clean the cartridges with a pressure nozzle using a standard hose. Spray directly at an angle to remove particulate.

When necessary, to remove particulate and calcium mineral deposits from the cartridges, soak cartridge in a solution of tri-sodium phosphate or similar strong detergent (2 lbs. to 10 gallons of water) and chlorine (1 pint). Soak the cartridge for one hour or longer, until the surface is no longer slippery. Rinse the filter thoroughly with clean water after soaking. Following the tri-sodium solution, soak cartridge for approximately ten (10) minutes in a solution of one part muriatic acid to twenty (20) parts of water. Rinse the filter thoroughly with clean water after soaking.

When the pressure differential across the filter is above12 psi and cleaning the filter will not decrease the pressure differential, replacement of filter cartridges is recommended.

Refer to the manufacturer's operation and maintenance manual for further information.

F – Disinfection

F.10 Functional Overview

Disinfection of the filtered water to prevent the growth of bacteria in the drinking water supplied to the Hamlet is accomplished using chlorine.

F.20 Unit Operation Description

The chlorine solution is added downstream of the filters prior to the water entering the water truck. The chemical feed system consists of a 115 litre mixing tank, a 115 litre solution holding tank, a chemical metering pump, tubing and associated valves, and chemical injection point.

F.30 Safety Procedures

Chlorine can be extremely harmful to skin and eyes and can destroy clothing, as it is highly corrosive. Dangerous gases can be formed if mixed with acids. Safety equipment such as eye protective glasses and rubber gloves are stored in the treatment facility to use when handling the chlorine solution. Generally, the operator should read all labels and be extremely careful when handling the chemical.

F.40 Normal Operation

The powder chlorine is delivered to the pumphouse on an as needed basis. It is mixed with water in the mixing tank and transferred to the solution holding tank. When the truck fill pumps are operating, the chlorine feed pump starts automatically and the chlorine solution is pumped from the 115 L solution tank and injected into the truck fill piping after the filters.

F.60 Emergency Provisions

Please refer to the chlorine Material Safety Data Sheet (MSDS) for emergency procedures.

F.70 Flow Control

The effectiveness of chlorination is directly related to the concentration of free available chlorine, however free chlorine is not available for disinfection unless the chlorine demand of the raw water is satisfied. Therefore, the dosage of chlorine required will vary with the quality of the water source. The dosage will also depend on the length of time from when the chlorine is added to when it is being consumed.

Water being transferred to the water trucks shall be dosed with chlorine at a rate sufficient that a free chlorine residual of 0.2 mg/L, after thorough mixing and 20 minutes of contact time, in accordance with the Public Health Act (1992) and associated Regulations.

Trial and error field adjustment will be required to obtain the desired chlorine feed pump rate. Desired dosage is achieved through stroke and frequency adjustments located in the face of the feed pumps. Chlorine feed pump rates can only be fine-tuned after checking the chlorine residuals using portable chlorine residual testing equipment.

F.80 Handling & Storage

Please refer to the chlorine Material Safety Data Sheet (MSDS) for handling and storage of chlorine

F.90 Monitoring & Reporting

Chlorine residuals shall be monitored daily, or as directed by a Public Health Inspector (as defined by the Public Health Act (1992)).

F.110 Maintenance

The chlorine feed system shall be inspected daily.

The chlorine pump requires little maintenance. Any required calibration or repairs should be done in accordance with the manufacturer's recommendations.

Check and clean injector nozzles monthly. Cleaning the injection points monthly should prevent blockage and eventual complications with the chlorine injector system. Keep a supply of spare injector parts on site.

Inspect the suction lines and chlorine distribution lines weekly for cracks or leaks. Keep a supply of repair fittings and plastic tubing on site. Ensure that the liquid end screws, the discharge lines, and the discharge and suction valves are tightly fitted in place.

Unit Operation G – Common Utilities

Heating and Ventilation

G.10 Functional Overview

The building is equipped with two infrared-red electric heaters, two boiler fed glycol unit heaters suspended from the ceiling. The heating system is set up to avoid excessively high or low temperatures from occurring in the building.

G.20 Unit Operation Description

The two infrared-red heaters operate as standby. The two boiler fed unit heaters are the primary heaters. There are two air ducts, one for fresh are intake and one for cooling when the temperature in the building gets too high.

G.40 Normal Operation

Under normal conditions, the system operates automatically.

G.60 Emergency Provisions

As previously mentioned, the electric are used a backup heaters.

If there is a system failure, the control panel will alert the Operator by using flashing lights. When the flashing lights come on, another flashing light located on the flagpole outside will automatically turn on.

