Hamlet of Cambridge Bay

Sewage Lagoon
Operation and Maintenance Manual

Prepared by:

AECOM
17203 103 Avenue NW 780 488 6800 tel
Edmonton, AB, Canada T5S 1J4 780 488 2121 fax
www.aecom.com

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1. Introduction

In 2012, the Hamlet of Cambridge Bay's Sewage Lagoon was re-developed and expanded. This manual presents the operation and maintenance (O&M) procedures associated with the re-developed facility. The proper operation and maintenance of Hamlet of Cambridge Bay's Sewage Lagoon facility is an important component of its sewage waste management system (SWMS). It is recognized that inappropriate operation and maintenance (O&M) of a sewage lagoon can cause a facility to become a source of potential public health hazards and adverse environmental impacts.

Water use and waste disposal in the Hamlet of Cambridge Bay is regulated by a Type B Water License issued by the Nunavut Water Board, included in Appendix A.

1.1 Objective of Hamlet of Cambridge Bay's SWMS Manual

This manual has been developed to:

1. Provide the Hamlet of Cambridge Bay with "best management practices" for the operation and maintenance of its Municipal Solid Waste disposal facility; and
2. Document these practices for review by the Nunavut Water Board (NWB) and the community.

The following general requirements to minimize the potential public health hazards and environmental impacts are addressed in this O&M manual; these requirements have been developed with the due diligence and operating principles that follow:

- To minimize environmental nuisances that can interfere with community life and development
- To minimize the possibility of polluting surface water with the application of retention, controlled discharge and wetland treatment
- To minimize occurrence of public health impacts through reduction of disease causing organisms

1.1.1 Due Diligence

Due diligence may be defined as: ***"the taking of all reasonable steps as part of the due care and attention to prevent the occurrence of an accident or mishap, as well as having a contingency plan to control an incident and limit any consequential damage"***.

Due diligence includes policy development, planning and goal setting, implementation of "best management" practices, checking and corrective action, and management review. Best management principles include:

- Good house keeping
- Preventative maintenance
- Inspections and record keeping
- Security
- Employee hiring and training
- Incident reporting
- Operations procedures
- Emergency response planning
- Risk identification and assessment
- Review and corrective action

1.2 Operating Principles

The sewage lagoon is to be operated by the following principles:

- Sewage Lagoon Operator (SLO) is on site as required
- Only approved or authorized waste is accepted for disposal
- Sewage acceptance occurs at the truck discharge flume at the western edge of the lagoon
- Surface water is managed and controlled within practical means
- Safe operating practices are followed and all lagoon personnel are encouraged to improve their skills and knowledge
- Records are maintained with respect to operations activities and site development
- Sewage lagoon operations are managed by a qualified SLO.

Contact lists for Hamlet personnel can be found in Appendix B.

1.3 Operation Policies

Operation Policies were developed to provide specific details related to the operation and maintenance of the facility in accordance with the intent of the design and in keeping with the requirements of the Water License.

These Policies, presented in Appendix C of this manual, cover a wide range of topics; including safety, access control, emergency response, record keeping, litter control, etc. All personnel involved with the operation of the facility must be fully conversant with these Policies.

The Operation Policies may be amended by the Municipal Services Manager as required. In case of discrepancies between the content of the manual and the Operation Policies, the Policies shall govern.

1.4 Location of Cambridge Bay

The Hamlet of Cambridge Bay is geographically situated on the Dease Strait between the Queen Maud Gulf and the Coronation Gulf in the North West Passage, at 69°07' N latitude and 105°03' W longitude. It is the largest community in the Kitikmeot Region and acts as the regional center and transportation hub.

Figure 1-1: Location of Cambridge Bay

Modified from original work of Algkalv and Dr. Blofeld, Wikimedia Commons

1.5 Geophysical and Climate Information

The Hamlet of Cambridge Bay is situated in an area of sags and swells, dry debris-strewn knolls, and moist depressions, with very little vegetation (Canadian Arctic Profiles – Indigenous Culture, 2006).

The surficial geology immediately surrounding the community is classified as a till veneer, with till deposits being patchy and generally less than 1m. The bedrock geology of the Cambridge Bay area comprises Paleozoic sedimentary rocks (carbonates, shales and sandstones). Bedrock is generally exposed at sporadic locations close to sea level. Where exposed, the bedrock comprises layers of dolomite and shale, and is jointed and frost shattered.

Cambridge Bay is situated in an area of continuous permafrost. The reported ground temperature below 3 m depth averages about –9 °C. The thickness of active layer varies from 0.3 m in poorly drained areas to over 2 m in well-drained areas. Excess ice contents of up to 10% have been reported in the subsurface soils.

The climate can be characterized by long cold winters and short cool summers. The daily average temperature is -14.4°C. The average total annual precipitation is 13.88 cm; consists of 82.10 cm of snowfall and 6.96 cm of rainfall. The July mean high is 12.3°C and mean low is 4.6°C. The January mean high is -29.3°C and mean low is -36.3°C. The prevalent wind direction is to the northwest at an annual average wind speed of 21.2 km/h (Canadian Climate Normals 1971-2000).

1.6 Waste Facilities Location

The Hamlet of Cambridge Bay's sewage waste management system (SMSW) site is located approximately 0.8 km northeast of the community. The Sewage Lagoon is immediately north of the landfill site. The current lagoon site has been operating for over thirty years but underwent redevelopment in 2012 in conjunction with improvements to the MSW landfill.

