WATER, SEWAGE AND SOLID WASTE OPERATIONS AND MAINTENANCE MANUAL

Chesterfield Inlet, NU

FINAL REPORT

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EXECUTIVE SUMMARY

This Operation and Maintenance (O&M) manual has been developed for use at the water distribution, sewage disposal, and solid waste facilities in the Hamlet of Chesterfield Inlet, Nunavut. The purpose of the O&M manual is to establish and describe standard operating and maintenance procedures for proper management of resources and equipment used in water distribution, sewage disposal and solid waste management at Chesterfield Inlet. Proper operation and maintenance of these municipal facilities will support:

- Effective treatment and management of water, sewage and solid wastes
- Successful implementation of the monitoring and sampling program
- Long-term performance of equipment and engineered structures
- Compliance with the Hamlet of Chesterfield Inlet's Water License
- Appropriate emergency response implementation.

This O&M Manual contains the following sections to provide current operations and maintenance procedures:

1. Water Distribution System Operations and Maintenance
2. Sewage Disposal Facility Operations and Maintenance
3. Solid Waste Disposal Facilities Operations and Maintenance
4. Emergency Response (includes a Spill Contingency Plan)
5. Abandonment and Restoration Plan (**Appendix C**).

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ABBREVIATIONS

A&R ..... Abandonment and Restoration

GN-CGS..... Government of Nunavut Department of Community & Government Services

GN-ENV .....Government of Nunavut Department of Environment

GN-HSS ..... Government of Nunavut Department of Health & Social Services

Hamlet.....Hamlet of Chesterfield Inlet

HDPE .....High-density polyethylene

HHW ..... Household Hazardous Waste

L .....litres

m^3.....cubic metres

MSW .....Municipal Solid Waste

NWB.....Nunavut Water Board

O&M..... Operation & Maintenance

ODS ..... Ozone Depleting Substance

SAO ..... Senior Administrative Officer

TSS ..... Total Suspended Solids

1 INTRODUCTION

1.1 Purpose

This Operation and Maintenance (O&M) manual has been developed for use at the water distribution, sewage disposal, and solid waste facilities in the Hamlet of Chesterfield Inlet (Igluligaarjuk), Nunavut. The purpose of the O&M manual is to establish and describe standard operating and maintenance procedures for proper management of resources and equipment used in water distribution, sewage disposal and solid waste management in Chesterfield Inlet. Proper operation and maintenance of these municipal facilities will support:

- Effective treatment and management of water, sewage and solid wastes
- Successful implementation of the monitoring and sampling program
- Long-term performance of equipment and engineered structures
- Compliance with the Hamlet of Chesterfield Inlet's Water License
- Appropriate emergency response implementation.

Preparation and execution of this O&M manual satisfies Item 1 of Part F of the Hamlet of Chesterfield Inlet's Water License (No. NWB3CHE0308), issued by the Nunavut Water Board (NWB) on December 15, 2003; the Water License is included in **Appendix A** of this O&M manual. As the Hamlet of Chesterfield Inlet is presently in the process of license renewal with the NWB, this O&M Manual will also satisfy the O&M requirements of the future license (expected in mid-2010); the water license in **Appendix A** should be updated with the new water license once it is obtained. An Abandonment and Restoration (A&R) plan has also been developed as part of this O&M manual. This A&R plan satisfies Item 1 of Part G of the Hamlet's Water License and is to be used as a guide for the abandonment and restoration of any water, sewage or solid waste facilities in the community. The A&R plan is included in **Appendix C**.

This O&M manual has been developed using the following guidelines or regulations:

- Hamlet of Chesterfield Inlet NWB Water License (No. NWB3CHE0308) general and specific conditions
- Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories (Duong and Kent 1996)
- Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories (Kent *et al*. 2003)
- Nunavut guidelines for Municipal Solid Wastes Suitable for Open Burning (GN-ENV ____)
- Environmental Guidelines for General Management of Hazardous Waste in Nunavut (GN-ENV 2002)
- Contingency Planning and Spill Reporting in Nunavut: A Guide to the New Regulations (GN-ENV ____)

- Operations and Maintenance Manual for the Water Supply Improvement Project Volume I: Truckfill Building and Raw Water Supply at Chesterfield Inlet, NWT (UMA 1991)
- Additional information on water, sewage and solid waste systems in Chesterfield Inlet has been obtained through the Government of Nunavut Department of Community and Government Services (GN-CGS), Nunami Jacques Whitford Limited Chesterfield Inlet project files, and interviews with key GN-CGS and Hamlet personnel.

1.2 Site Description

The Hamlet of Chesterfield Inlet is situated on the south shore of Chesterfield Inlet, on the western shore of Hudson Bay in Nunavut (approximately 63° 20' 27" N, 90° 42' 19" W). The community is located approximately 101 km northeast of Rankin Inlet, NU (see Figure 1 inset in **Appendix B**).

Chesterfield Inlet is located in the zone of continuous permafrost in the Canadian Shield. There are numerous rock ridges and lakes in the area. Tundra vegetation overlies bedrock, which is mainly Precambrian granite and gneiss. Sandy-gravel beach deposits, scattered boulders, muskeg, and exposed rocks are visible on the surface.

The average annual precipitation in the Hamlet consists of 146 mm of rainfall and 1,125 mm of snowfall, resulting in an annual total of approximately 259 mm of equivalent precipitation presented as rain. The July mean high and low temperatures are 13.1°C and 4.6°C, respectively. The July and August average daily temperature is about 10°C. The January mean high and low temperatures are -27.8°C and -35.2°C, respectively. The January average daily temperature is about -32°C. Winds are commonly from the northwest at an annual average speed of 22 km per hour.

The Hamlet provides daily trucked services for water delivery and sewage collection. Drinking water is obtained from Puiqsuk Lake (also known as First Lake), stored in a reservoir, and distributed to water trucks via the pumphouse truck fill. Sewage and wastewater are presently discharged directly into a natural tundra wetland, which treats the effluent and drains west and northwest eventually reaching the marine environment of Hudson Bay (via Finger Bay). This system has been in operation since at least 1993. Upgrades to the sewage disposal and treatment system and the water distribution system are planned for the summer of 2010.

Domestic solid waste is collected five days a week (Monday through Friday) by the Hamlet and disposed of at the municipal solid waste facility. Locations of the water distribution, sewage disposal, and solid waste disposal facilities are shown in Figure 1 in **Appendix B**.

Based on Canadian Census data, the Nunavut Bureau of Statistics estimated the population of Chesterfield Inlet at 370 in 2007 (Nunavut Bureau of Statistics 2008). Table 1-1 illustrates population projections for the Hamlet of Chesterfield for a 20 year period, based on an annual increase of 1%, as projected by the Nunavut Bureau of Statistics.

Table 1-1: Population Projection at Chesterfield Inlet, Nunavut – 2009 to 2029

Year	Population
2009	377
2014	397
2019	417
2024	438
2029	461

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2 BACKGROUND

2.1 Water Distribution System

The Chesterfield Inlet water distribution system consists of a water intake, pump shelter, overland pipeline, reservoir, and pumphouse with truck fill. Potable water is obtained from Puiqsuk Lake, approximately 2.6 km southwest of the community. A pump shelter is located near the shore of Puiqsuk Lake and houses the water pump, a 100 L diesel fuel tank, and intake and discharge hoses.

Water is piped via a 3.2 km overland pipeline from Puiqsuk Lake into a reservoir. Prior to 1991, when it appears the overland pipeline, reservoir and pumphouse were constructed, potable water was trucked directly from Puiqsuk Lake. The pumphouse and truck fill system are expected to be upgraded in the summer of 2010. Major components of the water distribution facility are illustrated in Figure 1 in **Appendix B**.

The reservoir is located approximately 150 m west of the community and was constructed by blasting bedrock to an average depth of 7 m (23 feet). The reservoir was constructed in the early 1990s and is fenced though unlined. Reservoir capacity is estimated at approximately 23,000 cubic metres (m^3).

The Hamlet uses trucked services for scheduled water delivery to all houses and other buildings. Water trucks obtain water from the reservoir via a submersible intake pump, which pumps water through the pumphouse. The pumphouse accommodates the water intake system, truck fill system, chlorination system, standby generator, and associated heating, electrical, and alarm systems. Annual water consumption volumes were estimated by Nunami (2009); these are displayed in Table 2-1 in Section 2.2 for the period 2009 to 2029, along with annual wastewater volumes.

2.2 Sewage Disposal Facility

The sewage disposal facility at Chesterfield Inlet is situated approximately 2.2 km west of the community and presently consists of one dumping station and a natural tundra wetland. The natural tundra wetland is comprised of four major ponds and several intermittent ponds, some small streams and open, boggy, wet tundra areas (natural wetlands) between them through which overland flow occurs. No engineered structures have been built.

Sewage is collected from the Hamlet's houses and other buildings by vacuum truck and discharged from a built-out gravel pad downslope into a natural depression pond. Effluent flows from this pond northwest through three other ponds and across natural wetlands before entering the marine environment of Finger Bay on Hudson Bay. Effluent flows 800 to 1000 m within this tundra wetland, from its discharge location at the existing sewage dumping station to Finger Bay.

In the summer of 2010, GN-CGS is planning to construct engineered improvements to the sewage treatment wetland to help ensure the sewage disposal facility meets the long-term needs of the community (20 years) and the effluent meets regulatory compliance criteria at the final discharge

point. These improvements include construction of two sewage detention cells, two flow diversion berms (south of Finger Bay), upgrading the existing dumping station, and constructing a new dumping station (one per detention cell). See Figure 2 in **Appendix B** for an illustration of the upgraded sewage disposal facility.

For information purposes, projected sewage generation rates for the period between 2009 and 2029 are provided in Table 2-1 (Nunami 2009). Sewage volumes are anticipated to be equal to water consumption volumes. The annual sewage generation is projected based on a per capita water consumption rate of 100 Liters per capita per day (L/c/d.). The volume of sewage produced during a ten-month (300 day) period each year is also included in the table to facilitate annual ice storage.

Table 2-1: Projected Sewage Generation from 2009 to 2029 at Chesterfield Inlet, NU (from Nunami 2009)

Year	Population	Annual Water Consumption (L)	Annual Sewage Volume (m^3)	10-month Sewage Volume (m^3)
2009	377	13,776,451	13,776	11,323
2010	381	13,914,215	13,914	11,436
2011	385	14,053,357	14,053	11,551
2012	389	14,193,891	14,194	11,666
2013	393	14,335,830	14,336	11,783
2014	397	14,479,188	14,479	11,901
2015	401	14,623,980	14,624	12,020
2016	405	14,770,220	14,770	12,140
2017	409	14,917,922	14,918	12,261
2018	413	15,067,101	15,067	12,384
2019	417	15,217,772	15,218	12,508
2020	421	15,369,950	15,370	12,633
2021	425	15,523,649	15,524	12,759
2022	430	15,678,886	15,679	12,887
2023	434	15,835,675	15,836	13,016
2024	438	15,994,031	15,994	13,146
2025	443	16,153,972	16,154	13,277
2026	447	16,315,511	16,316	13,410
2027	451	16,478,666	16,479	13,544
2028	456	16,643,453	16,643	13,680
2029	461	16,809,888	16,810	13,816

2.3 Solid Waste Disposal Facility

Chesterfield Inlet's solid waste disposal facilities consist of a fenced disposal area for municipal solid waste (MSW), a separate bulk metal disposal area approximately 200 m south of the fenced MSW area, and two drum storage areas, approximately 150 m and 270 m southeast of the MSW area. A decommissioned landfill is present between the fenced MSW area and the bulk metal disposal area, at the head of the sewage treatment wetland. Figure 2 in **Appendix B** illustrates components of Chesterfield Inlet's solid waste disposal facilities.

The Hamlet collects solid waste from community buildings on a scheduled daily basis (Monday to Friday) with a garbage truck and transports the waste to the MSW disposal facility, located 2.2 km west of the community. The MSW disposal facility covers an area approximately 24,000 m^2 and is situated adjacent to and north of the sewage disposal facility. The MSW disposal facility is unlined and runoff from the MSW disposal facility flows into the sewage disposal facility. Daily open burning of MSW is typically practiced within the MSW disposal facility. The annual amount of solid waste generated by the community was projected from 2009 to 2029 and is shown in Table 2-2.

Table 2-2: Projected Solid Waste Generation from 2009 to 2029 in Chesterfield Inlet, NU

Year	Population	Annual Solid Waste Generation (m^3)[a,b]	Annual Compacted Volume of Solid Waste (m^3)[c]
2009	377	2,267	1,134
2010	381	2,293	1,147
2011	385	2,319	1,160
2012	389	2,346	1,173
2013	393	2,372	1,186
2014	397	2,398	1,199
2015	401	2,424	1,212
2016	405	2,450	1,225
2017	409	2,477	1,238
2018	413	2,503	1,252
2019	417	2,529	1,265
2020	421	2,556	1,278
2021	425	2,582	1,291
2022	430	2,615	1,308
2023	434	2,642	1,321
2024	438	2,669	1,334
2025	443	2,702	1,351
2026	447	2,729	1,364

Year	Population	Annual Solid Waste Generation (m^3)[a,b]	Annual Compacted Volume of Solid Waste (m^3)[c]
2027	451	2,755	1,378
2028	456	2,789	1,394
2029	461	2,822	1,411
Total Volume of Solid Waste Generated and Compacted			**26,620**
Total Cover Material Required			**5,324**
Total Volume Required for Municipal Solid Waste Disposal			**31,944**

NOTE:

[a] Calculation from Kent *et. al.* (2003)

[b] Average residential solid waste volume estimated at 0.015 m^3/person/day (FSC 2000)

[c] Compacted volume is equal to 50% of total annual volume of solid waste

Some smaller metal wastes are stored within the fenced MSW disposal area however most large metals wastes are disposed of at the bulk metal disposal area. The bulk metal waste disposal area is not fenced or bermed and is used by the community to dispose of items such as automobiles, heavy equipment, appliances, old fuel tanks, and other bulky metal wastes.

Some hazardous waste management and segregation presently occurs at the MSW disposal facility in Chesterfield Inlet. This still can be improved upon to ensure risks to human health and the environment are minimized and the terms of the Hamlet's water license are met. Presently, waste oil is stored in drums at the second drum storage area (270 m southeast of the MSW area) while empty, crushed and palleted drums are stored in the first area (150 m southeast); the second drum storage area is bermed and lined with a geomembrane. Other household hazardous wastes, including, waste batteries, paint, antifreeze and other wastes are also usually stored at the second drum storage area.

3 WATER DISTRIBUTION SYSTEM OPERATIONS AND MAINTENANCE

3.1 Equipment

The following equipment is used to operate and maintain the water distribution system at Chesterfield Inlet.

- **Puiqsuk Lake to Reservoir:**
  - 150 mm diameter suction hose (approximately 30 m long) with 150 mm (6 inch) floating intake strainer
  - Gorman-Rupp® centrifugal diesel powered pump (Model No. 84B2-TS2) with an 1,800 L/min capacity, connected to a 150 mm discharge hose to the water supply pipeline
  - BRYTEX® prefabricated skid-mounted portable pump shelter, has 38 mm exhaust hose from exhaust of water pump motor to exterior of shelter
  - 200 mm diameter high-density polyethylene (HDPE) overland water supply pipeline to reservoir, approximately 3.2 km long
  - From water supply pipeline to reservoir, 150 mm discharge hose with 150 mm discharge strainer.
- **Pumphouse:**
  - Detailed equipment lists for the reservoir and pumphouse (including Pump Room, Genset Room and new pumphouse) can be found in O&M Manual for the pumphouse system (expected in mid-2010 concurrent with upgrades to the pumphouse and truck fill system).
- **Water Trucks:**
  - 2006 Freightliner 9,464 L (2,500 gallon) water truck (primary)
  - 2001 Sterling 7,571 L (2,000 gallon) water truck (back-up).

3.2 Site Personnel

Overall responsibility and management of the water distribution system lies with the Hamlet's Senior Administrative Officer (SAO). The SAO is responsible to ensure proper operation of the system is carried out, sampling and inspections are completed and documented, and annual reporting to the NWB is accomplished.

The Hamlet Maintainer is responsible for the operation and maintenance of the water intake, pump and overland pipeline from the Puiqsuk Lake, including filling the reservoir.