G.110 Maintenance

There is very little regular maintenance required on the heaters other than keeping all intakes clear of dust and debris and checking daily to ensure they are operational. Should functional disruptions occur then the manufacturer's instructions and recommendations are to be followed.

Power Supply and Distribution

G.10 Functional Overview

The building is supplied with 120/208 V, 3 Phase power.

G.20 Unit Operation Description

The facility is equipped with an 18 kW standby generator with an automatic transfer switch to provide backup power in the event of a power outage. The generator is situated within the building in the generator room. The generator is situated within the building in the generator room.

G.30 Safety Procedures

Only qualified and trained personnel should be allowed to operate, maintain and trouble-shoot electrical equipment. A Licensed Electrician who is fully familiar with the installed equipment must provide electrical troubleshooting or maintenance.

Extreme caution should be exercised when working around the generator set and transfer switch. Before working on the transfer switch, disconnect all power supplies to avoid electrical shock. A trained technician or electrician should carry out work within the transfer switch. Beware of moving parts, belts and pulleys, and wear protective earmuffs when the generator is operating.

G.40 Normal Operation

Normal power is provided through the incoming hydro service.

G.60 Emergency Provisions

The facility is equipped with an 18 kW indoor generator complete with an automatic transfer switch. Should a power failure occur, the automatic transfer switch (ATS) senses a grid failure and will call the standby generator to start. Once the standby generator is up to speed, the ATS will transfer the facility operations to generator power. The generator will provide power until normal hydro grid power is regained or until the generator runs out of fuel. When normal power is regained, the ATS will transfer facility operations back to normal power and the generator will automatically shut down.

G.110 Maintenance

The generator should be tested regularly under load conditions, for a minimum of 15 minutes.

The manufacturer's manual outlines other scheduled maintenance tasks to be completed by the operator or a technician.

The manufacturer's representative should visit the site once a year to maintain and test the generator.

Fuel Supply System

G.10 Functional Overview

The fuel supply system for the generator consists of a 4500 L storage tank, a 450 L day tank and two fuel pumps.

G.20 Unit Operation Description

The 4500 L storage tank is located outside the building and holds enough fuel to run the building for approximately 10 days. The 450 L day tank is located inside the building and holds enough fuel to supply the generator for one day.

G.40 Normal Operation

The system is automatic. The fuel pumps transfer the fuel from the larger storage tank to the smaller one inside the building. Under normal operation, when the fuel level is low in the small tank as indicated by the float switch, the pumps automatically turn on. When the small tank is nearly full, the pumps shut off.

G.60 Emergency Provisions

A fuel alarm will sound if the level in the small tank gets too low or high.

G.110 Maintenance

The operator should check the fuel levels in the large fuel storage tank weekly. This is done by reading the gauge on the top of the tank.

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BURNSIDE

Appendix E
Example Operation Logs for Water and Sewage

Hamlet of Qikiqtarjuaq

WATER DISTRIBUTION OPERATIONS LOG SHEET

Month: _____ **Truck #:** _____

Date	Number of Trips/Day	Approximate Truck Volume (L)	Total Quantity of Water Delivered/Day (L)	Driver Signature
EX.	***5***	***3000 L***	***15,000 L***	
1				
2				
3				
4				
5				
6				
7				
8				
9				
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Last Updated: August 2010

Hamlet of Qikiqtarjuaq

SEWAGE DISPOSAL OPERATIONS LOG SHEET

Month: _____ **Truck #:** _____

Date	Number of Trips/Day	Approximate Truck Volume (L)	Total Quantity of Sewage Discharged/Day (L)	Driver Signature
EX.	***5***	***3000 L***	***15,000 L***	
1				
2				
3				
4				
5				
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Appendix F
Waste Placement Form and Weekly Inspection Form

Hamlet of Qikiqtarjuaq

WASTE PLACEMENT FORM

Date	Number of Trips/Day	Truck Volume (m^3)	Quantity Waste Delivered/Day (m^3)	Additional Activities (i.e., burning, tipping over edge, maintenance)	Initials
EX.	***5***	***20 m^3***	***100 m^3***		

Hamlet of Qikiqtarjuaq

WEEKLY SOLID WASTE DISPOSAL FACILITY INSPECTION FORM

Inspected by: _____ Date: _____
Wind direction: _____ Temperature: _____
Precipitation: _____ Ground cover: _____