In 2009, the Hamlet was granted an updated Water License by the Nunavut Water Board that incorporated the (planned at the time) redevelopment of both the landfill and lagoon. The current Water License can be found in Appendix A.

Figure 1-2: Waste Facilities

2. Background

The *Waste Facility Improvements Detailed Design Report (Detailed Design Report)*, prepared by AECOM in 2008 for the Waste Disposal Improvements included details on sewage and solid waste generation and characterization. Some information from that report has been incorporated into this manual.

The population projections from that report are significantly higher than the current GN population projections, and as such, the calculations for sewage and waste generation based on those population projections are conservative. For example, the population projections from GN estimates when the *Detailed Design Report* was prepared called for a population of 1790 in 2011; the new GN estimate for 2011 was 1626 and the Canada Census in 2011 reported a population of 1608.

2.1 Water Supply and Distribution

The water use and waste disposal in the Hamlet of Cambridge Bay is regulated by a Type B Water License. The present source of the community's potable water source is Water Lake located approximately 3 km north of the community. The location of Water Lake relative to the community and the waste disposal facilities is presented in the following figure.

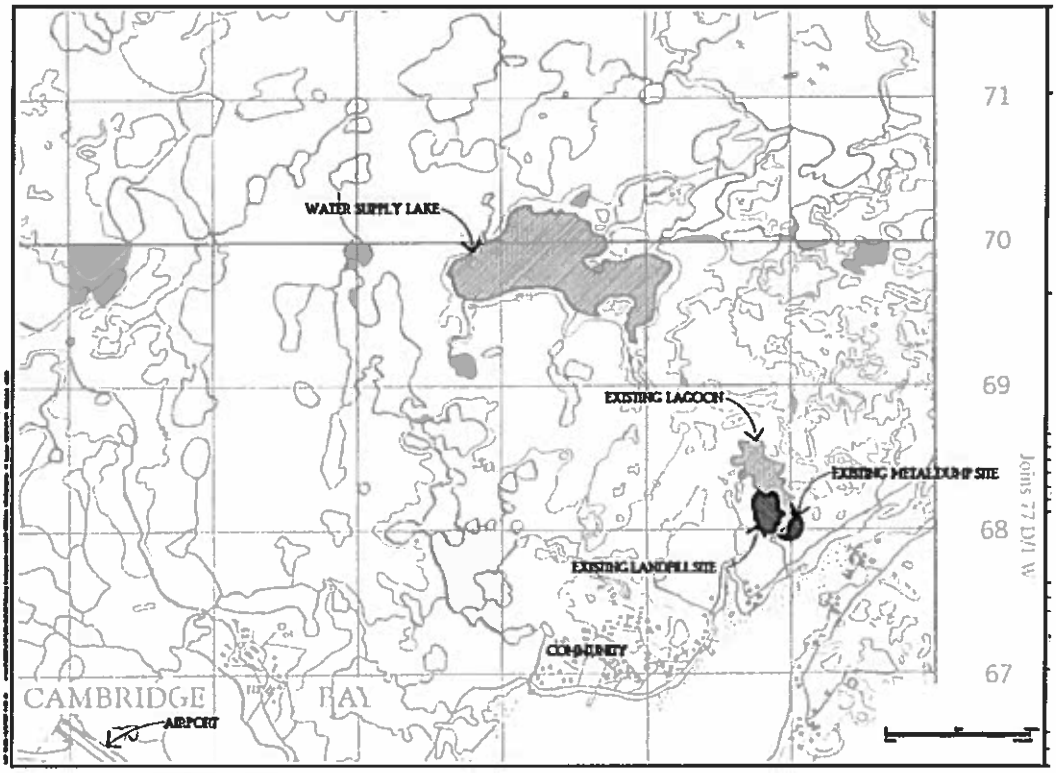


Figure 2-1: Cambridge Bay Water and Waste Disposal Facilities (Prior to Redevelopment)

A fill station is located in the community center and a water truck is used to distribute water to houses in the community. Water use from Water Lake totals 20 truckloads per day (12,000 L per truckload). The current water license (issued 2009) allows for the removal of 88,000 m^3 of water from Water Lake annually, which is approximately equal to the current withdrawals.

2.2 Wastewater Characteristics

Wastewater generated in Cambridge Bay is primarily domestic in source and characteristics. The wastewater quality from the community may be considered to be a "high strength" waste because of the use of a trucked sewage and trucked water system. The "high strength" condition is typical for trucked sewage and water systems due to the low water usage which translates into low dilution of the raw sewage. The expected raw sewage characteristics for high strength raw sewage would be 600 mg/L for BOD, 725 mg/L for TSS, and 10^7 coliforms/100 mL for Total Coliforms (NWT Water Board, 1986).

"Cambridge Bay Waste Facility Improvements Sewage Analysis – Summary Report" was prepared by AECOM (formerly Earth Tech) in August 2006. The report summarized the results of sewage samples collected in 1998, 2003, and 2006 and provides an overview of sewage characteristics and the treatment efficiency of the then existing sewage lagoon system.

The results showed that the concentration of all the effluent discharge parameters (contaminants) collected from "Lagoon" and "Pond" sampling points were below the respective municipal wastewater effluent (MWWE) Guidelines in all three samples (1998, 2003 and 2006). The sampling results of "Outlet" sampling point show that the concentration of most of the effluent discharge parameters were below the MWWE Guidelines with the exception of pH, Al_{total}, and Fe_{total}.