The Hamlet Foreman is responsible for day-to-day operation and maintenance of the pumphouse, including managing water delivery, sampling drinking water, ensuring chlorine solution is mixed, chlorine levels are tested, and completing monthly and annual inspections.

The Hamlet typically has six individuals hired that can operate the water truck(s) (includes permanent and emergency drivers) and distribute water to community buildings on a daily basis (Monday to Sunday). These individuals also operate the Hamlet's sewage trucks. Water Truck Drivers are responsible for monitoring volume of water pumped to residences everyday and reporting these volumes daily at the Hamlet Office. The Water Truck Drivers are also responsible for mixing chlorine solution and testing chlorine levels in the Pump Room.

3.3 Puiqsuk Lake Intake and Overland Water Supply Pipeline

3.3.1 Operations

Most information on operational procedures for the Puiqsuk Lake water intake and pumphouse systems were derived from the original O&M manual developed for the Chesterfield Inlet Truckfill Building and Raw Water Supply by UMA Engineering Ltd. in 1991. Operational information in this 1991 O&M manual has been slightly modified to reflect current conditions and equipment in the community.

Water is obtained from Puiqsuk Lake once per year, typically in August. The intake pump at Puiqsuk Lake runs 24 hours per day for approximately one to two weeks to fill the reservoir. Potable water from Puiqsuk Lake is pumped through the intake hose and strainer, via the intake pump, into discharge hoses and the overland pipeline which empties into the reservoir; the overland pipeline has a discharge hose and strainer at its terminus.

The pump shelter is mobile (on skids) though is typically left near the shore of Puiqsuk Lake throughout the year (approximately 63° 19' 49" N, 90° 46' 19" W). Prior to reservoir re-filling and operation of the pump and hoses, the operator should test and check each component of the system to ensure all components are functioning and are present; this includes inspecting the entire length of the overland water supply pipeline to ensure it is in good condition. The following set-up operational procedures should be carried out to ensure proper operation of the Puiqsuk Lake pump station.

1. **Intake/Suction and Discharge Hoses:**
    i. Since the pump shelter is mobile, the water intake and discharge lines at Puiqsuk Lake are not permanent and are usually removed and stored in the pump shelter after reservoir re-filling every year. Locate the intake/suction and discharge hoses on the hose racks inside the pump shelter. There should be eight 3.8 m lengths of intake hose and twelve 5 m lengths of discharge hose.
    ii. Set-up the intake/suction hose. It runs between Puiqsuk Lake and the water pump intake through the window on the shelter. Connect the intake hose to the lower connection on the water pump; the lower connection does not have valves associated with it.

a) Ensure the mating couplings are clean. Insert the male coupling into the female coupling, spreading the arms of the female coupling. Once inserted, press down on the arms of the female coupling until they are touching the hose.

iii. Set-up the discharge hoses. They run between the water pump discharge and the HDPE overland water supply pipeline through the window on the shelter, and between the overland pipeline and the reservoir. Connect the discharge hose to the upper connection on the water pump; the upper connection has a butterfly and check valve. The discharge hose is connected in the same manner as the intake/suction hose via couplings. Connect the discharge hoses to either end of the overland water supply pipeline.

2. Intake and Discharge Strainers:

i. Locate the intake and discharge strainers in the pump shelter. The intake/suction strainer is identifiable by a 0.5 m long section of stiff-walled suction hose clamped to it. Conversely, the discharge strainer has a 0.5 m long section of soft-walled discharge hose clamped to it.

ii. Ensure both strainers are free of any debris, blockages or physical damage which might inhibit performance.

iii. Join the intake/suction strainer to the end of the intake/suction hose in the same manner as the intake and discharge hoses via couplings. This is a floating strainer and functions to keep the intake/suction hose off the lake bottom and prevents large solids from entering the pump.

iv. Join the discharge strainer to the end of the discharge hose in the Reservoir. The discharge strainer joins in the same manner via couplings. This strainer disperses water discharged from the overland water supply pipeline to limit the amount of stirring in the Reservoir.

3. Raw Water Pump:

i. Check the oil level in the water pump engine. Add oil if required to bring the oil level to within the safe operating range (indicated on the oil dipstick).

ii. Check air filter on the water pump engine and clean if necessary.

iii. Check the fuel level in the diesel storage tank. If less than half full, fill the tank with diesel fuel.

iv. Ensure the butterfly valve on the water pump's discharge connection is open.

v. Open the ball valve on the priming unit located at the top of the water pump's discharge line. Fill the water pump casing with water by pouring water into the priming unit through the open ball valve. Once full, close the ball valve.

vi. Locate the ignition switch on the engine-mounted instrument panel. Turn the ignition switch to the "on" position.

vii. Locate the starter button on the engine-mounted instrument panel. Press the starter button until the engine starts.

a) If the engine does not start after 30 seconds, release the start button and wait five minutes. Press the starter button again. If the engine still does not start after 30 seconds, release the starter button and get mechanical assistance.

viii. Once the engine starts, check the intake/suction hose for signs of air leakage. If air leakage is present, re-adjust the couplings or replace hose sections to eliminate air leakage. Place the intake/suction hose and strainer into Puiqsuk Lake to begin pumping water.

ix. It may take between 15 – 30 minutes for the water pump to draw water into the pump. Once this occurs and the water pump discharges water, check the discharge hose for signs of water leakage. If water leakage is present, re-adjust the couplings or replace hose sections to eliminate water leakage.

x. Air will have to be vented or bled from the overland water supply pipeline to ensure water can flow freely through the pipeline. This is done by slightly loosening the flanged joints along the pipeline to let air escape.

a) Once the air has escaped and only water is flowing from the joint, re-tighten the flanged joint.

b) Air is to be vented one joint at a time along the overland water supply pipeline, starting at the flanged joint closest to Puiqsuk Lake and continuing along the pipeline towards the Reservoir. Each flanged joint must be re-tightened before continuing to the next joint.

xi. Check the raw water pump, engine, diesel fuel tank, exhaust, hoses, strainers and overland water supply pipeline at least twice daily during Reservoir filling.

4. Shut-down:

i. Once sufficient volume has been pumped into the reservoir, turn off the water pump by switching the ignition switch to the “off” position.

ii. Disconnect the intake strainer from the intake/suction hose at Puiqsuk Lake. Clean the strainer to remove any debris or blockages. Return to proper storage in the pump shelter.

iii. Disconnect the discharge strainer from the discharge hose in the Reservoir. Clean the strainer to remove any debris or blockages. Return to proper storage in the pump shelter.

iv. Disconnect the discharge hose from the overland water supply pipeline and water pump discharge connector. Drain discharge hose and replace on hose racks inside pump shelter.

v. Disconnect the intake/suction hose from the water pump intake connector. Drain the intake/suction hose and replace on hose racks inside the pump shelter.

5. On a monthly and annual basis, the volume of water pumped out of Puiqsuk Lake needs to be recorded. This volume of water obtained from Puiqsuk Lake should be recorded in a log book or other record form every time water is pumped.

3.3.2 Maintenance

Maintenance of the intake/discharge hoses, raw water pump and overland water supply pipeline are the responsibility of the Hamlet. The Hamlet Maintainer should inspect all components of the intake and overland pipeline system at least twice daily when water is being pumped from Puiqsuk Lake. The following maintenance procedures for the Puiqsuk Lake intake and overland pipeline should carried out at frequencies described to ensure the system remains in good repair.

Table 3-1: Maintenance Procedures Recommended for the Puiqsuk Lake Intake and Overland Water Supply Pipeline System

Item	Action	Frequency	Normal Condition and Solution
Pump Shelter			
	Keep building, piping, equipment and floor clean	Weekly during pump operation	
	Check interior and exterior of shelter for signs of damage	Monthly	
Raw Water Pump			
Engine Oil Level	Check dipstick on pump engine	Twice daily during pump operation	Oil level in “safe” range – add 1 L of oil if below safe range and re-check
Routine Engine Maintenance	Consult manufacturer’s manual for maintenance procedures	Annually, prior to start-up for reservoir re-filling	See manufacturer’s manual
Exhaust Pipe	Check for leakage and fastening	Twice monthly, prior to start-up	Pipe should be securely fastened and leak free
Fuel Piping and Flexible Connectors	Check for leakage and/or deterioration	Annually, prior to start-up	Pipe and appearances should be solid and leak free – fix leaks and replace deteriorated piping
Battery Cables and Electrical Connections	Check for cleanliness and corrosion	Annually, prior to start-up	Should be clean and corrosion free – clean corrosion and re-tighten connections as needed
Bolts, Screws and Fasteners	Check to ensure secure	Daily during pump operation	All should be secure – tighten as needed but DO NOT OVERTIGHTEN

Item	Action	Frequency	Normal Condition and Solution
Cooling Components	Check	Daily during pump operation	Should be clean – remove any debris and clean as needed
Water Pump	Check for signs of excessive vibration and noise and signs of leakage	Twice daily during pump operation	Pump should run normally with no leaks – repair large leaks immediately; repair small leaks at end of pump operation. Have technician investigate noise and vibration
Intake and Discharge Hoses			
Intake Hose	Check hoses and couplers for signs of damage or air leakage	Daily during pump operation	Should have no damage or leaks – adjust couplers to eliminate air leaks, replace damage hoses with new/spare ones
Discharge Hose	Check hoses and couplers for signs of damage or water leakage at pump discharge and overland pipeline	Daily during pump operation	Should have no damage or leaks – adjust couplers to eliminate water leaks, replace damage hoses with new/spare ones
Intake and Discharge Strainers			
	Check for signs of blockage or physical damage at end of intake hose, end of discharge hose in reservoir	Twice daily during pump operation	Should be free of blockages or damage – if blocked or damaged, shut off pump and remove blockage or repair damage. Replace strainer before restarting pump
Flow Rate of Discharge Water			
	Check for change in flow rate of discharge water at reservoir	Twice daily during pump operation	Flow rate should be constant during entire filling – if not constant, check pump system components and overland pipeline
Overland Water Supply Pipeline			
	Check entire length of overland pipeline for signs of damage	Annually, prior to pump start-up	Should be free of damage – if damaged, replace sections of overland pipeline
	Check flanged joints and overland pipeline for signs of leakage or damage	Daily during pump operation	Should be free of leaks or damage – if leak(s) present, tighten flange joints to eliminate leaks; if unsuccessful, shut down pump and replace flange. If pipeline damaged, replace sections of pipeline

Any issues or problems noted with components of the Puiqsuk Lake intake and overland pipeline system should be communicated to the Hamlet Foreman and/or SAO as soon as possible. Records of all inspections and repairs performed to the intake and overland pipeline system should be brought to the Hamlet Office for filing at least once per month.

3.4 Reservoir

3.4.1 Operations

The reservoir contains the end of the overland water supply pipeline from Puiqsuk Lake (discharge) and one submersible pump within the intake line from the Pump Room of the pumphouse. Water is typically pumped into the reservoir from Puiqsuk Lake once per year while water is removed from the reservoir daily through the Pump Room of the pumphouse. The capacity of the reservoir is estimated at approximately 23,000 m^3 however the entire capacity is generally not utilized. A crack in the bedrock, present near the top of the reservoir, prevents filling to capacity every year. The reservoir is typically filled to just below the bedrock crack.

Operational procedures for components within the reservoir are described in other sections. Operations for the Puiqsuk Lake water discharge pipe are described in Section 3.3.1 above, while operations for the reservoir's submersible pump and intake line are described as part of the pumphouse system in the O&M manual developed for the upgrades to the pumphouse in 2010 (see Section 3.5).

3.4.2 Maintenance

The reservoir is unlined and blasted out of bedrock. The Hamlet is responsible to clean the reservoir once every two or three years to remove any accumulated mud, algae or other materials.

The reservoir should be inspected periodically to ensure it and its surrounding fence are in good condition, that no repairs are required and that no contaminants are found within 50 m.

3.5 Pumphouse and Truck Fill

The GN-CGS is planning to complete upgrades to the pumphouse and truck fill system at Chesterfield Inlet in the summer of 2010. These upgrades include a new reservoir intake pump, a second pumphouse building housing a new filtration and chlorination system, and a new truck fill line. As part of this upgrade project, a new O&M Manual specific to the new pumphouse and systems will be completed.

For operations and maintenance procedures for the new pumphouse systems, please refer to the O&M manual developed by Nuna Burnside Engineering and Environment Limited (2010). However until this new pumphouse O&M manual is available, the 1991 O&M manual for the pumphouse and truck fill should be referred to (UMA 1991).

3.6 Water Trucks

3.6.1 Operations

Every day, water is delivered to houses and buildings in the community by water trucks. Only trained drivers should operate these trucks, including driving and water delivery.

See the Nuna Burnside Pumphouse O&M Manual (2010) for operational procedures to fill water trucks.

3.6.2 Maintenance

Water delivery to residences and buildings in the community is one of the key components of the water distribution system. It is very important that the water trucks are kept in good condition and any repairs are given top priority and completed immediately.

The water trucks and tanks should be inspected on a daily basis for leaks (water and fuel/oil), proper lighting and hose operation, and basic condition (e.g. rust). The trucks should receive a mechanical inspection at least once per year. Additionally, the water trucks should be parked in a heated garage to prevent the tanks from freezing and full tanks should not be allowed to rest for long periods of time, especially in winter.

The tanks of the water trucks need to be cleaned on a regular basis to maintain the quality of the drinking water being transported and delivered. The tanks should be thoroughly cleaned and rinsed at least once every month, or more often if conditions warrant (e.g., algae in the reservoir).

3.7 Troubleshooting

Troubleshooting procedures for the raw water pump and overland pipeline system are located in manufacturer brochures of the 1991 O&M manual for the pumphouse and truck fill system (UMA 1991). See “Installation, Operation, Parts List and Maintenance Manual” for the Gorman-Rupp Model 84Bs – TS2 S/G pump, contained in Tab 8 of Section 9.2 of the 1991 O&M manual.

3.8 Monitoring and Sampling

3.8.1 Monitoring

Monitoring programs are carried out to help ensure all systems are functioning correctly as they collect data on surface water quality to assess impacts to the freshwater aquatic environment and provide important feedback to the operators, helping them track progress of the system and provide warning or notice when issues arise. Monitoring programs also ensure any requirements or guidelines for water quantity and/or quality are being met; these requirements are typically provided in the community’s water license. Monitoring programs form an integral part of the O&M for all facilities and it is important to ensure they are being completed successfully. It is important that the Hamlet carry out a monitoring program as part of the daily, monthly and annual operations of the water distribution system.

The water license for the Hamlet of Chesterfield Inlet outlines the Monitoring Program for the community and requires only one monitoring station for the water distribution system. This station, CHE-1, is located at the Puiqsuk Lake water intake and is used to measure and record the volume of water removed from the lake. It should be noted at the time this O&M Manual was developed, the community's water license was expired and the Hamlet was in the process of license renewal. Monitoring requirements are based on the previous water license's monitoring and sampling requirements. Should monitoring requirements change in Chesterfield Inlet's new water license, this O&M Manual should be updated to reflect any change in conditions.

A second monitoring station, CHE-5, is required under the *Public Health Act* Consolidation of *Public Water Supply Regulations* (R.R.N.W.T. 1990,c.P-23), enforced by the GN Department of Health and Social Services (GN-HSS). This station is actually sampled at more than one location, including the raw water (either from the reservoir or from the Pump Room before chlorination), the water trucks, and a few taps within the community. This CHE-5 station is used to collect samples of drinking water for bacterial characteristics.

Table 3-2: Monitoring Stations for the Water Distribution System at Chesterfield Inlet, NU

Monitoring Program Station Number	Description	Monitoring Requirement	Location
CHE-1	Raw potable water supply at Puiqsuk Lake	Volume (m^3)	63° 19' 49" N 90° 46' 19" W
CHE-5	Raw water (reservoir or Pump Room before chlorination), water trucks, and a few taps within the community	Bacterial water quality	–

CHE-1

At CHE-1 the volume (cubic metres, m^3) of water being removed from Puiqsuk Lake should be recorded on a monthly basis. As water is removed from the lake once per year and there is no flow meter on the raw water pump or overland water supply pipeline, the total volume of water removed from Puiqsuk Lake in the current year can be estimated by tallying the total volume of water removed from the reservoir in the previous year; this assumes the reservoir is filled to approximately the same level every year. For example, since the reservoir is re-filled every August, the volume of water pumped out of the reservoir from August 2008 to August 2009 provides an estimate of the volume of water pumped out of Puiqsuk Lake in August 2008 year.