		YES	NO
1.	Is roadway and truck pad clear of snow?	_____	_____
2.	Does roadway require grading?	_____	_____
3.	Is there visible erosion on the berms?	_____	_____
4.	Is all signage visible and in tact?	_____	_____
5.	Is there litter on the fences?	_____	_____
6.	Is there evidence of leachate break-out from the face of the landfill?	_____	_____
7.	Are fences in good condition?	_____	_____
8.	Has there been any evidence of scavenging?	_____	_____
9.	Is there water accumulating in the Water Retention Area	_____	_____
10.	Has any hazardous material been incorporated into the waste pile?	_____	_____
11.	Does the waste require placement into the landfill?	_____	_____
12.	Are there any problems on the site?	_____	_____

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Appendix G
Contact Information

Appendix G
Contact Information

Contact	Location	Telephone	Fax
Territorial 24 Hour Spill Report Line	Iqaluit	(867) 920-8130	(867) 873-6924
Indian and Northern Affairs Canada – Spill Inspector	Iqaluit	(867) 669-2761	N/A
Government of Nunavut - Emergency Measures Officer		(888) 624-4043	N/A
Qikiqtarjuaq Health Centre	Qikiqtarjuaq	(867) 927-8916	N/A
Royal Canadian Mounted Police (RCMP) Detachment	Qikiqtarjuaq	(867) 927-1111	N/A
Hamlet of Qikiqtarjuaq Senior Administrative Officer or Designate	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Environment Canada (Emergency)	Yellowknife	(867) 669-4725	N/A
GN Environmental Health Office	Iqaluit	(867) 975-4817	N/A
Iqaluit Health Center	Iqaluit	(867) 897-8820	N/A
First Air Cargo	N/A	1-800-267-1247 or (867) 769-7505	N/A
Indian and Northern Affairs Canada Nunavut Regional Office - Water Resources Manger	Iqaluit	(867) 975-4550	(867) 975-4585
Nunavut Water Board	Gjoa Haven	(867) 360-6338	(867) 360-6369
Government of Nunavut - Regional Engineer	Pond Inlet	(867) 975-7314	N/A
Environment Canada - Environment Protection Branch Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Manager Pollution Control and Air Quality Environmental Protection Government of Nunavut	Iqaluit	(867) 975-5907	(867) 975-5981
Indian and Northern Affairs Canada Nunavut Regional Office - Land Administration Minister	Iqaluit	(867) 975-4280	(867) 975-4286
Department of Fisheries and Oceans Canada Nunavut Regional Office	Iqaluit	(867) 979-8000	(867) 979-8039
Fire Department	Qikiqtarjuaq	(867) 927-4422	N/A

Appendix G
Contact Information

Nunavut Water Board Contact:

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

Inspector Contact:

Water Resources Manager
Nunavut District, Nunavut Region
Department of Indian and Northern Affairs Canada
P.O. Box 2000
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4550
Fax: (867) 975-4585

Laboratory Contacts:

Taiga Environmental Laboratory
Renewable Resources & Environment
Indian and Northern Affairs Canada
4601 52nd Avenue
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2788
Fax: (867) 669-2718
Email: taiga@inac.gc.ca

Paracel Laboratories Ltd.
Ottawa East – Environmental Laboratory
300-2319 St. Laurent Blvd.
Ottawa, ON K1G 4J8
Telephone: (613) 731-9577
Email: paracel@paracellabs.com

Caduceon Environmental Laboratories
2378 Holly Lane,
Ottawa, ON, K1V 7P1
Telephone: (613) 228-1145
Fax: (613) 526-1244
Email: gclarkin@caduceonlabs.com

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Appendix H
NWT Spill Report

Northwest Territories | Nunavut | Canada

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDDUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR	REPORT NUMBER
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME	☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	____-____
C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)		
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN		
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS		
F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION		
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION		
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER	
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER	
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES	
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT	
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS			

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC | SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN | FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Instructions for Completing the NT-NU Spill Report Form

This form can be filled out electronically and e-mailed as an attachment to spills@gov.nt.ca. Until further notice, please verify receipt of e-mail transmissions with a follow-up telephone call to the spill line. Forms can also be printed and faxed to the spill line at 867-873-6924. Spills can still be phoned in by calling collect at 867-920-8130.