The overall sampling results suggested that the lagoon system of treatment is working satisfactorily to reduce the concentration of sewage contaminants to an acceptable level prior to discharge into the environment (ocean).

3. General Overview

Sewage is collected from the community by tanker trucks, and discharged into a sewage lagoon system which is used to treat wastewater for the community. Currently, on average 16 truckloads (12,000 L per truckload) of sewage are discharged into the lagoon each day.

The existing lagoon system has been in use for over thirty years. Prior to the 2012 improvements, the system consisted of several natural ponds connected in series (Pond 1, Pond 2, Pond 3, Pond 4, Pond 5 and Pond 6). The lagoon volume was approximately 72,000 m^3 based on the normal water level in the lagoon ponds (IEG, 2006). The sewage was discharged into Pond 1 at a truck discharge station, and treated sewage by the lagoon system was channeled into Cambridge Bay.

Improvements to the lagoon were completed in 2012. The work included the provision of a Primary Cell (from part of Pond 1), a Secondary Cell (from the rest of Pond 1 and Pond 2) and a Wetland (from Pond 3). Record drawings for the 2012 improvement can be found in Appendix D. The containment for the lagoon utilizes a combination of natural topography and constructed retention berms to provide a total capacity of 190,000 m^3. With the expansion, it is expected that the lagoon will have sufficient capacity until at least 2025.

Additional improvements included the construction of:

- A submerged berm to enhance primary settling (Primary Lagoon)
- A truck discharge
- Flow diversion berms to minimize run off into the lagoon from surrounding areas
- A pump (portable) decant system from Secondary Lagoon to the Wetland via a decant dispersion structure
- An emergency overflow spillway from the Secondary Lagoon to the Wetland
- A wetland flow control berm
- Dual culverts under the road and riprap apron outfall structures from the wetland into the ocean
- A sludge drying area

3.1 Effluent Guidelines

The Hamlet of Cambridge Bay's current Water License stipulates effluent quality levels, to be measured at CAM-5 (final discharge point for effluent from the retention sewage lagoon to the sewage wetland). Wastewater effluent quality parameters can be seen in the following table.

Table 3-1: Wastewater Effluent Quality Parameters

Parameter	Maximum Concentration of Any Grab Sample
Fecal Coliforms	1 x 10^6 CFU/dl
BOD_5	100 mg/L
Total Suspended Solids	120 mg/L
Oil and grease	No visible sheen
pH	Between 6 and 9

Effluent samples collected shall be analyzed for the following parameters:

Table 3-2: Effluent Sample Parameters

Parameter	
Biochemical Oxygen Demand (BOD)	Faecal Coliforms (FC)
Total Suspended Solids (TSS)	pH
Conductivity	Nitrate-Nitrite as Nitrogen (NO3-NO2)
Oil & Grease (OGG Visual)	
Magnesium (Mg)	Calcium (Ca)
Sodium (Na)	Potassium (K)
Chloride (Cl)	Sulphate (SO4)
Total Hardness	Total Alkalinity
Ammonia Nitrogen (NH3-N)	Total Zinc (Zn)
Total Cadmium (Cd)	Total Iron (Fe)
Total Cobalt (Co)	Total Manganese (Mn)
Total Chromium (Cr)	Total Nickel (Ni)
Total Copper (Cu)	Total Lead (Pb)
Total Aluminum (Al)	Total Arsenic (As)
Total Mercury (Hg)	Total Organic Carbon (TOC)

These parameters may change as additional items may become incorporated into the NWB Water Licence or may be requested by an inspector as defined in Part H, Items 3-7 and 14.

4. Administrative Structure

4.1 Senior Administrative Officer (SAO)

The Senior Administration Officer (SAO) has overall responsibility over all Hamlet Departments, including the Municipal Services/Public Works Department which is responsible for management and operation of the MSW Solid Waste Disposal Facility. Duties of the SAO in relation to the sewage lagoon include:

- Review capital projects related to improvements to the lagoon
- Review and allocate operating budget
- Monitor the overall operations to confirm they are in accordance with this O&M manual and the requirements of the Water License
- Obtain and review operating and monitoring records
- Confirm personnel obtain proper training
- Review emergency response plans and confirm exercises occur on a regular basis
- Coordinate with AANDC for decanting and annual inspection of the facility
- Liaise with the NWB
- Review and submit reports to the NWB, as required by the Water License
- Respond to public inquiries
- Address any complaints

4.2 Municipal Services Manager (MSM)

The MSM is responsible for management of the Sewage Lagoon and reports to the SAO. Duties of the MSM in relation to the sewage lagoon include the following:

- Plan for improvement of the facility operation
- Conduct sewage lagoon inspections as required
- Ensure water monitoring occurs as required under NWB Licence No. 3BM-CAM0914 (Water Licence)
- Prepare annual operation and maintenance budgets
- Manage operation and maintenance activities in accordance with the Water License and as indicated in this manual
- Organize training of personnel on Environmental awareness and facility operation
- Prepare emergency response plans and schedule regular exercises
- Update the Safety Plan for the facility and environment
- Prepare reports required by the Water License
- Prepare and maintain an operational record of the facility
- Ensure current and accurate facility signage, warning and contact information for facility users
- Conduct Safety Orientation for Visitors and Contractors (may be completed by Safety Co-ordinator)