Volume of water removed from the reservoir can be obtained from the tallied volumes of water delivered or from the flow meters at the pumphouse. See the Nuna Burnside Pumphouse O&M Manual for a description of the flow and water meter system of the pumphouse.

To obtain water volume pumped out of Puiqsuk Lake using delivered water volumes, tally the total volume of water delivered by the trucks in the previous year. The Hamlet uses a software program called FLUID MANAGER to monitor daily volumes of water delivered. Within the water truck, a flow meter monitors volume of water distributed to residences and other buildings every day. At the end

of each day, the water truck driver prepares or prints out tickets detailing the volume of water distributed and delivers the ticket to the Hamlet Office for input into the FLUID MANAGER program.

At the end of the year (e.g., August, when reservoir re-filling occurs), all monthly volumes of water removed from the reservoir will be tallied to estimate the annual volume of water removed from Puiqsuk Lake the previous August. The SAO will report the monthly and annual volumes of water to the NWB in the Hamlet's Annual Water License Report.

CHE-5

At CHE-5, a water sample for *Escherichia coli* (*E. coli*) and other bacteria (total coliforms) should be taken during the first week of the month, at a minimum. Water samples should be taken from the reservoir (raw water), water trucks, and from two to three buildings in the community (tap water). Treated water being distributed to the community should have zero coliforms (from *E. coli* and total coliform tests). Samples are analysed by GN-HSS in Rankin Inlet and results are communicated to the SAO. The GN-HSS' Environmental Health Officer will review the results of bacterial analyses to monitor the effectiveness of water treatment.

If bacterial tests have failed (e.g., have greater than zero *E. coli* or total coliforms), the Environmental Health Officer will contact the SAO and discuss what should be done next to confirm results. Next steps may include, but not be limited to, re-sampling, increasing chlorine dosage, flushing water lines of the pumphouse, and/or issuing a boil water advisory.

Indian and Northern Affairs Canada (INAC) Water Resource Officers (Inspectors) will also take drinking water samples for chemical characteristics; these samples are taken at least once every two years. INAC Inspectors report the results to the Hamlet and the Environmental Health Officer.

3.8.2 Sampling Procedures

Bacterial water samples will be taken by the Hamlet Foreman and sent to the GN Environmental Health Laboratory in Rankin Inlet to be analysed.

A water sampling procedure for bacterial sampling is found in **Appendix D**. The sampling procedure should be carried out for all bacterial sampling of the water distribution system to ensure the correct sample bottles are obtained, proper sampling procedures are completed and contamination of samples is minimized.

3.9 Record Keeping

Records of activities, inspections and sampling for the water distribution system should be kept. These records should be stored at the Hamlet Office and kept by the SAO. These records will assist with the planning of annual operations and maintenance of the system, as well as assess how well system components are functioning.

Every year by March 31st, the Hamlet is required to submit an Annual Report to the NWB. The SAO is responsible to ensure the Annual Report is submitted annually. The Annual Report provides the

NWB with information pertaining to the results of the Monitoring Program, volumes of water consumed, volumes of wastewater discharged, and summaries of any modifications, major maintenance work, and spills.

Therefore, at a minimum, the following records should be kept:

- Number of trips water trucks make per day;
- Volume of water pumped from Puiqsuk Lake monthly and annually;
- Volume of water consumed by the community monthly and annually;
- Dates any sampling has been completed;
- Results from any sampling;
- Dates and description of any maintenance activities (including inspections) carried out on the system by Hamlet personnel or other Inspectors;
- Dates and description of any modifications and/or major maintenance work, and abandonment and restoration work carried out on the system, including on associated equipment (e.g. water trucks, etc); and,
- Dates, description and clean-up activities of any spills (fuel, oil, etc) related to the water distribution system.

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4 SEWAGE DISPOSAL FACILITY OPERATIONS AND MAINTENANCE

As previously noted, upgrades to the sewage disposal facility at Chesterfield Inlet are expected to be completed in the summer of 2010. The following section details components and operations and maintenance procedures for the upgraded system.

4.1 Equipment

The two main components of the sewage disposal facility at Chesterfield Inlet are the two detention cells and the tundra wetland, having a combined area of approximately 10.4 hectares (104,000 m^2). The Hamlet has two sewage vacuum trucks to operate the sewage disposal facility, a primary 2008 Sterling vacuum truck and a back-up 2007 Sterling sewage vacuum truck; the back-up truck is used infrequently. The volumes of the two trucks are approximately 5,700 L (1,500 gal.) each.

4.2 Site Personnel

The SAO has overall responsibility for the operation and maintenance of the sewage disposal system. The SAO is responsible to ensure proper operation and maintenance of the system is carried out, including sampling, inspections, and annual reporting to the NWB.

The Hamlet Foreman is responsible for day-to-day operation and maintenance of the sewage facility, including managing daily sewage collection, ensuring sewage volumes are recorded, sampling wastewater, and completing inspections and other maintenance activities.

The Hamlet typically has six individuals hired that can operate the sewage vacuum truck (includes permanent and emergency drivers) and collect sewage from residential and community buildings seven days a week. These individuals also operate the Hamlet's water trucks. The sewage truck drivers are responsible for recording and reporting the volume of sewage released to the detention cell daily, and inspecting the sewage trucks.

4.3 Health and Safety

All personnel working within the sewage disposal facility should be made aware of potential health hazards associated with working around sewage and wastewater. This is imperative so individuals make a conscious effort to perform all necessary safety procedures to protect themselves, their co-workers and family members at home. Safety precautions include:

- Ensuring all equipment is kept as clean as possible
- Assume anything touched by sewage is contaminated
- Protective clothing such as coveralls, gloves, boots and safety glasses are to be provided to personnel and worn at all times when working around sewage

- Workers must always wear protective gloves, especially when hands are chapped, burned, or have a rash or a cut
- Workers work clothing is not worn home, work clothing must be left at work
- Workers wash their hands with soap and water on a regular basis, especially before eating, going home, and delivering drinking water
- Workers should not be permitted to collect sewage and deliver drinking water on the same day
- Workers are prohibited from eating or drinking in and around the sewage vacuum trunks
- Workers keep their vaccinations up to date.

See Section 6 of this O&M Manual for emergency response procedures in the event of a sewage spill at the sewage disposal facility or elsewhere within the community.

4.4 Operations

In Chesterfield Inlet, sewage is collected Monday to Sunday every week of the year and is released into one of the detention cells, located approximately 2.5 km west of the community. Sewage effluent is held in the detention cells for a period of time to receive primary treatment. Effluent is released from each detention cell via an outlet in each cell's impervious berm. Effluent then flows into the tundra wetland where it receives further treatment. Two diversion berms are situated immediately south of Finger Bay to channel flow from the tundra wetland for a defined outlet and compliance point. A third diversion berm is situated within the solid waste disposal facility to divert leachate into the tundra wetland and allow additional treatment.

As little is required in the way of operational procedures for the detention cells or tundra wetland, basic operational procedures for the sewage disposal facility have been developed. Components of the sewage disposal facility are illustrated in Figure 2 in **Appendix B** and in engineered drawings for the sewage wetland improvements in **Appendix E**.

The following procedures should be carried out daily when sewage collection and release to the detection cells occur:

1. Sewage is collected Monday through Sunday from holding tanks in residences and other buildings in the community. Sewage is collected through the use of the sewage vacuum truck(s).
2. The vacuum truck pumps out sewage from the building holding tanks and transports it to the detention cells.
3. Sewage is deposited into one of the detention cells from the vacuum trucks using the offload chutes and splash pads, located on the west side of each of the offload truck pads (dumping stations). The sewage truck backs up to one of the offload chutes and the release valve of the truck is opened. Bollards have been placed next to each offload chute for safety precautions.

4. The sewage truck driver should record the daily wastewater volumes discharged to the detention cells and the number of trips they make there per day. A logbook or other record form should be kept in each truck for this purpose. An example Sewage Volume Record form is located in **Appendix G** and can be used for this purpose.
5. The detention cells provide primary treatment of sewage as effluent is held in the impervious cells for a period of time.
    i. Effluent is automatically released from each of the detention cells when the volume of effluent reaches a certain height.
    ii. The top of the detention cell berms are at 17.8 m (above sea level) elevation; the berms are impervious except for an installed rip rap area at elevation 17.5 m. Once effluent reaches 17.5 m, it flows through the rip rap area and into the first pond of the tundra wetland.
6. Once effluent is released to the tundra wetland, the effluent flows in a west and northwest direction, receiving treatment from native vegetation, soil bacteria, and the chain of small ponds and boggy areas. The tundra wetland discharge passes between flow diversion berms (berms D and E on Figure 2 of **Appendix B**) and reaches the marine environment of Finger Bay.

Sewage is discharged into the detention cells year round. In the winter, the sewage freezes in the detention cells and will be discharged only when the effluent reaches the rip rap height in the detention cell berms.

4.5 Maintenance

Maintenance activities for the sewage disposal facility should be performed by the Hamlet on a monthly and/or annual basis, depending on the facility component. The following sections outline procedures for proper maintenance of the detention cells, tundra wetland, flow diversion berms, sewage trucks, access road, truck pads, and offload chutes.

Inspections are an integral part of the maintenance procedures of the sewage disposal facility as they identify concerns and deficiencies, and recognize areas or components which need improvement, correction, repair, and/or replacement. All maintenance inspections should be completed by the Hamlet Foreman or a licensed engineer, where required, and all inspection records should be filed at the Hamlet Office. Any problems or issues noted during the inspections should be communicated to the Hamlet Foreman and/or SAO as soon as possible. A Sewage Disposal Facility Inspection Form has been included in **Appendix G**.

Detention Cells

The following maintenance activities should be carried out to ensure the detention cells remain in sound condition:

- Monthly inspection of the offload chutes and riprap for condition and stability

- Monthly inspection of the detention cell berms for stability
- Monthly inspection of each detention cell outlet structure
- Annual geotechnical inspection of the detention cell berms by a qualified engineer.

Tundra Wetland

Maintenance activities within the tundra wetland should be performed to ensure the wetland effectively treats wastewater and free flow of water and effluent is allowed:

- Monthly inspection of the flow diversion berms near Finger Bay and in solid waste disposal facility for condition and stability
- Monthly inspection of signage throughout the tundra wetland to ensure it is still present and readable
- During open water season, bi-weekly inspection of tundra wetland drainage courses to ensure they are unblocked and free flowing, removing any blocking debris if present
- During early spring and late fall, daily inspections of the drainage courses should be conducted to determine when flow is present. Inspections should take place at each monitoring station. Presence of flow within the tundra wetland in May will initiate the Monitoring Program while the program will terminate in August (see Section 4.6).
- Sampling at tundra wetland monitoring stations when required (see Section 4.6).

Sewage Trucks

Sewage collection from residences and buildings in the community is one of the main components of the sewage disposal facility. It is very important that the sewage trucks are kept in good condition and any repairs are given top priority and completed immediately to ensure continued collection service.

Sewage trucks and tanks should be inspected on a daily basis for leaks (sewage and fuel/oil); proper lighting, hose and valve operation, and basic condition (e.g., rust). Sewage trucks should be parked in a heated garage in the winter to prevent the tanks from freezing and full tanks should not be allowed to rest for long periods of time, especially in winter.

The trucks should also receive a mechanical inspection by a certified mechanic at least once per year.

Access Road and Offload Truck Pads

To ensure continued access to the sewage disposal facility, the Hamlet should regularly perform basic road maintenance activities on the access road and offload truck pads. The following should be carried out:

- Weekly inspection of the truck pad offload areas should be conducted by the vacuum truck drivers to examine for signs of erosion or other issues.
- The access road and offload truck pad should be graded and re-shaped at least once per year, or more often as required.

- The access road and truck pad should be cleared of snow regularly in the winter, taking care to not damage berms, offload chutes, bollards and other areas.
- Any repairs or erosion issues related to the access road or truck pad should be repaired promptly.
- Any spilled and/or frozen wastewater should be removed and deposited in one of the detention cells. See Section 6 for sewage spill contingency plans.

4.6 Monitoring and Sampling Procedures

4.6.1 Monitoring Requirement

Monitoring programs are carried out to help ensure all systems are functioning correctly as they collect data on surface water quality to assess impacts to the freshwater aquatic environment and provide important feedback to the operators, helping them track progress of the system and provide warning or notice when issues arise. Monitoring programs also ensure any requirements or guidelines for water quantity and/or quality are being met; these requirements are typically provided in the community's water license. Monitoring programs form an integral part of the O&M for all facilities and it is important to ensure they are being completed successfully. It is important that the Hamlet carry out a monitoring program as part of the daily, monthly and annual operations of the sewage disposal system.

The Monitoring Program outlined in the Hamlet's water license requires that two stations are monitored within the sewage disposal facility. These stations will provide water quality or quantity information to operators and regulators and help assess the sewage treatment performance of the tundra wetland. Similar to monitoring for the water distribution system, this O&M Manual was developed when the community's water license was expired and the Hamlet was in the process of license renewal. Monitoring requirements are based on the previous water license's monitoring and sampling requirements. Should monitoring requirements change in Chesterfield Inlet's new water license, this O&M Manual should be updated to reflect any change in conditions. The two monitoring stations and their locations are provided in Table 4-1 below; monitoring stations are also depicted in Figure 2 in **Appendix B**.

Table 4-1: Monitoring Stations for the Sewage Disposal Facility at Chesterfield Inlet, NU

Monitoring Program Station Number	Description	Monitoring Requirement	Location
CHE-3	Sewage truck release point (into the detention cells)	Volume (m^3)	Sewage offload pads: 63° 20' 40" N 90° 45' 2" W and 63° 20' 34" N 90° 44' 59" W
CHE-4	Final discharge point of the tundra wetland	Water Quality	Between the flow diversion berms south of Finger Bay: 63° 20' 59" N 90° 45' 36" W

CHE-3

At station CHE-3, the monthly volume (m^3) of effluent released from the sewage truck(s) should be monitored. A logbook or record form should be kept within each sewage truck. Every time a truck releases effluent into the detention cell, the volume released should be recorded in the logbook or record form, as well as the total number of trips to the detention cell per day. Logbooks/record forms should be filed at the Hamlet Office each week.

At the end of each month, the SAO will tally the volumes to obtain the monthly volume released. Similarly, at the end of each year, the monthly volumes will be tallied to obtain the volume of effluent released throughout the year (annually). The monthly and annual volumes of effluent released will be reported to the NWB in the Hamlet's Annual Report.

CHE-4

The effluent at the CHE-4 station should be sampled at monthly intervals during the months of May to August, inclusive. All effluent samples taken from the monitoring station will be analysed for:

- Biochemical Oxygen Demand (BOD_5)
- Faecal Coliforms
- Total Metals (including arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel and zinc)
- pH
- Conductivity
- Oil and Grease (visual)
- Ammonia Nitrogen
- Nitrate-Nitrite
- Anions and Cations (includes magnesium, calcium, sodium, potassium, and sulphate)
- Total Phenols
- Total Suspended Solids (TSS)

4.6.2 Water Sample Procedures

As mentioned previously, the effluent at the CHE-4 station should be sampled monthly during May to August, inclusive. Effluent samples will be taken by the Hamlet Foreman, or other trained personnel appointed by the Hamlet Foreman, and sent to Taiga Laboratory in Yellowknife, or another approved laboratory, to be analysed. The parameters listed previously will be examined in effluent samples from all tundra wetland monitoring stations.

A water sampling procedure for the tundra wetland is found in **Appendix F**; example laboratory forms for the Taiga Laboratory have also been included. The water sampling procedure should be carried out for all sampling in sewage and solid waste facilities to ensure the correct sample bottles are obtain, proper sampling procedures are completed and contamination of samples is minimized.

4.7 Sewage Sludge Management

Sewage sludge is generated by the settling of wastewater solids during primary treatment. Sludge produced in Chesterfield Inlet would be considered 'lagoon sludge' (FSC 2001) and will be contained

within the detention cells. The amount of sludge accumulation in the detention cell needs to be monitored to ensure the accumulation does not exceed a certain percent volume of the cell.