A. Report Date/Time	The actual date and time that the spill was reported to the spill line. If the spill is phoned in, the Spill Line will fill this out. **Please do not fill in the Report Number**: the spill line will assign a number after the spill is reported.
B. Occurrence Date/Time	Indicate, to the best of your knowledge, the exact date and time that the spill occurred. Not to be confused with the report date and time (see above).
C. Land Use Permit Number /Water Licence Number	This only needs to be filled in if the activity has been licenced by the Nunavut Water Board and/or if a Land Use Permit has been issued. Applies primarily to mines and mineral exploration sites.
D. Geographic Place Name	In most cases, this will be the name of the city or town in which the spill occurred. For remote locations – outside of human habitations – identify the most prominent geographic feature, such as a lake or mountain and/or the distance and direction from the nearest population center. **You must include the geographic coordinates** (Refer to Section E).
E. Geographic Coordinates	This only needs to be filled out if the spill occurred outside of an established community such as a mine site. Please note that the location should be stated in degrees, minutes and seconds of Latitude and Longitude.
F. Responsible Party Or Vessel Name	This is the person who was in management/control/ownership of the substance at the time that it was spilled. In the case of a spill from a ship/vessel, include the name of the ship/vessel. Please include full address, telephone number and e-mail. Use box K if there is insufficient space. **Please note that, the owner of the spilled substance is ultimately responsible for any spills of that substance, regardless of who may have actually caused the spill.**
G. Contractor involved?	Were there any other parties/contractors involved? An example would be a construction company who is undertaking work on behalf of the owner of the spilled substance and who may have contributed to, or directly caused the spill and/or is responding to the spill.
H. Product Spilled	Identify the product spilled; most commonly, it is gasoline, diesel fuel or sewage. For other substances, avoid trade names. Wherever possible, use the chemical name of the substance and further, identify the product using the four digit UN number (eg: UN1203 for gasoline; UN1202 for diesel fuel; UN1863 for Jet A & B)
I. Spill Source	Identify the source of the spill: truck, ship, home heating fuel tank and, if known, the cause (eg: fuel tank overfill, leaking tank; ship ran aground; traffic accident, vandalism, storm, etc.). Provide an estimate of the extent of the contaminated/impacted area (eg: 10 m^2)
J. Factors Affecting Spill	Any factors which might make it difficult to clean up the spill: rough terrain, bad weather, remote location, lack of equipment. Do you require advice and/or assistance with the cleanup operation? Identify any hazards to persons, property or environment: for example, a gasoline spill beside a daycare centre would pose a safety hazard to children. Use box K if there is insufficient space.
K. Additional Information	Provide any additional, pertinent details about the spill, such as any peculiar/unique hazards associated with the spilled material. State what action is being taken towards cleaning up the spill; disposal of spilled material; notification of affected parties. If necessary, append additional sheets to the spill report. Number the pages in the same format found in the lower right hand corner of the spill form: eg. "Page 1 of 2", "Page 2 of 2" etc. **Please number the pages to ensure that recipients can be certain that they received all pertinent documents.** If only the spill report form was filled out, number the form as "Page 1 of 1".
L. Reported to Spill Line by	Include your full name, employer, contact number and the location from which you are reporting the spill. Use box K if there is insufficient space.
M. Alternate Contact	Identify any alternate contacts. This information assists regulatory agencies to obtain additional information if they cannot reach the individual who reported the spill.
N. Report Line Use Only	**Leave Blank**. This box is for the **Spill Line's use only**.

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Appendix I
Notification of Laboratory Form

Hamlet of Qikiqtarjuaq

NOTIFICATION OF LABORATORY FORM

Attention: Technical Advisor
Nunavut Water Board

Re: Notification of Laboratory
Water License 3BM-QIK0712

Dear Sir/Madame,

The following CALA-certified laboratory has been retained by the Hamlet of Qikiqtarjuaq to complete the sample analysis required by Water License 3BM-QIK0712:

Name of Laboratory :_____

Address :_____

:_____

:_____

Phone # :_____

Fax # :_____

Regards,

Name (print) :_____

Signature :_____ Date : _____

Please send this form, once completed, to the Nunavut Water Board at the following address:

Nunavut Water Board
c/o Technical Advisor
PO Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

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Appendix J
Example Annual Report

ANNUAL REPORT FOR HAMLET OF QIKIQTARJUAQ

Year Being Reported: _____

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water License 3BM-QIK0712 issued to the Hamlet of Qikiqtarjuaq.

The table below summarizes the monthly and annual quantities in cubic meters of freshwater obtained from all sources, and monthly and annual quantities in cubic meters of each and all wastes discharged.

Month Reported	**Quantity of Water Obtained From all Sources (m^3)**	**Quantity of Sewage Waste Discharged (m^3)**	**Quantity of Waste Discharged to Landfill (m^3)**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
Annual Total			

Please indicate volumes in cubic meters – 1 cubic meter equals 1,000 liters.

Attached to this document are the tabular summaries of all analytical data collected under the Monitoring Program for Monitoring Stations QIK-6, QIK-7, QIK-8, QIK-12, QIK-13, QIK-14, and QIK-15.

A summary of modifications and/or maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and facilities.

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 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 required by the Board by November 1st of the year being reported.

Updates or revisions to the approved Operation and Maintenance Plans.

Additional information that the licensee deems useful.

Follow up regarding inspection/compliance concerns.