4.2.1 Lagoon Operator

The Lagoon Operator reports to the MSM and is responsible for overseeing vehicular traffic, day-to-day operations of the lagoon, and monitoring lagoon conditions. Duties of the Lagoon Operator include:

- Carry out winter and summer maintenance of roads, sewage disposal area, and drainage ditches
- Assist with inspections of Lagoon Infrastructure as required in the Water Licence

- Initiate and maintain operation of the temporary decant pump during annual discharge
- Maintain equipment and keep records of sewage disposal and decant quantities
- Co-ordinate the overall operations to ensure lagoon site is operated according to the current O&M manual, lagoon policies (Appendix C) and the Water License
- Co-ordinate and collect grab samples from Monitoring Stations CAM-5, CAM-6 and any instructed point. Complete or arrange for packing, labelling, and transportation to an approved laboratory for testing
- Take corrective action for issues of non-compliance and instruction by AANDC/NWB
- Recommend corrective action to the MSM for any spills, leakage, failure or unauthorized uses of the facility
- Administer the Site Safety Plan
- Litter control
- Surface water management and assist with third party water sampling
- Emergency response and spill control as per Spill Contingency Plan in Appendix E
- Record keeping (sewage, vehicle load and equipment uses) and reporting to Municipal Services Manager

A complete and current list of personnel responsible for operation and maintenance of the lagoon sites; along with emergency and regulatory contact information must be maintained. The current contact list is presented in Appendix B with Emergency Contacts; this list should be updated as required.

Further details on water sampling can be found in Appendix F (QA/QC Plan) and Appendix G (Water Sampling Instructions and Laboratory Certification).

5. Sewage Lagoon Configuration and Operation

5.1 General

Lagoons in general are designed to take advantage of natural physical, chemical and biological processes that will treat sewage with minimal operation and maintenance requirements. Those operating requirements that are present for lagoons are essential to maintaining the long-term viability of the sewage treatment system.

Appendix D includes the record drawings for the 2012 improvements. The major components of the lagoon system are discussed over the next several sections.

5.2 Primary Lagoon and Secondary Lagoon (Retention Lagoon)

The primary lagoon is partitioned from the secondary lagoon by a submerged, pervious (rock) berm which is designed to slow down the flow and promote settling of the sludge in the north-western section of the system. The maximum holding storage elevation (level) is 10.00 m.

The secondary lagoon is a larger pond enclosed by the main retention berm, which includes the emergency overflow spillway to ensure that the water level in the lagoon does not exceed 10.00 m. The secondary lagoon allows for biodegradation of the sewage during the summer months. On an annual basis, over the course of about three weeks in late summer, a portable pump shall be used to transfer water from the secondary lagoon to the wetland by decanting from the secondary lagoon.

5.3 Wetland

The wetland has been improved to provide additional treatment. It extends from the main retention berm south along the Scrap Metal Dump isolation berm to a pair of diversion berms. A flow control berm moderates flow and is approximately 80 m north of Ovayok Road. Dual culverts under Ovayok Road convey the effluent from the wetland to the outfall at the ocean.

5.4 Run off Diversion Berms and Retention Berms

Three run off diversion berms have been constructed to prevent snow melt from surrounding areas from entering the lagoon, and are located along the northeast and northwest corners of the sewage lagoon.

The main retention berm is located at the south edge of the secondary lagoon and incorporates an emergency overflow spillway at an elevation of 10.00 m. The access road to the berm is along the northern edge of the main landfill site.

5.5 Decant System Structures

The decant system incorporates:

1. An apron covered with rip-rap on which the decanting intake pipe is laid, located within the secondary cell at the south-west end of the main retention berm.
2. A decant dispersion structure with perforated pipe.
3. A portable pump on wheels.

5.6 Truck Discharge

A truck discharge facility has been constructed at the western edge of the primary lagoon.

5.7 Sludge Drying Pad

A 50 x 50 m pad has been provided south of the primary lagoon for drying the sludge from the primary lagoon. De-sludging operations are typically completed every eight to 12 years.

Prior to the removal of sludge, the Hamlet is required to submit as defined in Part F, Condition 1(c) for NWB approval a 'Sewage Sludge Management Plan' that clearly outlines the chemical composition of the sludge and how to treat the sludge.

6. Site Management

6.1 Normal Operations

This lagoon is intended for domestic municipal sanitary sewage only. Be aware of the regular sewage truck operators and look for signs at the truck discharge and in general, that wastes other than municipal sanitary sewage aren't being discharged into the sewage lagoon system. For any spills, refer to the Spill Contingency Plan in Appendix E. Litter should be collected on a weekly basis.

General public access to the lagoon area should be discouraged. Possible contamination or infection from pathogenic organisms exists with every contact with the sanitary sewage. This area should not be used for recreational activities.

6.2 Inspection of Sewage Lagoon System and Components

A brief check of the lagoon shall be done daily. Site and weather conditions shall be noted, as well as any activities carried out that day.

On a weekly basis during snow-free periods, the integrity of all main components of the sewage lagoon system should be inspected. A report shall be filed, noting the date and any issues identified. During open water periods, the water level in the lagoon should be observed and recorded. Forms can be found in Appendix H. Inspections of signs should occur monthly.