The quality of the effluent will determine when a sludge management program is initiated. Sludge is typically monitored annually to determine its volume and physical and chemical characteristics. The monitoring indicates when the performance of the detention cells starts to degrade. Sludge may need to be removed from the detention cells and disposed of if too much begins to accumulate and/or it becomes contaminated. Sludge contains a great deal of high-value organic matter and nutrients and is used in a lot of places around the world as fertilizer for crops. However sludge contamination can result from mixing of domestic wastes with industrial and household hazardous wastes (e.g. cleaning chemicals, prescriptions, solvents, etc, dumped down the drain), which are then concentrated into the sludge during primary treatment.

Sludge must be sampled and tested to ensure the disposal method selected is appropriate, safe and environmentally responsible. The sludge may be of a quality suitable for land disposal. If the sludge is not suitable for land disposal, it may be disposed of at the MSW disposal facility if it meets the facility's requirements. The sludge may require additional treatment before disposal (FSC 2001).

The sewage sludge has not been sampled in Chesterfield Inlet. Before an appropriate sludge management plan can be developed, the sludge should be sampled to obtain its chemical and physical characteristics. Additionally, the volume of sludge in the detention cell should be measured. The annual quantities of sewage sludge removed from the detention cells also needs to be measured and reported to the NWB in the Hamlet's Annual Report. Once the chemical composition of the sludge is understood, a sludge management plan can be developed to explore the best options for removal and disposal.

4.8 Record Keeping

Records of activities, inspections and sampling for the sewage disposal system should be kept. These records should be stored at the Hamlet office and kept by the SAO. These records will assist with the planning of annual operations and maintenance of the system, as well as assess how effective the system is operating.

Every year by March 31st, the Hamlet is required to submit an Annual Report to the NWB. The Annual Report provides the NWB with information pertaining to the results of the Monitoring Program, volumes of water consumed, volumes of wastewater discharged, and summaries of any modifications, major maintenance work, and spills.

Therefore, at a minimum, the following records should be kept:

- Number of trips the sewage truck(s) make per day
- Volume of wastewater released into the detention cells daily (tallied for monthly and annual volumes)
- Dates any sampling has been completed
- Results from any sampling

- Dates and description of any maintenance activities (including inspections) carried out on the sewage disposal system by Hamlet personnel or other Inspectors
- Dates and description of any modifications and/or major maintenance work, and abandonment and restoration work carried out on the system, including on associated structures, facilities and equipment (e.g. old sewage disposal facility, sewage trucks, etc)
- Dates, description and clean-up activities of any spills (sewage, fuel, oil, etc) related to the sewage disposal system.

5 SOLID WASTE DISPOSAL FACILITIES OPERATIONS AND MAINTENANCE

5.1 Equipment

The Hamlet uses the following equipment to operate the solid waste facility at Chesterfield Inlet:

- 2002 Chevrolet 3500 garbage truck, estimated weight capacity is 225 – 320 kg (approximately 500 – 700 lbs.)
- 1992 950F Caterpillar wheel loader
- 2009 Volvo grader (as required).

The solid waste disposal facilities in Chesterfield Inlet are inclusive of the fenced MSW disposal facility, the bulk metal waste disposal area, located 180 m south of the MSW facility, and the two drum storage areas, located 150 m and 270 m southeast of the MSW facility; see Figure 2 in **Appendix B**. Operations and maintenance procedures for each of the four facilities are provided in the following sections.

5.2 Site Personnel

The SAO has overall responsible of the solid waste disposal facilities to ensure proper operation and maintenance is carried out, including compacting, burning, covering, inspections, sampling, and annual reporting to the NWB.

The Hamlet Foreman is responsible for day-to-day operation and maintenance of the solid waste facilities. All day-to-day activities take place at the MSW disposal facility, including managing waste collection, proper segregation of waste, compacting and burning of waste, sampling leachate from the facility, completing inspections and other maintenance activities.

The Hamlet typically has one individual hired to operate the garbage truck and collect waste from community buildings five days a week. This Waste Truck Driver is also responsible for ensuring collected waste is properly segregated, and refusing the collection of hazardous waste if present. If properly trained, this individual may also be required to operate heavy equipment at the MSW disposal facility.

5.3 Health and Safety

The public and all personnel working within the solid waste disposal facilities should be made aware of potential health and safety hazards associated with working around municipal solid wastes and hazardous wastes. This is imperative so individuals make a conscious effort to perform all necessary safety procedures to protect themselves, their co-workers and family members at home. The requirements of the Nunavut *Safety Act* will be followed at all times. A site-specific safety plan should be developed by the Hamlet for the MSW disposal facility and the hazardous waste storage area,

once developed. The site-specific safety plans should outline all potential hazards, safe work practices, training requirements, equipment requirements (e.g., fire extinguishers, spill response kits, etc), and emergency procedures.

Public access to the MSW disposal facility should be restricted to specific areas and/or times to minimize potential hazards to the public. Public access to any hazardous waste storage areas should always be restricted. Additional health and safety precautions for the public and site personnel will be taken during burning of MSW and accidental spills.

See **Section 6** of this O&M Manual for emergency response procedures in the event of a fire or spill at the MSW disposal facility.

5.4 Municipal Solid Waste Disposal Facility

5.4.1 Operations

5.4.1.1 Waste Segregation

The MSW disposal area is partially fenced and the Hamlet presently does not limit who disposes of waste and where. Proper waste segregation is imperative to the long-term operation of the facility as it helps ensure potential human health and environmental hazards are minimized, un-compactable wastes (e.g., bulky metal wastes) are kept out of the landfill, hazardous wastes are properly managed, and waste re-use and recycling can occur.

The MSW disposal facility at Chesterfield Inlet was likely designed as a natural attenuation landfill. This means that the landfill is not lined and small amounts of contaminants can enter the surrounding environment to be naturally broken down. In this type of landfill, the rate that contaminants enter the environment is expected to occur at a rate such that contaminants can easily be broken down and the surrounding environment is not overwhelmed. Natural attenuation landfills also rely on permafrost aggrading into the covered waste cells of the landfill and eventually freezing them. However, as contaminants are able to freely enter the environment in this type of landfill, proper waste segregation is important to ensure harmful contaminants are kept out of the landfill.

Initial waste segregation should begin at the community's residences and other buildings, ensuring residents and business are familiar with acceptable wastes for the MSW disposal facility. Household hazardous or bulky wastes need to be kept out of the landfill and Burn Area and need to be transported to the appropriate disposal/storage locations.

The Waste Truck Driver should be familiar with operational procedures for the MSW disposal facility, acceptable wastes for burning and landfilling (see Section 5.4.1.2 for appropriate burnable waste), and proper waste segregation practices. Ultimately the Hamlet Foreman (site operator) is responsible to ensure proper waste segregation occurs.

The Waste Truck Driver should monitor the waste they collect from community buildings every day, collecting only that which is acceptable for disposal at the MSW disposal facility. The Hamlet could provide a 'grace' day once or twice per year to collect residents' household hazardous and/or bulky

metal waste. The Hamlet could also provide help to residents who have larger items to dispose of and have no means of transporting them to the correct disposal area.

The MSW disposal facility needs to be properly signed to inform operators and residents of the correct location to dispose of or store certain wastes. At a minimum, the MSW disposal facility should have disposal/storage areas for:

- Domestic burnable waste (for burning and landfilling) – a selected Burn Area
- Domestic non-burnable waste (for landfilling)
- Treated wood and wood products
- Building/construction materials
- Bulk metal waste – the separate bulk metal waste disposal area
- Re-usable/recyclable material (i.e., Salvage Area)
- Household hazardous waste (i.e., Drop-off Hazardous Waste Area).

Seacans or constructed drum shelters can be used to store specific household hazardous wastes in a designated area before being shipped out of the community. Hazardous waste management is described in Section 5.8 below.

5.4.1.2 Burning

Once waste has been properly segregated, burnable waste should be burned at least once per week to keep the volume of waste manageable. Burning should only occur when winds are light and blowing away from the community. Table 5-1 outlines wastes acceptable for burning.

Table 5-1: Examples of Burnable and Non-burnable Wastes

Burnable	Non-Burnable
Domestic waste (e.g., food waste, paper products, paperboard/ cardboard packaging, etc)	Non-wood building/construction materials (e.g., roofing materials, electrical wire, insulation, plastics, asbestos, etc)
Non-treated wood (this may also be recyclable/salvageable)	Treated wood (e.g., telephone poles, pilings, cribbing, foundation wood)
	Asphalt and asphalt products Tires
	Hazardous wastes
	Waste paint
	Fuel and lubricant containers
	Aerosol cans and other compressed gas containers (e.g., propane tanks)

The Hamlet presently does not apply for a permit to burn through the Chesterfield Inlet Fire Department, though they should. Hamlet personnel typically carry out and control burning of waste at the MSW disposal facility. Controlling the open burn is extremely important to reduce the risk of uncontrolled fire and hazards to the public, employees and the surrounding environment. Burning practices at the MSW disposal facility should include:

- Confirmation of weather forecasts prior to any burning. If heavy rain is or will be present, burning should be postponed (burning during heavy rain events may result in poor or incomplete combustion and the potential to generate harmful contaminants).
- Confirmation of wind speed and direction prior to any burning. If loose debris can be carried by the wind, burning should be postponed.
- Obtaining a Permit to Burn through the Chesterfield Inlet Fire Department.
- Burning in the selected Burn Area only and ensuring burning does not occur in landfill piles.
- Presence of an attendant during initial stages of the burn and periodic inspection of the burn once it has been established.
- Maintaining a minimum of 5 m buffer zone around the burning area and all ensuring attendants or personnel remain upwind of the burn area.
- Closing the MSW disposal facility to the public during burn events.
- Confirmation the MSW is no longer hot or burning prior to the addition of more waste, or covering with granular material. This can be accomplished by moving around the ash and remaining materials to ensure the fire is out and material can cool.

5.4.1.3 Operational Procedure

The MSW disposal facility requires daily, weekly and monthly operations to ensure it continues to optimally function as the Hamlet's primary MSW disposal site, and potential public health and environmental hazards are minimized.

Specific information regarding waste segregation and burning were provided in the preceding section. Further information on hazardous waste management at the MSW disposal facility is provided in Section 5.5 below. The following general procedure should be followed to ensure proper operation of the MSW disposal facility:

1. The Waste Truck Driver collects MSW from community buildings five times per week. The garbage truck has estimated weight capacity of 225 – 320 kg and is used to collect and transport MSW to the MSW disposal facility.
2. The number of trips and estimated weight of every load transported to the facility should be recorded in a log book or on a record form kept in the garbage truck (a Solid Waste Quantity Form is included in **Appendix G**). If waste is present at the MSW facility that has been brought by others, the Waste Truck Driver should make an estimate of the quantity and record this as well. Trip records should be filed at the Hamlet Office daily. The SAO will include results in the Hamlet's Annual Report to the NWB.

3. At the MSW disposal facility, waste from the garbage truck will be tipped into the cold Burn Area. Waste should not be tipped onto the Burn Area if a burn is occurring. An alternate tipping/burning area should be designated.

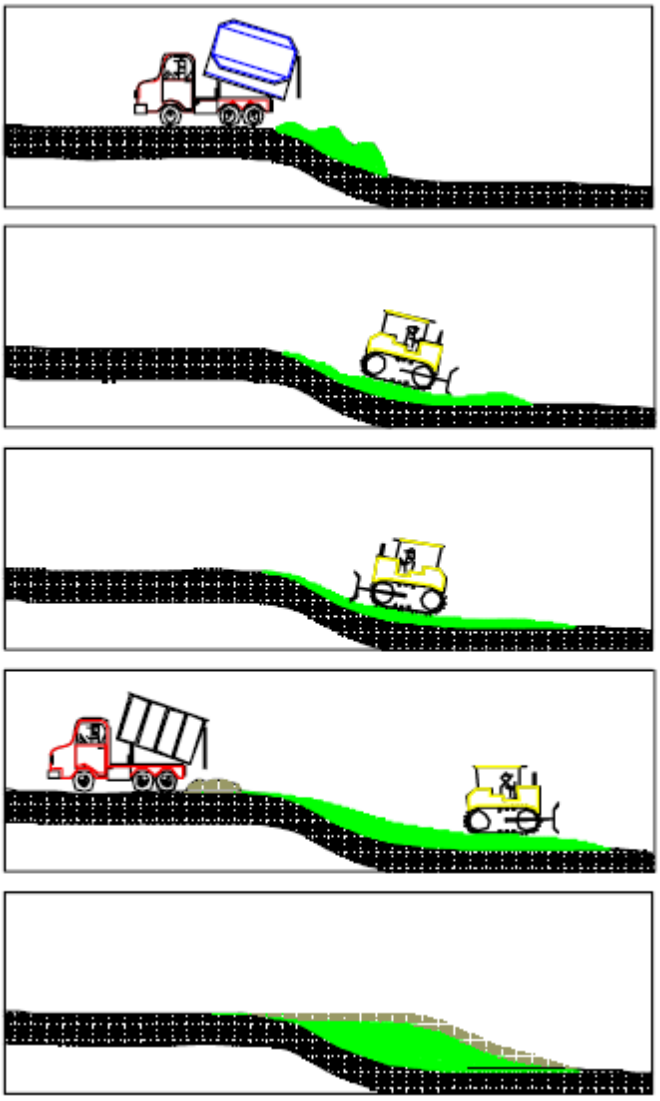
   The Waste Truck Driver should then complete an initial inspection of the waste pile to ensure it does not contain any non-burnable wastes. If so, that waste should be diverted to the appropriate disposal areas:

   - Household waste is dumped out of the garbage truck in the selected Burn Area of the MSW disposal facility. Waste is properly segregated into burnable and non-burnable waste.
   - Any non-burnable, non-hazardous waste should be moved to the edge of the covered portion of the MSW disposal facility landfill (tipping face).
   - Any materials requiring disposal in the bulk metal waste facility should be transported there.
   - Hazardous waste materials need to be transported to their appropriate storage areas.
   - Reusable/recyclable materials (e.g., wood) should be transported to a Salvage Area of the MSW disposal facility. Salvaging of materials will only be supported in the designated Salvage Area due to public health and safety concerns.

4. Burning of combustible waste should only occur in the designated Burn Areas. Burning should occur at least weekly to ensure materials are burned in manageable volumes. However conditions for open burning depends on weather and burning should only occur when winds are light and blowing away from the community. A permit to burn must be obtained from the Chesterfield Inlet Fire Department before any burning occurs. The guideline for *Municipal Solid Wastes Suitable for Open Burning* from the GN Department of Environment (GN-ENV) can be found at their website (http://www.gov.nu.ca/env/environment.shtml).
5. After every burn, once the operator confirms the MSW to be cold and no longer burning, the CAT loader or a bulldozer should be used to push the ash and remaining material to the landfill tipping face (presumably downslope, if the depression method for landfilling is used).
6. At least twice per month, the CAT loader or a bulldozer should push the collected MSW pile over the edge of the landfill tipping face and spread out the MSW. The waste should be worked upslope gradually, to a maximum 3:1 grade (e.g., 3 m wide by 1 m tall). The CAT loader should drive over the waste pile at least three to five times to ensure it is packed down and the 3:1 grade is achieved.
7. The act of burning (waste reduction) and compaction should result in a manageable waste mound on the landfill tipping face that can be covered annually, or when waste volume requires covering. The waste mound should only be allowed to reach two metres high. Annually, or once the waste mound is approximately three metres wide, the waste mound should be covered with 0.3 m of granular material and packed down to form a covered waste cell.

- Cover material can be limited and harder to find in Chesterfield Inlet. Though dry, sandy material is the preferred cover material for landfilling (Kent e*t. al.* 2003), sand, gravel and cobbles are also appropriate cover material. Landfilling operations can be made easier by stock piling cover materials close to the MSW disposal facility.

8. Landfilling can continue beside and behind the covered waste cell until the landfilling area is full. See Figure 5-1 for a depiction of the depression method of landfilling. Based on landfill design, it is assumed this method is likely used in Chesterfield Inlet.
9. Once the landfill site is full, the MSW disposal facility must be closed out. To close out the site, cover with 0.6 m (2 ft.) of granular material and pack. Water must run off waste piles. For more information on closing out the MSW disposal facility, see **Appendix C** for the Hamlet of Chesterfield Inlet's Abandonment and Restoration Plan.