6.2.1 Inlet Structures

The truck discharge point, primary lagoon and surrounding area should be examined weekly for signs of erosion or other operational problems.

The truck discharge system consists of an HDPE plastic mat laid on a slope for conveying the sewage from the truck discharge into the primary cell. The mat is anchored at the top and bottom of the slope. A pressure treated timber wheel stop and steel bumper posts are provided to control the position of the trucks during discharge. The operator should inspect the anchoring of the plastic mat on a regular basis as well as the condition of the mat, noting any cracks forming in the mat.

The pressure treated timber wheel stop and steel bumper posts should be inspected regularly for any signs of damage or instability.

6.2.2 Berm and Related Infrastructure Checking – Open Water Season

The objective of berm inspection is to make sure erosion is not occurring from either leakage or from wave action. Regular monitoring and maintenance are required to control bank erosion. Monitoring shall be conducted during open water season, as this is the only time of year in which the berm conditions are entirely visible.

Several infrastructure components should be checked weekly during open water periods. These components are:

- Runoff diversion berms –the runoff diversion berms (three in total) should be inspected for any signs of erosion along both faces of the berms. This should be done weekly during spring melt. Outside of this key period, monthly inspections are sufficient.

- Overflow structure – weekly inspections when water levels are above 9.50 m.

The following components should be inspected at least monthly during open water season:

- Runoff diversion channels – should be inspected to observe any signs of channel blockage.
- Retention berm and overflow structure – should be inspected to observe any signs of erosion along both faces of the berms and on the inlet and outlet of the overflow structure.
- Wetland diversion berms – the runoff diversion berms (three in total) should be inspected to observe any signs of erosion along both faces of the berms.
- Flow control berm – should be inspected to observe any signs of erosion along both faces of the berms.
- Discharge culverts – the discharge culverts to the sewage wetlands should be inspected to observe any signs of erosion at the inlet or the outlet of the culverts.
- Discharge apron from culverts – the discharge rip-rap apron from the culverts and the wetland should be inspected to observe any signs of erosion.
- All visible parts of the lagoon bank should be observed and the condition be noted.

6.3 Sewage Colour

The variations in the colour of sewage during open water periods can be an important indicator of a sewage lagoon system performance. The following list provides frequently observed sewage colours and associated performance indicators:

- *Dark Green* – Good. High pH and high dissolved oxygen (DO).
- *Dull Green to Yellow* – Not very good. pH dropping, DO dropping, and blue-green algae are becoming established.
- *Grey to Black* – Very bad. Lagoon anaerobic.
- *Tan to Brown* – Okay if caused by a type of algae bloom. Not good if due to silt or bank erosion.
- *Red or Pink* – Indicates presence of sulphur bacteria (anaerobic conditions) or presence of red algae (aerobic conditions).

Lagoon colour shall be noted during the weekly inspections. If the lagoon colour indicates poor performance (dull green to yellow, grey to black and red or pink) the Hamlet shall consult with the NWB to determine appropriate remedial actions. Sewage of this colour is not ready for decanting.

6.4 Annual Discharge Operations

Decanting of sewage effluent can be done by pumping from the secondary cell into the Sewage Wetland (at CAM-5) during late summer. The quantity of the discharge can be marked with the consultation of the MSM and in accordance with the annual discharge policy. The portable pump shall be placed at the "Pumped Decant System Location". Appropriate hoses shall be connected and placed so that the wastewater in the secondary lagoon can be drawn down and pumped into the decant piping structure for release into the Sewage Wetland for further treatment and ultimate discharge into the ocean. For additional details, please refer to the Annual Discharge Policy in Appendix C.
Pump operations shall be performed in accordance with the pump manufacturer's instructions (Appendix I), including exercising caution to minimize fire risk when refueling the pump.

6.5 Maintenance

6.5.1 Odour Problems and Weed & Insect Control

6.5.1.1 Odour Problems

Under normal operating conditions, the sewage lagoon system will not cause any serious odour problems. However, at times, severe odours may occur subject to sewage quality and various environmental factors. The sewage lagoon is located a significant distance (~ 1.0 km) from the nearest house, therefore, odour is not normally considered to be a problem.

The periods of concern for odour are:

1. In the period following ice break-up,
2. During an extensive period of cloud cover, where the absence of sunlight would lead to reduced algae activity and reduced oxygen production, and
3. The presence of extensive floating sludge mats.

The operator of the sewage lagoon system has limited control over these conditions. For Item 1, the problem will normally be of short duration. It is also likely to occur annually. For item 2 the situation should improve once the cloud cover breaks. For Item 3, floating scum and algae mats need to be broken up and screened for removal and drying on the sludge drying pad, for eventual disposal in the landfill.

6.5.1.2 Lagoon Vegetation

Surface weeds can develop in sewage lagoons. The primary concern with surface weeds is that they may block sunlight which is needed for sewage treatment. In addition, when floating plants die, they begin to decompose and deplete oxygen, which is needed by the bacteria for sewage treatment.

Surface weeds may be controlled as follows:

1. Skimming – this is often difficult and must be done numerous times, and
2. Use of herbicides – Water Board approval is required for their use.

The removed weeds should be landfilled and buried, where possible, to prevent odour and insect problems.