1. Dump MSW at Burn Area, near slope.
2. Once waste has been properly segregated and then burned, spread ashes, left over burned material and any non-burnable, non-hazardous waste down the slope.
3. Work the waste back upslope a bit at a time. Drive over the waste 3 – 5 times with the CAT loader or a bulldozer to pack it.

   This should be done once per week.
4. Alternate between dumping, spreading and packing waste until waste is 2 m (6.5 ft) high.
5. In the spring or fall, or when waste is approximately 3 m (9.8 ft.) wide, cover waste with 0.3 m (1 ft.) of granular material. Pack with CAT loader or a bulldozer to make a covered waste cell.

   Repeat steps until landfill is full.

Figure 5-1: Depression Method of Landfilling for the MSW Disposal Facility at Chesterfield Inlet, NU (adapted from Kent *et al.* 2003)

5.5 Bulk Metal Waste Disposal Area

5.5.1 Operations

The bulk metal waste disposal area requires less operational activity than the MSW disposal facility (e.g., does not need to be burned or covered) however proper waste segregation is required and only specific materials should be disposed of here. The following is a list of materials acceptable for disposal in the bulk metal waste disposal facility:

- Large metal wastes (i.e., clean and decommissioned fuel tanks and drums, towers, poles/posts, culverts, etc)
- Tires
- Appliances
- Properly abandoned vehicles, snowmobiles, and all-terrain vehicles (ATVs):
    - *Properly abandoned* implies all vehicles have had their batteries removed and have been drained of fuel, oil, antifreeze, transmission fluid, and other fluids; these wastes should be properly stored in the hazardous waste storage area.
    - Vehicles can also contain ozone-depleting substances (ODS') in their air conditioning systems. These systems should be properly decommissioned by a qualified technician.
    - Once vehicles have been properly abandoned, they should be tagged to indicate they have been inspected and meet these criteria.

All waste within the bulk metal waste disposal area should be segregated into separate disposal areas for the above listed items (e.g., a vehicle disposal area, an appliance disposal area, etc). Eventually all waste within the bulk metal disposal area should be removed from the community through a back haul program and properly disposed of at appropriate receivers. The Hamlet could work with other communities, the GN and a transportation company to establish a backhaul program to remove and dispose of materials at the bulk metal waste disposal area.

5.6 Drum Storage Areas

The drum storage areas are located approximately 150 m and 270 m southeast of the MSW disposal facility (see Figure 2 in **Appendix B**). The first drum storage area (150 m southeast) is presently a holding area and contains crushed and palleted 205 L (45 gal.) drums waiting to be shipped out of the community. Since containers that previously held Dangerous Goods are considered hazardous themselves (GNWT 2005), certain operational procedures should be followed to ensure empty drums are handled and stored properly.

The second drum storage area (270 m southeast) is used to store waste fuel in 205 L drums and is bermed and lined with a geomembrane. As the Hamlet does not have a formal hazardous waste storage area, it is recommended the second drum storage area be designated as this. Operations and maintenance procedures for these two hazardous waste storage areas is contained in Section 5.8.

5.7 Solid Waste Disposal Facilities Maintenance

5.7.1 Inspections and Audits

Regular inspections of the solid waste disposal facilities will provide the Hamlet Foreman, SAO and other personnel with information on the effectiveness of waste segregation, burning, landfilling, signage, and any remedial activities. Inspections are an integral part of the maintenance procedures of the MSW disposal facilities as they identify any concerns and deficiencies, and recognize areas or items which need improvement, correction, repair, and/or replacement.

The Hamlet Foreman, or trained personnel appointed by the Hamlet Foreman, should complete weekly inspections of the MSW disposal facility, the bulk metal waste disposal area and the hazardous waste storage areas (including drum storage area). Site Inspection Forms will be used to document the findings of the inspections and ensure basic items requiring weekly inspection and/or maintenance are examined. Site Inspection Forms will also document other relevant information, such as weather conditions, health and safety concerns, and follow-up on any incidents which may have occurred (e.g., accident, fires, flooding, spills, etc) or deficiencies noted in previous inspections. The following factors will be inspected:

- Site equipment (including heavy equipment, signage, and any storage containers)
- Site infrastructure (including access road, truck pads, drainage systems, fencing, berms, landfill cover and erosion)
- Waste segregation
- Burn completion and proper burn practices
- Proper landfilling practices
- Health and safety concerns (public and personnel)
- Hazardous waste storage area.

The Site Inspection Forms should be filed at the Hamlet Office and results reported to the SAO monthly. The SAO is required to include inspection results and maintenance activities in the Hamlet's Annual Report to the NWB. A Solid Waste Disposal Facility Inspection Form has been included in **Appendix G**.

Following year end, the Hamlet will undertake a review of the past year's inspection results and follow-ups to determine where improvements to the disposal facilities are required. These improvements should be documented and the O&M Manual updated.

5.7.2 Maintenance Activities

Specific maintenance activities may need to be completed on portions of the solid waste disposal facilities. This will help ensure the facilities remain in good condition, appropriate practices are followed, and human health and safety, and environmental hazards are minimized. The following maintenance activities may be periodically required:

- Grading (in summer) or clearing snow (in winter) of all access roads and truck pads used for the solid waste disposal facilities
- Repair of drainage ditches from erosion
- Fence repair
- Repair or replacement of signage
- Litter which has been wind carried to the surrounding area outside the MSW disposal facility fence should be removed and deposited in the facility
- Litter which has accumulated against the fence of the MSW disposal facility should be removed and deposited in the facility
- Repair of the MSW disposal facility flow diversion berm or landfill cover from erosion or settling.

5.8 Hazardous Waste Management

Hazardous wastes are those that are known to be dangerous due to their chemical, physical or biological properties, are no longer used for their original purpose, and are intended for recycling, treatment, disposal or storage (GNWT 1998, GN-ENV 2002). All hazardous wastes require special handling, storage and disposal methods to prevent human health and environmental exposure.

The *Environmental Guideline for the General Management of Hazardous Waste* (GN-ENV 2002) provides information regarding the proper management of hazardous waste in Nunavut, and has the intent to establish a monitoring system for hazardous wastes, from generation to final disposal. From the *Guide*, the generator of any hazardous waste is ultimately responsible for ensuring it will be properly managed from is creation to its disposal (GN-ENV 2002). Generators typically use carriers to transport the hazardous waste to appropriate receivers for disposal. Both carriers and receivers need to be registered with GN Environmental Protection Service and follow specific regulations and training.

Chesterfield Inlet presently does not have a formal hazardous waste storage area. However the second drum storage area (270 m southeast of the MSW disposal facility), currently used to store waste fuel, is bermed and lined with a geomembrane liner. It is recommended this area be formally used as the Hamlet's Hazardous Waste Storage Area as the berm and liner will limit the amount of potentially hazardous leachate entering the surrounding environment.

Chesterfield Inlet's solid waste disposal facilities (through the Hazardous Waste Storage Area) is only licensed to accept municipal wastes for disposal and shall only accept household hazardous wastes for storage. Industrial hazardous wastes shall not be accepted for storage or disposal at the Chesterfield Inlet MSW Disposal Facility or Hazardous Waste Storage Area. Industrial sources (generators) are responsible to manage their own hazardous wastes.

The following hazardous waste operations and maintenance procedures deal with household hazardous wastes (HHW) only. Typical HHW which may be found in Chesterfield Inlet include:

- Pesticides and herbicides
- Paint
- Solvents (e.g., paint cleaners)
- Flammable liquids
- Empty contaminant containers (e.g., 205 L fuel drums)
- Batteries (wet and dry cell)
- Used fuel and oil
- Oil filters
- Antifreeze
- Propane tanks and cylinders
- Aerosol cans (not empty)
- Fluorescent light tubes and compact fluorescent light bulbs
- Fire extinguisher
- Corrosive cleaners

Generally, any household items which have the following symbols are considered household hazardous wastes.


Corrosive


Explosive


Flammable


Poison

Certain items considered HHW cannot be stored at the MSW disposal facility or Hazardous Waste Storage Area however. These include:

- Ammunition, flares and explosives (including fireworks) – contact the Chesterfield Inlet RCMP for proper disposal
- Prescriptions, medications and bio-hazardous wastes (includes syringes) – dispose of these at the Health Care Centre
- Reactive chemicals (e.g., ammonium nitrate) – contact the GN-ENV Environmental Protection Services for disposal options.

Contaminated soil from spill clean-up is the only non-HHW that should be accepted by the Hamlet for storage at the Hazardous Waste Storage Area. Contaminated soil should be stored in 205 L steel drums and shipped out of the community every year. Businesses or individuals wishing to store contaminated soil at the Hazardous Waste Storage Area must contact the Hamlet Foreman or SAO to discuss storage options and fees. The decision to accept contaminated soil from industrial sources rests with the Hamlet.

5.8.1 Operations

5.8.1.1 Drum Storage Area

The drum storage area (located 150 m southeast of the MSW disposal facility) presently contains empty, crushed and palleted drums. These drums are ready to be shipped out and should be removed from the community as soon as possible. Once all drums are removed from this area, it is recommended that additional empty drums be stored in the bermed and lined hazardous waste storage area. Empty drums still have a small amount of contaminant remaining and the storage of a high volume of drums means a high volume of contaminant. Even small amounts of contaminant can leak to the surrounding environment and contaminate surface and sub-surface soils, impact surface and ground waters, and affect animals and plants (INAC 2009). The berm and liner of the hazardous waste storage area will help protect the surrounding environment from any potential releases of contaminant from empty drums.

However if this drum storage area continues to function for empty drum storage, it is important to ensure all drums stored here are fully empty, cleaned and ready for crushing. The drum storage area is not lined and any contaminant spilled could directly enter the environment. Hence drums should be cleaned prior to storage here. The following procedures should be used to prepare and clean drums for storage at the drum storage area:

- Any drums deposited in the drum storage area should be inspected weekly to ensure they are empty
    - If drums are not empty, move drums to the Hazardous Waste Storage Area. If only small amounts of fuel or other contaminants are left in drums and/or the drums are leaking, empty drums into designated waste containers in the Hazardous Waste Storage Area. Drums should be emptied to the greatest extent possible. If the drums are relatively full and are not leaking, leave them in the Hazardous Waste Storage Area and do not empty. They can possibly be used as additional contaminant waste containers if in an acceptable condition.
        a) Prior to emptying contents of drums, ensure you know what the contents are. Only add contents of drums into waste containers with the same contaminant (i.e., fuel into waste fuel containers, antifreeze into waste antifreeze containers). Never mix contaminants!
- Once the drums have been inspected and are confirmed empty, the drums should be cleaned with high-pressure hot water and an appropriate cleansing agent, if available. Since a sump system is not present in the Hamlet Garage, cleansing water from the drums can be stored in an alternate tank and/or be removed by the sewage vacuum truck and transported to the tundra wetland for disposal. Drum cleaning can occur monthly or more/less often, depending on the amount of drums being deposited in the storage area. Drum cleaning should happen often enough that manageable volumes are cleaned at a time; not left until 100 or more drums need cleaning.

- Once drums have been cleaned, they should be rendered unusable (i.e., pierced or crushed). If regular crushing is unavailable, drums should be crushed at least once per year to reduce volumes. Until drums are crushed, they should be laid on their sides, bung removed and the bung hole on the top. Drums shouldn't be stacked more than three high.

If the Hamlet is unable to clean the empty drums, all drums should be stored within the Hazardous Waste Storage Area.

5.8.1.2 Hazardous Waste Storage Area

The second drum storage area in Chesterfield Inlet is recommended to be designated as the community's Hazardous Waste Storage Area since it is bermed and lined with geomembrane. This area needs to be properly signed as the "Hazardous Waste Storage Area", should be fenced with a lockable gate, and have appropriate storage options for expected HHW. Proper signage helps operators of the facility properly store the wastes. Fencing around the area will allow only trained personnel access to the Hazardous Waste Storage Area and help minimize health and safety risks to the public from hazardous wastes and reduce the potential for vandalism.

The Hazardous Waste Storage Area is intended for storage only, not disposal. It is expected that hazardous wastes will be stored for up to five years. This should be sufficient time for the community to build up enough waste to make it economical for a back haul out of the community to a licensed waste receiver.

Once the Hazardous Waste Storage Area has been formally designated, the Hamlet should create a site map of the facility, detailing disposal and storage locations for various wastes. This site map should be posted at the facility, the Hamlet Garage and contained within the Spill Contingency Plan. All site personnel should be familiar with the layout and disposal/storage areas.

Collection

Since the MSW disposal facility and Hazardous Waste Storage Area is generally accessible to the public, residents can come and drop off HHW throughout the year. However the general public should not have direct access to the Hazardous Waste Storage Area for health and safety reasons. If the Hamlet does not restrict access to the Hazardous Waste Storage Area (i.e., through a fence and locked gate), the public should be discouraged from entering the Hazardous Waste Storage Area and a designated public drop-off area for HHW should be used. The public drop-off area could be located within the MSW disposal facility and tended to on a daily basis by the Hamlet Foreman, Waste Truck Driver, or other designated and trained site personnel, to remove and properly store any deposited HHW into the Hazardous Waste Storage Area.

The Hamlet should also hold a 'grace' day for residents, helping them collect and drop off their HHW or bulky metal wastes. This grace day can be held once or twice per year (e.g., in spring and/or fall) and should be advertised in the community up to 30 days before the event. This grace day will encourage residents to drop off their HHW and bulky metals wastes, and provide information pamphlets on HHW, waste disposal, segregation, and recycling. Like many community-based management programs, successful implementation comes from informed and concerned residents.

Providing facts and figures supporting proper disposal, segregation and minimization of hazardous wastes will help sustain hazardous waste management in the community.

Storage

All HHW collected needs to be properly stored in the Hazardous Waste Storage Area to ensure any environmental and human health hazards are minimized. The GN-ENV provides information on proper storage of specific HHW; these include:

- **Antifreeze** – use original containers where possible, or bulk-store waste antifreeze into good condition 16 gauge or lower gauge steel or plastic 205 L drums.
- **Batteries** – bulk-store waste batteries into good condition 16 gauge or lower gauge steel or plastic 205 L drums, or other form of containment away from weather; wooden pallets should be used to keep batteries and containers off the ground during storage and transport.
- **Fluorescent light tubes/compact fluorescent light bulbs** – use original containers where possible and prevent breakage of light tubes/bulbs; keep away from weather.
- **Ozone Depleting Substances** (ODS') – do not landfill; wastes with ODS' (i.e., refrigerators and refrigeration equipment, vehicle air conditioners, ODS-containing fire extinguishers [typically purchased before 1997]) should be diverted to the bulk metal waste disposal area. The Hamlet can hire technicians to remove ODS' from stored equipment.
- **Paint** – use original containers where possible, or bulk-store compatible paints into good condition 16 gauge or lower gauge steel or plastic 205 L drums; do not mix different types of paint (i.e., alkyd and latex).
- **Solvent** – use original containers where possible, or bulk-store compatible waste solvents into good condition 16 gauge or lower gauge steel or plastic 205 L drums.

See the GN-ENV website (http://www.gov.nu.ca/env/environment.shtml) for further information on guidelines for storage and disposal of HHW.