6.5.2 Insect Control

Flies and mosquitoes create the most common insect problems. Most mosquitoes breed in sheltered, calm water containing vegetation and floating materials to which the female can attach eggs. The egg clusters are fragile and easily damaged by turbulent action caused by wind and currents. Improper weed control and the accumulation of a scum layer will make insect problems worse.

6.5.3 Warning Signs

Warning signs have been installed at regular intervals around the sewage lagoon system; please see the lagoon drawings in Appendix D for sign locations. Lost or damaged signs should be replaced as soon as possible.

6.5.4 Maintenance of Access Road

The access road was designed for year round access. Maintenance of the access road should follow winter and summer maintenance with snow clearing in the winter and surface grading debris free in the summer.

6.5.5 Overflow Structure

An overflow structure has been incorporated into the main retention berm between the secondary lagoon and the wetland. This structure limits the water level in the lagoon to elevation 10.0 m, and is intended to protect the lagoon berm / structure should the water level rise above 10.0m. Any problems with the rip-rap apron on the overflow structure should be repaired as soon as possible; items that could cause a blockage or restrict flow through the overflow should be removed immediately.

7. Record Keeping and Reporting

Record keeping is necessary to have information on the state of the lagoon system at a specific time and for keeping track of any unusual operation or occurrences. The use of accurate records is very important for the Hamlet, the NWB and its supporting agencies. The records must be detailed enough to allow evaluation of performance and to track the development of problems. The records also provide a record of completed and outstanding tasks.

Lagoon management must establish and maintain an operating record and prepare annual reports, as indicated in the Lagoon Operating Policies – Administration Record Keeping. Forms are provided in Appendix H.

7.1 Daily Log

The normal operational check of the sewage lagoon system involves observation of daily truck load numbers and quantity of sewage disposal as well as any spills or unwanted / abnormal situations. Observations should also be made of the lagoon surface, noting if there is material floating and what the material may be.

An entry should be made every day on the Daily Inspection Record to either indicate that the operation is normal, or that something abnormal was observed and corrective steps had to be taken. Forms can be found in Appendix H. The log shall be maintained with the operator, with a copy to the MSM daily/weekly for recording and reporting purposes.

7.2 Weekly Check

On a weekly basis, the MSM with the lagoon operator shall inspect the lagoon site and fill out the Weekly Systems Check form (found in Appendix H). During open-water season, the lagoon operator shall also inspect berms and related components (as detailed in Section 6.2.2).

7.3 Monthly Reports

The MSM shall prepare a report and carry out a monthly check on the lagoon site. The Monthly Site Operations Check form can be found in Appendix H. During open-water season the lagoon operator shall also inspect berms and related components (as detailed in Section 6.2.2).

The completed Monthly Site Operations Check shall form the main part of the Monthly Report, along with a summary of the daily logs.

7.4 Sewage Sampling

The purpose of taking samples for testing is to obtain information related to the performance of the lagoon system and to fulfill the sampling requirements set out in the Water License. The Lagoon Operator should be familiar with the Quality Assurance and Quality Control Plan (Appendix G), which details water/effluent sampling procedures, locations and parameters. Further water sampling instructions can be found in Appendix H. Additional sampling requirements for the MSW Facility are also defined in the Water License; see the Water Licence for further details. Effluent quality guidelines can be found in the Water License and are also summarized in Section 3.1.

7.4.1 Sample Locations

Samples are required to be taken from the following locations, as stated in the Water Licence:

1. At the Final Discharge Point for effluent from the Retention Sewage Lagoon to the Sewage Wetland (CAM-5)
2. Outfall area from the Wetland (CAM-6) (samples should be taken from the culvert outlet)

When surface water accumulations are pumped from the Municipal Solid Waste Facility to the Retention Lagoon, additional sampling is required (CAM-4); refer to the Quality Assurance and Control Plan (Appendix G), the Municipal Solid Waste O&M Manual, and the Water Licence for additional information on CAM-4 sampling.

The CAM-4, CAM-5 and CAM-6 sampling locations are shown on Figure 7-1. CAM-4 is not place specific and is required for any pumping of surface water from the Municipal Solid Waste Facility (or Metal Dump). Samples for CAM-5 should be taken at the beginning, middle, and near the end of the annual lagoon decant. Samples for CAM-6 should be taken monthly, during periods of observed flow.

Normally, the only field (on-site) test is pH. The equipment for this is a pH litmus paper kit (with instructions included).

7.5 Annual Report

The Hamlet must file an annual report to the NWB no later than March 31st of the year following the calendar year reported. The information required in the report is described in Part B of the water license (complete water license can be found in Appendix A).

The annual report prepared by the MSM shall include:

- Tabular summaries of all data generated under the Monitoring Program
- The monthly and annual quantities (in cubic metres) of all waste discharged
- A summary of modifications and/or major maintenance work carried out on the facilities, including all associated structures
- A list of unauthorized discharged and summary of follow-up action taken
- A summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for next year
- Any addendum with updates or revisions for manuals and plans (i.e. Operations and Maintenance Manual) as required by changes in operation and/or technology
- A summary of any studies or reports requested by the Board that relate to water use and waste disposal or restoration, and a brief description of any future studies planned

In addition for the report to the NWB, an annual operations summary shall be prepared by the MSM, and shall include:

- Major incidents and corrective actions taken, if applicable (other than those reported to the NWB)
- Record of public complaints and response actions
- Annual environmental compliance inspections
- Current operations in relation to design plans
- Annual Decant Record for the most recent year
- Findings of the most recent Annual Inspection and most recent Geotechnical Inspection
- Summary of any special activities carried out that are not included in the corrective action reports

Other special activities may form part of the operational requirements of the Hamlet's sewage lagoon system in addition to the activities presented in this manual. Special activities must be approved in advance by the Nunavut Water Board. WHMIS (Workplace Hazardous Material Information System) guidelines must be followed in the use of all chemicals.

7.6 Corrective Action Report

In the event that conditions of the Water License are not met, corrective action is required. The corrective action shall be documented and maintained in the operating record. A corrective action report may include:

- A description of the problem
- A description of activities undertaken to correct the problem and results
- A description of the monitoring and effectiveness of the corrective action

7.7 Accident/Incident Reports

Special reports shall be filed for any accident/incidents occurring on site; including vehicle accidents (Section12.3), personal injury (Sections 12.1 & 12.2), spill of deleterious substances (Appendix E), fires (Section 10), etc.

7.7.1 Spill of Deleterious Substances

In the event of a spill (other than sewage), the Lagoon Operator shall immediately report to the MSM. The MSM will then notify NWB and Department of Environment of the release and will provide the following details:

- Nature of the spill
- Cause of the spill
- Current actions to contain the spill
- Anticipated time frame to correct the problem

The MSM will report the spill by telephone to the Hamlet of Cambridge Bay SAO. The MSM will document the call and keep a record of the call in the operating record. A spill contingency plan is provided in Appendix E.

7.7.2 Unauthorized Discharges

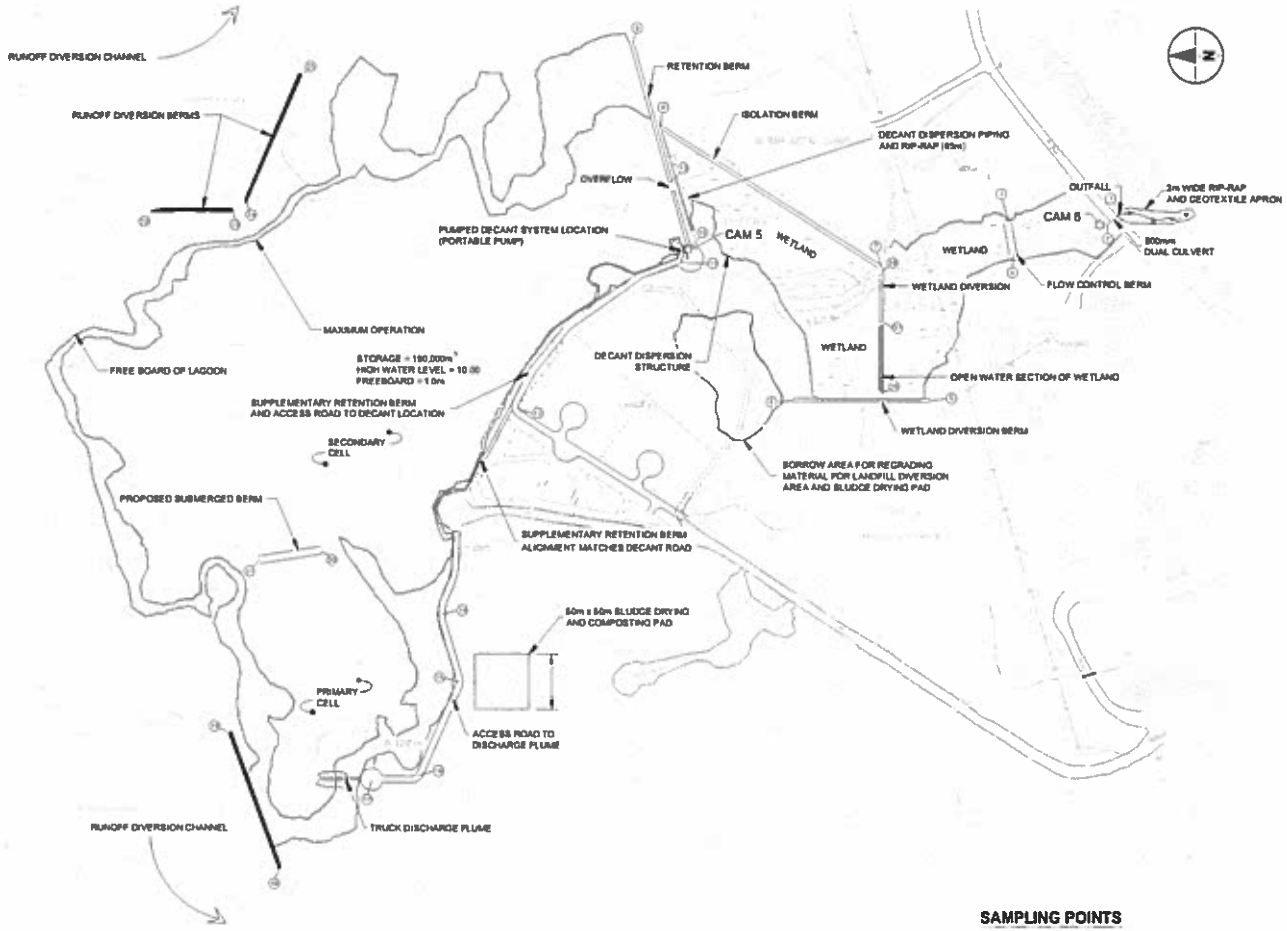
Unauthorized waste found at the site shall be documented in the annual report, along with a description of corrective action taken. Unauthorized liquid discharges (meaning wastewater not discharged at the truck dump) shall be documented at the time of occurrence using the Incident/Near Miss Form (Appendix H)

7.8 Wildlife

The presence of bears or other animals at the site shall be reported to the MSM and to the Department of Environment Conservation's Office at (867) 983-4164.