As the Hamlet currently stores waste oil in drums at the second drum storage area and may be designating the area as the community's Hazardous Waste Storage Area, it is recommended they register the site as a hazardous waste storage facility with the GN-ENV Environmental Protection Services (R. Eno, *pers. comm.*). Registering the facility will help the GN-ENV monitor and track hazardous wastes, and eventually improve handling and disposal in the territory To register a facility, contact:

Robert Eno
Manager, Pollution Control
Environmental Protection Services
Government of Nunavut
P.O. Box 1000, Stn 1195
Iqaluit, NU X0A 0H0
Phone: (867) 975 – 7729
Email: reno@gov.nu.ca

When developing the Hazardous Waste Storage Area in Chesterfield Inlet, several factors also need to be considered. From Phifer and McTigue Jr. (1988) and GN-ENV (2002), these are:

- **Compatibility**
  - Compatibility of wastes and their storage containers, and wastes and nearby materials should be considered. For example, some wastes need to be stored in specific containers to minimize the potential for corrosion and leaks (e.g., acids cannot be stored in steel drums due to corrosion, waste fuel should not be stored long-term in plastic drums). Additionally not all wastes can be stored in the same area (e.g., flammable wastes near ignition sources).
- **Packaging**
  - Storage of HHW in original containers is acceptable. Bulk storage of compatible HHW in 205 L 16 gauge or lower gauge steel or plastic drums is generally acceptable though may depend on the type of waste. All containers need to be in good condition and sealable. Contact the GN-ENV or a licensed waste carrier or receiver for advice on specific wastes. All storage containers also need to be properly labelled, following requirements of WHMIS or *Transportation of Dangerous Goods* regulations, if transport is planned.
- **Regulatory Compliance**
  - The GN-ENV *Environmental Guideline for the General Management of Hazardous Waste* and hazardous waste minimum storage volumes should be considered when planning the Hazardous Waste Storage Area.
- **Segregation**
  - If some HHW can be recovered or recycled at a later time, the HHW should be segregated and stored in a manner to allow this. Final destination of the HHW should be considered during storage.
- **Ventilation**
  - All HHW should be properly ventilated to reduce build up of potentially poisonous or noxious fumes. Most wastes should be stored outside in sheds or under roofs providing free air movement.
- **Climate**
  - Not all HHW can be stored directly outside. Waste containers should be stored with some overhead cover (e.g., roof or tarp) and on an impermeable base to prevent contact with rain, snow and direct sunlight. This also makes clean up of spills and leaks easier and cheaper. Some communities utilise old seacans for storage of some HHW.
- **Handling**
  - All handlers of HHW will have proper training. At a minimum, all handlers should have WHMIS (Workplace Hazardous Materials Information System) training.

- **Security**
  - Certain security precautions may need to be taken to prevent theft, accidental discharge or harm to the public from collected HHW. Only persons authorised and trained to handle HHW should have access to the Hazardous Waste Storage Area.

5.8.2 Maintenance

Inspection of the Hazardous Waste Storage Area should occur with the weekly inspections of the other solid waste disposal facilities by the Hamlet Foreman or other trained personnel. Inspections of the Hazardous Waste Storage Area will be documented on Site Inspection Forms and will look for proper segregation and storage containers, container condition, spills and leaks, and follow-up on any incidents (e.g., spill) or deficiencies noted in the previous inspection.

Site Inspection Forms for the Hazardous Waste Storage Area and other solid waste facilities will be filed at the Hamlet Office and results reported to the SAO monthly. The SAO will include inspection results and maintenance activities in the Hamlet's Annual Report to the NWB. A Solid Waste Disposal Facility Inspection Form has been included in **Appendix G**.

5.9 Monitoring and Sampling Procedures

5.9.1 Monitoring Requirement

Monitoring programs are carried out to help ensure all systems are functioning correctly as they provide important feedback to the operators, helping them track progress of the system and providing warning or notice when issues arise. Monitoring programs also ensure any requirements or guidelines for water quantity and/or quality are being met; these requirements are typically provided in the community's water license. Monitoring programs form an integral part of the O&M for all facilities and it is important to ensure they are being completed successfully.

The Monitoring Program outlined in the Hamlet's water license requires that one station is monitored within the MSW disposal facility. Again, this O&M Manual was developed when the community's water license was expired and the Hamlet was in the process of license renewal. Monitoring requirements are based on the previous water license's monitoring and sampling requirements. Should monitoring requirements change in Chesterfield Inlet's new water license, this O&M Manual should be updated to reflect any change in conditions.

The MSW disposal facility monitoring station will provide water quality information to operators and regulators and help assess the leachate quality leaving the MSW disposal facility and entering the sewage treatment tundra wetland. Leachate quality data will also help assess leachate treatment performance of the tundra wetland and provide an indication of waste segregation success. A description and the location of this station is provided in Table 5-2 below. The CHE-2 monitoring station is depicted in Figure 2 in **Appendix B**.

Table 5-2: Monitoring Stations for the Solid Waste Disposal Facility at Chesterfield Inlet, NU

Monitoring Program Station Number	Description	Monitoring Requirement	Location
CHE-2	Run-off from the MSW disposal facility	Water Quality	63° 20’ 46” N 90° 45’ 20” W

The water at the CHE-2 monitoring station should be sampled monthly during the period from May to August, inclusive. All water samples taken at CHE-2 will be analysed for:

- Biochemical Oxygen Demand (BOD5)
- Faecal Coliforms
- Total Suspended Solids (TSS)
- Conductivity
- Anions and Cations (includes magnesium, calcium, sodium, potassium, and sulphate)
- Oil and Grease (visual)
- Total Phenols
- Ammonia Nitrogen
- Nitrate-Nitrite
- pH
- Total Metals (including arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel and zinc)

5.9.2 Sample Procedures

As mentioned above, water at station CHE-2 should be sampled monthly from May to August, inclusive. Water samples will be taken by the Hamlet Foreman, or other trained personnel appointed by the Hamlet Foreman, and sent to Taiga Laboratory in Yellowknife, or another approved laboratory, to be analysed. The parameters listed above will be examined in water samples of seepage from the MSW disposal facility.

A water sampling procedure is found in Appendix F; example laboratory forms for the Taiga Laboratory have also been included. The water sampling procedure should be carried out for all sampling in sewage and solid waste facilities to ensure the correct sample bottles are obtained, proper sampling procedures are completed and contamination of samples is minimized.

5.10 Record Keeping

Records of activities, inspections and sampling for the MSW disposal facility should be kept. These records should be stored at the Hamlet office and kept by the Hamlet Foreman or SAO. These records will assist with the planning of annual operations and maintenance of the disposal facilities, as well as assess how successful facility practices (e.g., waste segregation, HHW storage, etc) are operating.

Every year by March 31st, the Hamlet is required to submit an Annual Report to the NWB. The Annual Report provides the NWB with information pertaining to the results of the Monitoring

Program, volumes of water consumed, volumes of wastewater discharged, quantities of solid waste disposed, and summaries of any modifications, major maintenance work, and spills.

Therefore, at a minimum, the following records should be kept:

- Number of trips the garbage truck makes per day
- Quantity (weight) of MSW disposed of per day (tallied for monthly and annual quantities)
- Quantity (weight and/or volume) and types of HHW stored at the Hazardous Waste Storage Area
- Dates any water sampling has been completed
- Results from any water sampling
- Dates and description of any maintenance activities (including inspections) carried out on the disposal facilities by Hamlet personnel or other Inspectors
- Dates and descriptions of any modifications and/or major maintenance work, and abandonment and restoration work carried out on the disposal facilities, including on associated structures, facilities and equipment (e.g., old landfill, garbage truck, CAT loader, grader, etc)
- Dates, description and clean-up activities of any spills (fuel, oil, hazardous waste, etc) related to the MSW disposal facility, bulk metal disposal area, drum storage area or hazardous waste storage area.

6 EMERGENCY RESPONSE

6.1 Fire

Surface Fires

If site personnel discover a surface fire in the MSW disposal facility, the Chesterfield Inlet Fire Department will be called immediately and informed of the situation.

CHESTERFIELD INLET FIRE DEPARTMENT: (867) 898-4422

In the event of an uncontrolled fire during routine burning of MSW, the Fire Department will be contacted and should assess the danger of the burn. Depending on the burn severity, the Fire Department may assume control of the MSW disposal facility. The MSW disposal facility should normally be closed to the public during any controlled open burn of MSW and will remain closed if a burn becomes uncontrolled, until the Fire Department has deemed the site safe.

If site personnel discover a small surface fire, fire extinguishers located in the MSW disposal facility can be used to manage small fires. Covering a fire with soil by hand or using the CAT loader may also be used. However, site personnel should not attempt to fight a fire if it cannot be done safely.

The cause of any surface fires will be investigated and necessary steps taken to prevent an uncontrolled surface fire from recurring. The fire incident and all response measures should be documented on the weekly Solid Waste Disposal Facility Inspection Form (**Appendix G**), and reported to the SAO.

Subsurface Fires

If a subsurface fire is suspected at the landfill of the MSW disposal facility, the Chesterfield Inlet Fire Department will be called and informed of the situation. The MSW disposal facility should be closed to the public whenever a subsurface fire is suspected.

The Fire Department should be called to site to determine if a subsurface fire is present and to assess the danger of the fire. The Fire Department may assume control of the MSW disposal facility if the subsurface fire is deemed an emergency. Hamlet personnel should not excavate a suspected subsurface as the fire may quickly get worse when exposed to more oxygen, may release toxic or poisonous fumes, or may have caused underground voids causing an unstable surface prone to collapse. The Fire Department should manage the suppression of any subsurface fires.

The cause of any subsurface fires will be investigated and necessary steps taken to prevent a subsurface fire from recurring. The fire incident and all response measures should be documented on the weekly Solid Waste Disposal Facility Inspection Form (Appendix G), and reported to the SAO.

6.2 Spill Contingency Plan

The intent of this Spill Contingency Plan is to provide a guide to operators and other Hamlet personnel in the event of an accidental release of fuel, sewage, or other waste at the water, sewage, and solid waste facilities in Chesterfield Inlet. The Spill Contingency Plan is planned to be protective of the local environment and public and personnel health and safety.

This Spill Contingency Plan (SCP) has been developed for implementation at the water distribution system, sewage disposal facility, and solid waste disposal facilities in Chesterfield Inlet. At these sites, there may be situations that arise that are beyond the scope of this SCP. In these situations, all activities at the site should stop until a revised procedure or SCP is prepared, reflecting the changing conditions at the site (e.g., operation of a new Hazardous Waste Storage area should not continue until this SCP is updated to reflect new conditions).

All persons involved with operations at the water, sewage and solid waste facilities should read and be familiar with this SCP. To be effective, it is important that all personnel are familiar with their responsibilities and steps to take in the event of a spill. Personnel should not be reading the SCP for the first time during an emergency.

6.2.1 Site Descriptions

The water, sewage and solid waste facilities have been described in the preceding sections of this O&M Manual. The sites are shown in Figures 1 and 2 in **Appendix B**.

6.2.2 Regulations

Under Section 34 of the *Environmental Protection Act*, the Nunavut Consolidation of Spill Contingency Planning and Reporting Regulations was enabled by the Commissioner in 1998. In the Spill Contingency Planning and Reporting Regulations, a SCP is required to include the following:

- The name and address of the owner or person in charge, management or control of the site(s)
- The name, job title and 24-hour telephone number for the person(s) responsible for activating the contingency plan
- A description of the facility(ies) including location, size, type and amount of contaminants normally stored on the site(s), and site map(s)
- The steps to be taken to report, contain, clean up and dispose of a contaminant in the case of a spill
- The means by which the contingency plan is activated
- An inventory and location of the response and clean-up equipment available to implement the plan
- A description of the training required and provided to employees who respond to a spill
- The date the plan was prepared.

6.2.3 Contacts and Regulatory Authorities

The SAO has overall responsibility of Hamlet sites, including the water, sewage and solid waste facilities. The Hamlet Maintainer and Hamlet Foreman manages the facilities and are to be responsible for initiating the Spill Contingency Plan; the Hamlet Foreman should be contacted when a spill occurs at the water, sewage or solid waste facilities. Contact information for the SAO, Hamlet Maintainer and Hamlet Foreman are in Table 6-1 below.

Table 6-1: Hamlet of Chesterfield Inlet Contact Information for Spill Contingency Planning

Senior Administrative Officer	Hamlet Maintainer	Hamlet Foreman
Hamlet of Chesterfield Inlet Office Phone: (867) 898-9951 Fax: (867) 898-9108 Email: sao_hamlet@qiniq.com	Hamlet of Chesterfield Inlet Office Phone: (867) 898-9951 Fax: (867) 898-9108	Greg Tanuyak Hamlet of Chesterfield Inlet Office Phone: (867) 898-9951 Fax: (867) 898-9108 Email: fore_hamlet@qiniq.com

Every time a spill is identified, the Hamlet Maintainer and/or Hamlet Foreman should be contacted as soon as possible. The 24-hour Emergency Spills Report Line should also be contacted in the event the quantity of contaminant spilled exceeds the reportable amount. Reportable spill quantities range from any amount spilled to 100 L or greater of contaminant; reportable spill quantity for sewage is any amount. See Section 6.2.5 for specific information on reportable quantities of contaminants.

24-HOUR EMERGENCY SPILL REPORT LINE: (867) 920-8130

Any person reporting a spill is required to give as much information as possible, however reporting of a spill should not be delayed if all of the necessary information is not known. Additional information can be provided later. From the *Consolidation of Spill Contingency Planning and Reporting Regulations* (1998), as much of the following information should be reported during the initial spill report:

- Date and time of spill
- Location of spill
- Direction spill is moving
- Name and phone number of a contact person close to the location of the spill
- Type of contaminant spilled and quantity
- Cause of spill
- Whether spill is continuing or has stopped
- Description of existing contaminant
- Action taken to contain, recover, clean up, and dispose of spilled contaminant
- Name, address and phone number of person reporting the spill
- Name of owner or person in charge, management or control of contaminants at the time of the spill.

Other regulatory agencies which have a legislated (vested) interest in the event of a spill are summarised in Table 6-2 below. These authorities do not need to be immediately contact if a spill occurs, however may be involved in follow-up or additional clean-up activities.

Table 6-2: Regulatory Agency Contact Information for Spill Contingency Planning

Agency	Legislation	Contact Information
Nunavut Water Board	*Nunavut Waters and Surface Right Tribunal Act*	Phone: (867) 360-6338 Fax: (867) 360-6369
Nunavut Impact Review Board	*Nunavut Land Claims Agreement Act*	Phone: (867) 983-2593
Government of Nunavut Department of Environment	*Nunavut Environmental Protection Act*	Phone: (867) 975-7700 Fax: (867) 975-7740
Environment Canada	*Canadian Environmental Protection Act,* 1999	Phone: (867) 975-4464 Fax: (867) 975-4645
Fisheries and Oceans Canada	*Fisheries Act*	Phone: (867) 979-8000 Fax: (867) 979-8039
Transport Canada (Coast Guard)	*Transportation of Dangerous Goods Act*	Phone: (867) 979-5269 Fax: (867) 979-4260

6.2.4 Potential Contaminants

At the date of this SCP, the Hamlet of Chesterfield Inlet had not completed a waste inventory and exact types and quantities of contaminants are unknown. However the following contaminants are anticipated to be used at the facilities, and may be involved in a spill:

- Gasoline
- Diesel
- Hydraulic oil
- Motor oil
- Other lubricating oil
- Antifreeze and other coolants
- Sewage
- Chlorine powder

At the water, sewage and solid waste facilities, spills may result from any of the following occurrences:

- Leaks or ruptures of fuel storage tanks
- Valve or line failure in systems, vehicles or heavy equipment
- Heat expansion due to overfilling or improper storage
- Improper storage of contaminants
- Vehicular accidents
- Spill during transfer of contaminant
- Vandalism.

6.2.5 Reportable Spill Quantities

Under the Nunavut *Spill Planning and Reporting Regulations*, all spills which are of a quantity greater than or equal to the amount set out for that contaminant type must be immediately reported to the 24-hour Emergency Spill Report Line; this is called a 'reportable spill'. Reportable spill quantities are located in Table 6-3 below.

Table 6-3: Reportable Spill Quantities[1]

Item No.	TDGA Class[2]	Contaminant	Reportable Spill Quantity
1	1	Explosives	Any amount
2	2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity greater than 100 L
3	2.2	Compressed gas (non-corrosive, non-flammable)	Any amount of gas from containers with a capacity greater than 100 L
4	2.3	Compressed gas (toxic)	Any amount
5	2.4	Compressed gas (corrosive)	Any amount
6	3.1, 3.2, 3.3	Flammable liquid	100 L
7	4.1	Flammable solid	25 kg
8	4.2	Spontaneously combustible solids	25 kg
9	4.3	Water reactant solids	25 kg
10	5.1	Oxidizing substances	50 L or 50 kg
11	5.2	Organic Peroxides	1 L or 1 kg
12	6.1	Poisonous substances	5 L or 5 kg
13	6.1	Infectious substances	Any amount
14	7	Radioactive	Any amount
15	8	Corrosive substances	5 L or 5 kg
16	9.1 (in part)	Miscellaneous products or substances, excluding PCB mixtures	50 L or 50 kg
17	9.2	Environmentally hazardous	1 L or 1 kg
18	9.3	Dangerous wastes	5 L or 5 kg
19	9.1 (in part)	PSCB mixtures of 5 or more parts per million	0.5 L or 0.5 kg
20	None	Other contaminants	100 L or 100 kg

NOTE:

[1] *Environmental Protection Act*, *Consolidation of Spill Contingency Planning and Reporting Regulations*

2 TDGA Class = Transportation of Dangerous Goods Class under *the Transportation of Dangerous Goods Act*

6.2.6 Spill Response Procedures

The following steps outline the general spill response procedures for reporting, containing, cleaning up and disposing of materials in the event of hydrocarbon (e.g., fuel, oil, etc) and other waste spill, or sewage spill.

6.2.6.1 Hydrocarbon Spills

Three procedures for hydrocarbon spills have been developed depending on the media on which the spill has occurred. The following sections outline procedures for hydrocarbon or other waste spills occurring on land (soil, gravel, sand, rock and vegetation), water, or snow/ice.

Spills on Land

1. Once a spill is identified, all sources of ignition turned off (e.g., no smoking, shut off engines).
2. The spilled material should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access of the area should be restricted.
4. If possible, identify the source of the spill. Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
5. If the spill is too large to be controlled with the spill materials at hand, contact the facility(ies) manager and report the spill immediately (see Section 6.2.3 for contact information).
6. If the spill is small enough to be controlled with the materials at hand, prevent spilled contaminants from spreading or entering waterways by using sorbent (oil-absorbing) materials or a soil dyke down slope from the spill. This is especially the case with liquid contaminants (e.g., gasoline, diesel).

   If some contaminant has entered a waterway, follow procedures in the next section (***Spills on Water***) to contain and clean-up the contaminant in the water.
7. Once the spill has been controlled and further spreading prevented, contact the facility(ies) manager and report the spill (see Section 6.2.3 for contact information).
8. If possible with materials at hand, clean up the remaining spilled contaminant and store contaminated materials in a secure container for disposal. Do not flush the affected area with water.
9. If possible, remove any contained liquid by pumping into secure drums.
10. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
11. Contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** to report the spill as soon as possible and obtain additional advice.

12. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

Spills in Water

1. Once a spill is identified, all sources of ignition turned off (e.g., no smoking, shut off engines).
2. The spilled material should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access of the area should be restricted.
4. If possible, identify the source of the spill. Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container).
5. If the spill is too large to be controlled with the spill materials at hand, contact the facility(ies) manager and report the spill immediately (see Section 6.2.3 for contact information).
6. If the spill is small enough to be controlled with the materials at hand, use sorbent booms to contain the spill for recovery. Place sorbent sheets on the water within the boomed area to help contain the contaminant. For narrow waterways, place one or more sorbent booms across the waterway, downstream of the spill location, and anchor the booms on the each bank.
7. Once the spill has been controlled and further spreading prevented, contact the facility(ies) manager and report the spill (see Section 6.2.3 for contact information).
8. If possible with materials at hand, clean up the remaining spilled contaminant within the boomed area. Store contaminated materials in a secure container for disposal.
9. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
10. Contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** to report the spill as soon as possible and obtain additional advice.
11. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

Spills on Snow/Ice

1. Once a spill is identified, all sources of ignition turned off (e.g., no smoking, shut off engines).
2. The spilled material should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access of the area should be restricted.
4. If possible, identify the source of the spill.

5. Since a spill occurring on snow or ice presents the potential for immediate access of contaminants into waterways, contact the facility(ies) manager and report the spill immediately (see Section 6.2.3 for contact information) if the spill is too large to be controlled with the spill materials at hand.
6. Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
7. If the spill is small enough to be controlled with the materials at hand, prevent spilled contaminants from spreading or entering waterways by using sorbent materials or a snow/soil dyke down slope from the spill. This is especially the case with liquid contaminants (e.g. gasoline, diesel).
8. Once the spill has been controlled and further spreading prevented, contact the facility(ies) manager and report the spill (see Section 6.2.3 for contact information).
9. If possible with materials at hand, clean up the remaining spilled contaminant and store contaminated materials in a secure container for disposal. Impacted snow should also be stored in drums for disposal.
10. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
11. Contact the **24-Hour Emergency Spill Report Line (Phone:(867) 920-8130)** to report the spill as soon as possible and obtain additional advice.
12. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

Additional Spill Delineation or Monitoring

In the event of a large spill in which not all of the spilled contaminant can be readily cleaned up with materials at hand (as described above), delineation of the affected area may be required. This would include subsurface investigation of the area (i.e., digging of test pits, soil sampling, installation of monitoring wells) to determine how large and how deep the contaminant affected the subsurface soil and/or groundwater (lateral and vertical extent of the spill). The delineation would result in the development of an appropriate remediation plan for the affected area. In this case, a qualified environmental consultant should be retained to provide advice on how to proceed with delineation and remediation of a large spill.

6.2.6.2 Sewage Spills

Raw sewage can contain infectious bacteria, viruses, fungi and parasites that can cause serious human illnesses and even death. A risk of environmental contamination also exists from sewage spills as raw sewage can also contain unknown chemicals from improper chemical disposal. It is imperative to safely and properly clean up all sewage spills to reduce the chance of human infection and environmental contamination.

Spills on Land

1. Once a spill is identified, the affected area should be vacated and secured, ensuring the area is safe for entry and does not represent an immediate threat to human health and safety of the spill responders. Public access of the area should be restricted.
2. If possible, identify the source of the spill. Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
3. Ensure all spill responders wear the appropriate personal protective equipment, including waterproof gloves, safety glasses/goggles, rubber boots and disposable protective coveralls.
4. If the spill is too large to be controlled with the spill materials at hand, contact the facility(ies) manager and report the spill immediately (see Section 6.2.3 for contact information).
5. If the spill is small enough to be controlled with the materials at hand, prevent spilled sewage from spreading or entering waterways by constructing an impervious soil dyke, or other impervious barrier.
6. Once the spill has been controlled and further spreading prevented, contact the facility(ies) manager and report the spill (see Section 6.2.3 for contact information).
7. If possible, remove any contained liquids using the sewage vacuum truck(s). Transport and dispose of this in the detention cell of the sewage disposal facility.
8. If possible with materials and equipment at hand, clean up the remaining spilled sewage and dispose of contaminated soil in the detention cell of the sewage disposal facility. Do not flush the affected area with water. Other materials used for clean-up of the sewage spill should be burned in the Burn Area of the MSW disposal facility.
9. Any hard surfaces (e.g. paving, concrete, equipment, rubber boots, etc) that having come into contact with spilled sewage should be cleaned with a detergent solution and then disinfected. Use only approved disinfectants.
10. Once the sewage spill has been cleaned up, dispose of disposable PPE (i.e., coveralls, gloves, safety glasses/goggles) in Burn Area of MSW disposal facility. Ensure other PPE (i.e., rubber boots) is properly cleaned and disinfected prior to re-use.
11. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
12. Contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** to report the spill as soon as possible and obtain additional advice. Sewage spills must always be reported to the Emergency Spill Report Line.
13. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

Spills in Water

1. Once a spill is identified, the affected area should be vacated and secured, ensuring the area is safe for entry and does not represent an immediate threat to human health and safety of the spill responders. Public access of the area should be restricted.
2. If possible, identify the source of the spill. Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
3. A sewage spill into a waterway should be immediately reported to the facility(ies) manager (see Section 6.2.3 for contact information).
4. Ensure all spill responders wear the appropriate personal protective equipment, including waterproof gloves, safety glasses/goggles, rubber boots and disposable protective coveralls.
5. If the spill is small enough to be controlled with the materials at hand, prevent spilled sewage from further spreading or entering waterways by constructing an impervious soil dyke, or other impervious barrier.
6. If the sewage has entered a waterway which could directly impact human health (e.g., Puiqsuk Lake, reservoir, etc), water removal (if any) from that source will be immediately stopped. Immediately contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** and GN departments (see table below) to report the sewage spill and obtain additional advice on how to proceed further. The water should be sampled as soon as possible to determine if and how the sewage spill has impacted the waterway.

GN-CGS 24-Hour Emergency Management	Government of Nunavut Department of Health and Social Services Environmental Health Officers
(867) 645-3625	Kivalliq: (867) 645-2171 Qikiqtaaluk: (867) 975-4817

1. If the sewage has entered a waterway which poses little risk to human health (e.g., into the sewage treatment tundra wetland, non-potable source), the public should be notified and the access to the area restricted. Further action may be required once the spill is reported to the 24-Hour Emergency Spill Report Line.
2. Once the sewage spill has been controlled and further spreading prevented, if possible remove any other contained liquids using the sewage vacuum truck(s). Transport and dispose of this in the detention cell of the sewage disposal facility.
3. If possible with materials and equipment at hand, clean up the any remaining spilled sewage on the land and dispose of contaminated soil in the detention cell of the sewage disposal facility. Do not flush the affected area with water. Other materials used for clean-up of the sewage spill should be burned in the Burn Area of the MSW disposal facility.

4. Any hard surfaces (e.g., paving, concrete, equipment, rubber boots, etc) that having come into contact with spilled sewage should be cleaned with a detergent solution and then disinfected. Use only approved disinfectants.
5. Once the sewage spill has been cleaned up, dispose of disposable PPE (i.e., coveralls, gloves, safety glasses/goggles) in Burn Area of MSW disposal facility. Ensure other PPE (i.e., rubber boots) is properly cleaned and disinfected prior to re-use.
6. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
7. Contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** to report the spill as soon as possible and obtain additional advice. Sewage spills must always be reported to the Emergency Spill Report Line.
8. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

Spills on Snow/Ice

1. Once a spill is identified, the affected area should be vacated and secured, ensuring the area is safe for entry and does not represent an immediate threat to human health and safety of the spill responders. Public access of the area should be restricted.
2. If possible, identify the source of the spill. Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
3. Since a spill occurring on snow or ice presents the potential for immediate access of contaminants into waterways, contact the facility(ies) manager and report the spill immediately (see Section 6.2.3 for contact information).
4. Ensure all spill responders wear the appropriate personal protective equipment, including waterproof gloves, safety glasses/goggles, rubber boots and disposable protective coveralls.
5. If the spill is small enough to be controlled with the materials at hand, prevent spilled sewage from further spreading or entering waterways by constructing an impervious soil/snow dyke, or other impervious barrier.

   If the sewage spill has entered a waterway, follow the procedure in the preceding section (***Spills in Water***).
6. Once the spill has been controlled and further spreading prevented, if any liquid remains (e.g., is not frozen), remove contained liquids using the sewage vacuum truck(s). Transport and dispose of this in the detention cell of the sewage disposal facility.
7. If possible with materials and equipment at hand, clean up the any remaining spilled sewage on the snow/ice and dispose of contaminated snow/ice/soil in the detention cell of the sewage disposal facility. Other materials used for clean-up of the sewage spill should be burned in the Burn Area of the MSW disposal facility.

8. Any hard surfaces (e.g., paving, concrete, equipment, rubber boots, etc) that having come into contact with spilled sewage should be cleaned with a detergent solution and then disinfected. Use only approved disinfectants.
9. Once the sewage spill has been cleaned up, dispose of disposable PPE (i.e., coveralls, gloves, safety glasses/goggles) in Burn Area of MSW disposal facility. Ensure other PPE (i.e., rubber boots) is properly cleaned and disinfected prior to re-use.
10. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
11. Contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** to report the spill as soon as possible and obtain additional advice. Sewage spills must always be reported to the Emergency Spill Report Line.
12. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

6.2.7 Spill Kit and Training Requirements

The following sections outline the recommended minimum requirements for contents and number of spill kits that should be present at the water, sewage and solid waste facilities. Personnel training requirements are also provided.

Spill Kit Contents

Each spill kit should be regularly inspection to ensure it always contains the following, at a minimum (in part from INAC [2007]):

- 1 – 205 L open top steel drum with lid, bolting ring and gasket (spill kit container)
- 10 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm) with ties
- 4 – 12.5 cm x 3 m (5 in. X 10 ft.) sorbent booms
- 10 kg bag of sorbent particulate
- 100 sheets (1 bail) of 50 cm x 50 cm sorbent sheets
- 2 large (5 m x 5 m) plastic tarps
- 1 roll duct tape
- 1 utility knife
- 1 field notebook and pencil
- 1 rake
- 1 pick-axe
- 3 spark-proof shovels
- 4 Tyvex® splash suits
- 4 pairs chemical resistant gloves

- 4 pairs of splash protective goggles
- Instruction binder, including Spill Contingency Plan.

The entire spill kit contents, with the exception of the spark-proof shovels, can be stored within the 205 L steel drum. The drum should be sealed securely to protect the spill kit contents though should always be accessible without the use of tools (i.e., finger tight bolt ring). The drum's bolt ring should be inspected regularly during facility inspections to ensure it turns freely and is lubricated.

Extra spill response materials should also be available for use, in addition to the spill kit contents. These include:

- 10 – 205 L open top steel drum with lid, bolting ring and gasket
- 2 spark-proof shovels
- 50 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm)
- 10 – 12.5 cm x 3 m (5 in. X 10 ft) sorbent booms
- 5 – 10 kg bags of sorbent particulate
- 500 sheets (5 bails) of 50 cm x 50 cm sorbent sheets
- 2 Tyvex® splash suits
- 2 pairs of chemical resistant gloves
- 2 pairs of splash protective goggles.

Spill Kit Locations

At least one spill kit should be clearly marked and present at the sewage disposal and solid waste disposal facilities. Two spill kits should be present for amenities within the water distribution facility; one should be located at the pumphouse and the second at the First Lake pump shelter.

Required Training

To ensure the SCP is carried out effectively, the following actions should occur:

- The SCP should be reviewed annually to ensure it is still up-to-date for current conditions.
- When required, the SCP should be revised to reflect current conditions.
- The SCP should be distributed to and read by all personnel who work at the Hamlet's water, sewage and MSW facilities.
- Personnel at these facilities should be familiar with the location of all HHW and other potentially hazardous materials, and their associated Material Safety Data Sheets (MSDS).
- Personnel at these facilities should be trained to read and use MSDS.
- Personnel should receive proper spill response training to learn and understand the techniques and materials used to contain, clean up and remediate spills. Trained personnel will be aware of the importance of first response in reducing the impact of spills with respect to protecting human health and safety, the environment, and property.

6.3 Detention Cell Berm Failure

1. Once a berm failure occurs and is identified, the affected area should be vacated and secured, ensuring the area is safe for entry and does not represent an immediate threat to human health and safety of the workers. Public access of the area should be restricted. Sewage discharge to the detention cell has to cease.
2. Determine if the failure has stabilized/equalized or if failure is still occurring (i.e., still eroding). If the degradation has not stopped, determine if it is safe to stop or control the berm failure (e.g., fill in failure area),
3. Ensure all workers wear the appropriate personal protective equipment, including waterproof gloves, safety glasses/goggles, rubber boots and disposable protective coveralls.
4. Contact the facility(ies) manager and report the berm failure immediately (see Section 6.2.3 for contact information).
5. If the berm failure is small enough and can be controlled with materials at hand that will prevent sewage from spreading or entering waterways, that work should be initiated by reconstructing the berm, or other impervious barrier. On a temporary basis, sand bags, a sand source and a synthetic liner can be utilitised.
6. If possible, remove any downstream liquids using the sewage vacuum truck(s). Transport and dispose of this in the other functioning detention cell of the sewage disposal facility, or if both have failed, upstream of the detention cell(s).
7. If possible, increase the downstream flow pathway to the discharge location by berming, damming and restricting flow through the downstream tundra wetland as much as possible.
8. If possible with materials and equipment at hand, clean up the sewage and dispose of contaminated soil in the functioning detention cell of the sewage disposal facility.
9. Once the berm has been reconstructed, dispose of disposable PPE (i.e., coveralls, gloves, safety glasses/goggles) in Burn Area of MSW disposal facility. Ensure other PPE (i.e., rubber boots) is properly cleaned and disinfected prior to re-use.
10. Complete the Nunavut Spill Report Form with as much information as possible. This form is included in **Appendix H** of this O&M Manual.
11. Contact the **24-Hour Emergency Spill Report Line (Phone: (867) 920-8130)** to report the berm failure and spill as soon as possible and obtain additional advice. Sewage spills must always be reported to the Emergency Spill Report Line.
12. Fax the completed Nunavut Spill Report Form to the **24-Hour Emergency Spill Report Line (Fax: (867) 873-6924)**.

In the event of a detention cell berm failure, further investigation of the area may be required. The investigation would result in the development of an appropriate remediation plan for the affected area. In this case, a qualified environmental engineer should be retained to provide advice on how to proceed with the investigation of a failure and the re-building of the detention cell berm.

6.4 Record Keeping

Records of any spills, spill response activities, follow-up inspections, monitoring, and any additional remedial work must be kept. These records should be stored at the Hamlet office and kept by the SAO. These records will assist with the annual review of the SCP, operations and maintenance practices at all facilities, and spill response requirements.

Every year by March 31st, the Hamlet is required to submit an Annual Report to the NWB. The Hamlet is required to provide a list of all spills and a summary of follow-up action taken for each spill. Therefore, at a minimum, the following records should be kept:

- Reports of all spills and spill reports submitted to the 24-Hour Emergency Spill Report Line
- Types and quantities of spill contaminants
- All spill follow-up activities
- Inspections of spill kit contents and replacement records for any items
- Records of spill response training for all Hamlet spill responder personnel.

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Phifer, R.W., and W.R. McTigue Jr. Handbook of Hazardous Waste Management for Small Quantity Generators. Chelsea, MI: Lewis Publishers Inc, 1988.

UMA Engineering Ltd. (UMA). Operation and Maintenance Manual Volume 1: Water Supply Improvement Project – Truckfill Building and Raw Water Supply at Chesterfield Inlet, NWT. Prepared for Government of the Northwest Territories Department of Public Works. Yellowknife, NT: UMA, 1991.

7.2 Personal Communications

Eno, R. Manager, Pollution Control. Government of Nunavut Department of Environment. November 19, 2009

APPENDIX A

Hamlet of Chesterfield Inlet Water 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

DECISION

LICENCE NUMBER: NWB3CHE0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated June 17, 2003, made by:

Hamlet of Chesterfield Inlet

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

DECISION

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

Licence Number NWB3CHE0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-10-05)

SIGNED this 15th day of December 2003 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

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I. BACKGROUND

The Hamlet of Chesterfield Inlet is located on a small bay on the south shore of Chesterfield Inlet, which is on the west shore of Hudson Bay. Chesterfield Inlet is located at 63°20' N and 90° 42'W, and is 101 km northeast of Rankin Inlet and 1,147 air km's east of Yellowknife. The predominant local topography of Chesterfield Inlet, which is located on a low and narrow coastal strip, is low and rolling, with low granite outcrops and numerous inland lakes. The average annual precipitation in Chesterfield Inlet consists of 14.6 cm of rainfall and 112 cm of snowfall. The mean high in July is 13.1 degrees with a mean low of 4.6 degrees. In January, the mean high is -27.8 degrees and a mean low of -35.2 degrees.

II. PROCEDURAL HISTORY

On June 17, 2003, an application for a water licence was filed by the Hamlet of Chesterfield Inlet, which was previously un-licensed by the NWB. The Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement*, on October 10, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

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

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the compliance record of the Applicant. Specifically, the September 4, 2002 DIAND Inspection Report indicated:

1. The lagoon contains considerable amounts of refuse (including drums), which should be removed from the treatment lagoon;
2. The reservoir supply line requires maintenance, as sediment produced by leakage has a potential to impact on the First Lake water source;
3. Concentrations of ammonia exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*; and
4. Levels of Total Suspended Solids and BOD exceeded the *Municipal Wastewater Effluent Quality Guidelines*.

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

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

In review of the application DIAND, has recommended that a licence term of five (5) years. 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. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

Water Use

The Municipality currently receives water from the First Lake water supply located 4.2 km west of the Hamlet. This run-off water is stored in a 33,000 m^3 reservoir located 1 km west of the Hamlet, adjacent to the truck fill station. The water receives a chlorine treatment and is then distributed to the community by truck. Water requirements for 2003 were reported as11,379 m^3. Demand for 2008 was not reported in the application. Utilizing the water demand formula developed by the Department of Municipal and Community Affairs (Government of the Northwest Territories), projected demand requirements for 2008 were calculated at 17,248 m^3.

No concerns were expressed by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Based upon the projected

requirements of the Hamlet, the Board has set the terms and conditions in the water licence, which govern water usage. The maximum permitted usage of water by the Hamlet of Chesterfield Inlet, over the term of the water license and for all purposes, has been set at 20,000 m^3 annually.

Deposit of Waste

Sewage

The Hamlet of Chesterfield Inlet utilizes a Sewage Disposal Facility approximately 3.1 km west of the Municipality. This Sewage Disposal Facility is located at the Solid Waste Disposal Facility, and consists of a simple truck offload discharge area which is directed to a natural depression which functions to contain sewage. The effluent from this containment area proceeds downstream to the marine environment through natural wetlands along a 900 m flow path prior to entering Hudson Bay. The total area of the wetland is 165,000 m^2.

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

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

Solid Waste

The Hamlet's solid waste management site is located adjacent to the Sewage Disposal system, approximately 3.1 km from the community. Waste is segregated, with a generic landfill area, a bulky wastes area, and a segregated for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered annually.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND and Environment Canada. DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. This Operations and Maintenance Plan would include specific measures to control the deposition of litter into the Hamlet Sewage Disposal Facility. DIAND further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. Environment Canada and DIAND recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. Finally, DIAND recommended that the Hamlet take steps to control and monitor the dumping of commercial/industrial waste by construction contractors. These steps could include the enactment of Municipal Bylaws, to compel contractors to segregate their waste, and place it within designated areas within the landfill. DIAND also indicated that the Hamlet was within their rights to strictly regulate, and if necessary to refuse to accept, hazardous wastes from commercial interests. DIAND also indicated that such a Bylaw could include levying additional fees to offset the additional burdens (on staff and facilities) of managing commercial/industrial waste. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence.

LICENCE NWB3CHE0308

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 CHESTERFIELD INLET

(Licensee)

of **CHESTERFIELD INLET, NUNAVUT, X0A 0J0**

(Mailing Address)

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

Licence Number **NWB3CHE0308**

Water Management Area **NUNAVUT 06**

Location **CHESTERFIELD INLET, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **20,000 CUBIC METRES ANNUALLY**

Date of Licence **DECEMBER 15, 2003**

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

Dated this 15th of December 2003 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Chesterfield Inlet, Nunavut (63°21' N; 90° 42'W);

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

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

2. Definitions

In this Licence: **NWB3CHE0308**

"Act" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"Licensee" means the holder of this Licence;

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

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

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

"Sewage Disposal Facilities" comprises the area and engineered lagoon and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on June 17, 2003;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on June 17, 2003;

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

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

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on June 17, 2003; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the First Lake Water Supply, as described in the Application for Water Licence filed by the Applicant on June 17, 2003.

PART B: GENERAL CONDITIONS

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

   i. tabular summaries of all data generated under the "Monitoring Program";

   ii. the monthly and annual quantities in cubic metres of fresh water obtained from all sources;

   iii. the monthly and annual quantities in cubic metres of each and all waste discharged;

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

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

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

vii. a summary of any studies, reports and plans (e.g., Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;

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

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

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

4. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall, within ninety (90) days after the first visit of the Inspector, post the necessary signs, where possible, to identify the stations of the "Monitoring Program." All signage postings shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector.

6. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130) any spills of Waste, which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Water Supply or Waste Disposal Facilities.

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

8. Any communication with respect to this Licence shall be made in writing to the attention of:

(i) Chief Administrative Officer:

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

(ii) Inspector Contact:

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

(iii) Analyst Contact:

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

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

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from the First Lake Water Supply using the Water Supply Facilities or as otherwise approved by the Board.

2. The annual quantity of water used for all purposes shall not exceed 20,000 cubic metres.

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

4. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all Sewage to the Sewage Disposal Facilities or as otherwise approved by the Board.

2. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Program Station CHE-4 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1 x 10^4CFU/dl
BOD_5	80 mg/L
Total Suspended Solids	100 mg/L
Oil and grease	No visible sheen
pH	between 6 and 9

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, shall be maintained at all dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

4. The Licensee shall advise an Inspector at least ten (10) days prior to initiating any decant of the sewage lagoon.

5. The Sewage Disposal Facility shall be maintained and operated, to the satisfaction of an Inspector in such a manner as to prevent structural failure.

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

7. The Licensee shall implement measures to ensure hazardous materials and/or leachate from the Solid Waste Disposal Facility does not enter water.

8. The Licensee shall submit to the Board for review within six (6) months of the issuance of this license a report identifying each Final Discharge Point. The report shall at least include:

a. Plans, specifications and a general description of each Final Discharge Point together with its specific geo-referenced location;

b. A description of how each Final Discharge Point is designed and maintained.

9. If, during the term of this Licence, additional Final Discharge Points are identified, the Licensee shall submit the information as required by Part D, Item 8 for each new Final Discharge Point within 30 days after the discharge point is identified and at least 60 days prior to depositing Effluent from the new Final Discharge Point and/or proposed changes are made to a Final Discharge Point.

10. The Licensee shall implement measures to control the deposition of waste from the Solid Waste Disposal Facility into the Sewage Disposal Facility.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval design drawings stamped by a qualified engineer registered in Nunavut prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

2. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Waste Disposal Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

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

ii. said modifications do not place the Licensee in contravention of the Licence or the *Act*;

iii. the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and

iv. the Board has not rejected the proposed modifications.

3. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met may be carried out only with written approval from the Board.

4. The Licensee shall provide as built plans/drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, within 6 months of the issuance of this license, submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996). In addition, this Plan shall specifically address hazardous waste disposal and operational issues at the Solid Disposal Facility.

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

3. The Licensee shall revise the Plan referred to in Part F, Item 1, if not acceptable to the Board. The revised Plan shall be submitted to the Board for approval within thirty (30) days of notification of the Board decision

4. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:

    i. employ the appropriate contingency plan as provided for in the Operation and Maintenance Plan;
    ii. report the incident immediately via the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
    iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

5. In the absence of a contingency plan contained within an approved Operation and Maintenance Plan, and should during the period of this Licence an unauthorized discharge of waste occur, or if such a discharge is foreseeable, the Licensee shall:

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

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities and the construction of new facilities to replace existing ones. The Plan shall include, but not be limited to where applicable:

   i. water intake facilities;
   ii. the water treatment and waste disposal sites and facilities;
   iii. petroleum and chemical storage areas;
   iv. any site affected by waste spills;
   v. leachate prevention;
   vi. an implementation schedule;
   vii. maps delineating all disturbed areas, and site facilities;
   viii. consideration of altered drainage patterns;
   ix. type and source of cover materials;
   x. future area use;
   xi. hazardous wastes; and
   xii. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

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

3. The Licensee shall revise the Plan referred to in Part G, Item 1 if not approved. The revised Plan shall be submitted to the Board for approval within thirty (30) days of receiving notification of the Board's decision.

4. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Monitoring Station	Description
CHE-1	Raw water supply at the First Lake Water Supply prior to treatment

CHE-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
CHE-3	Raw Sewage at truck offload point
CHE-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

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

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

3. The Licensee shall measure and record in cubic metres the monthly and annual quantities of water pumped from Monitoring Station CHE-1 for all purposes.

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

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

6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 120 days of the issuance of this license.

7. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board.

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

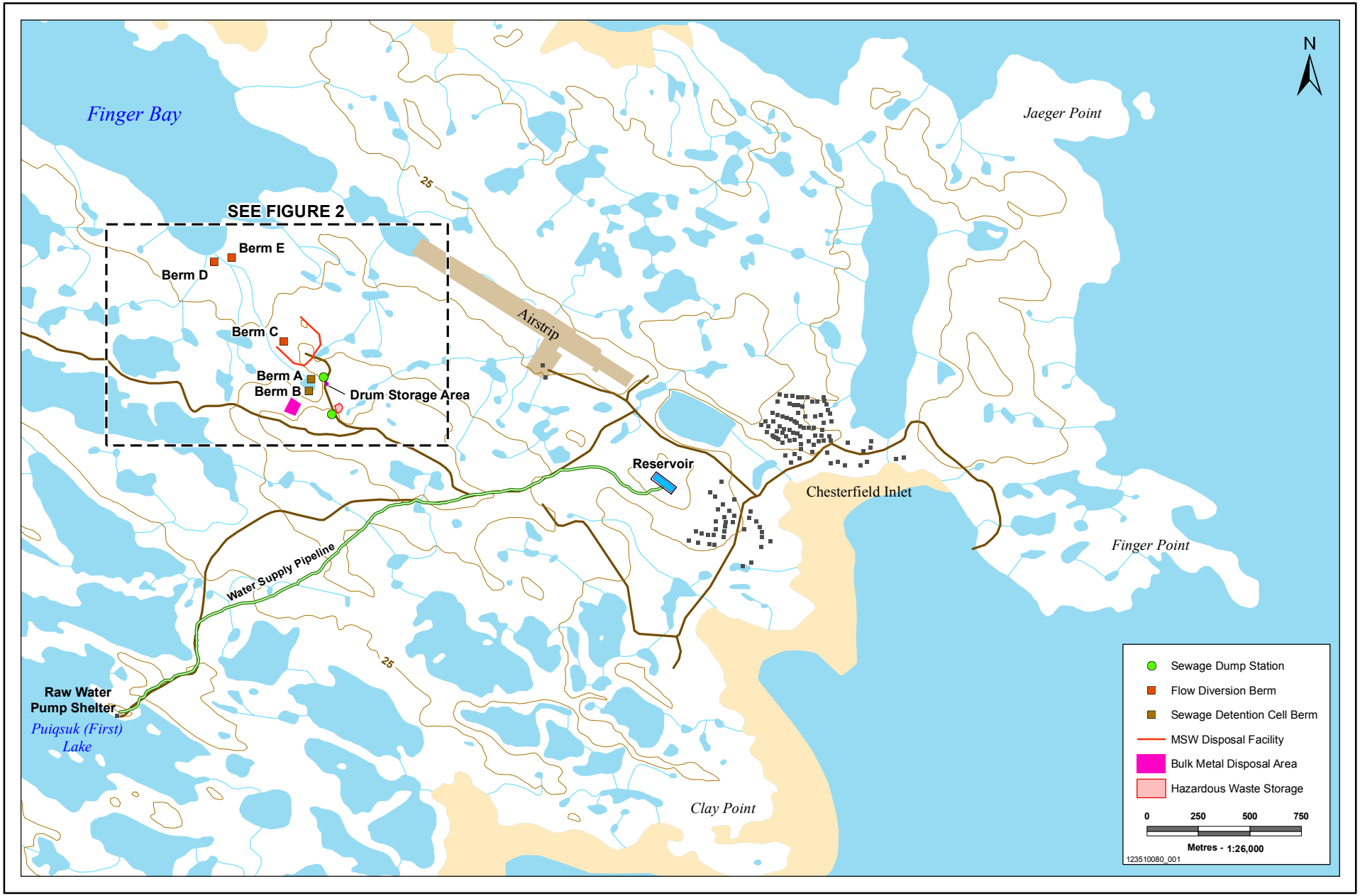
9. The Licensee shall measure and record the annual quantities of sewage solids removed from the Sewage Disposal Facility.

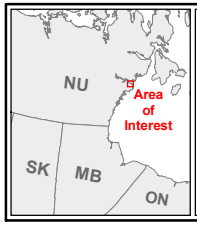
10. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the “Monitoring Program” in the Licensee's Annual Report, as required *per* Part B, Item 1.

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

APPENDIX B

Water, Sewage and Solid Waste Facilities Figures





Chesterfield Inlet Operations & Maintenance Manual

Chesterfield Inlet Water, Sewage & Solid Waste Facilities Overview

Acknowledgements: Original Drawing by Nunami Stantec

PREPARED FOR
NUNAMI STANTEC

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FIGURE NO.
1

Last Modified: May 5, 2010 by jsetho

Chesterfield Inlet Operations & Maintenance Manual

Chesterfield Inlet Sewage & Solid Waste Disposal Facilities

Acknowledgements: Original Drawing by Nunami Stantec

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FIGURE NO.
2

Last Modified: May 5, 2010 by jsetho