7.9 Geotechnical Inspection

A Geotechnical (or otherwise approved by the NWB) Engineer shall inspect all engineered facilities annually in July or August, and the engineer's report shall be submitted to the NWB within sixty days of the inspection. With the engineer's report, the Hamlet shall provide a covering letter outlining an implementation plan for each of the engineer's recommendations.



LEGEND

- EDGE OF ROAD (ELEV 10.0m)
- DRAINAGE ROUTE
- RIP-RAP
- SEWAGE LAGOON/WETLAND BERM
- RUNOFF DIVERSION BERM
- OPEN WATER SECTION OF WETLAND
- FREE BOARD
- MAX OPERATION WATER LEVEL
- OPEN WATER SECTION

NOTES:

ELEVATIONS ARE EXPRESSED in METER OR DECIMALS THEREOF

SAMPLING POINTS

SAMPLING LOCATION	DESCRIPTION
CAM 4	EFFLUENT FROM MODIFIED SOLID WASTE DISPOSAL FACILITIES BEING DISCHARGED TO THE RETENTION SEWAGE LAGOON
CAM 5	FINAL DISCHARGE POINT FOR EFFLUENT FROM THE RETENTION SEWAGE LAGOON TO THE SEWAGE WETLAND
CAM 6	OUTFALL AREA FOR THE SEWAGE WETLAND

BERM LOCATION POINTS

BERM POINTS	NORTHING	EASTING
1	7067953.67	498929.34
2	7067964.75	498917.18
3	7068038.83	498918.56
4	7068050.79	498899.67
5	7068126.82	498757.16
6	7068232.18	498757.16
7	7068170.48	498678.77
8	7068372.90	498606.78
9	7068397.97	498582.42
10	7068347.00	498696.03
11	7068357.13	498883.20
12	7068305.96	498746.79
13	7068363.63	498656.63
14	7068573.61	498580.78
15	7068557.39	498499.29
16	7068907.34	498411.68
17	7068636.10	498410.28
18	7068722.31	498329.18
19	7068707.58	498452.94
20	7068684.04	498619.15
21	7068740.07	498610.20
22	7068636.17	498930.79
23	7068784.43	498930.23
24	7068752.28	498638.83
25	7068722.41	498664.24
26	7068171.72	498764.31
27	7068171.12	498629.37
28	7068170.48	498678.77
29	7067936.60	498915.42
30	7067970.64	498901.51

8. Annual Inspection

In addition to the Geotechnical Inspection of engineered facilities described in Section 7.9, the MSM (with the assistance of the Lagoon Operator) shall conduct an annual inspection of the Lagoon Facility; the Hamlet may opt to have this inspection carried out by a Professional Engineer or inspector who is experienced in lagoon construction and management. The results of the inspection shall be documented. The Hamlet shall remedy any parts of the infrastructure or operation which are not in accordance with the O&M Plan and/or the requirements of the Water License.

8.1 Site Inspection

The site inspection shall be conducted at the same time as the annual geotechnical inspection required by the NWB.

A visual examination of the site shall be carried out to verify:

- Condition of all components (including the berms)
- Remaining capacity in relation to design life expectancy of the facility
- Condition of infrastructure and equipment (including signs, roads, drainage system, truck discharge)
- General site management and operation (including litter control, condition of the cells, etc.)

8.2 Review of Records

A review of the daily and weekly logs and monthly and annual reports shall also be carried out to evaluate:

- Issues related to operations, spills, safety, fires, infractions, etc.
- Public complaints
- Quality of record keeping practices

If the Hamlet wishes, it may carry out the annual review of records at the same time or immediately following the preparation of the annual report to the NWB.

9. Safety Plan

9.1 General

The Lagoon Operator(s) must make sure that all aspects of municipal sanitary sewage management are conducted safely. Site safety at the lagoon is coordinated through the Lagoon Operator. All operations are to be conducted with safety as a priority at all times and in accordance with the Safe Work Policy. Possible contamination or infection from pathogenic microorganisms exists with every contact with the sanitary sewage.

General public access to the lagoon area should be discouraged. Possible contamination or infection from pathogenic organisms exists with every contact with the sanitary sewage. This area should not be used for recreational activities.

Equipment and any other structures should be kept clean. This reduces safety hazards and protects the equipment.

Use of proper hand gloves, safety boots, safety vest, jacket, pants, safety eyewear and any primary safety tools are mandatory during sewage collection and disposal and lagoon operation. After work, before eating, and at other convenient times, the Lagoon Operator(s) should wash their hands thoroughly.

Caution should be used when working with sanitary sewage. If an operator is splashed accidentally with sewage, the area should be promptly washed with plenty of water. All cuts and skin abrasions should be treated immediately to prevent any infection.

Operators and personnel should remain attentive and aware of any potential health and safety hazards, such as tripping hazards; like debris or ice. When possible, hazards should be removed. Care should especially be taken when obtaining samples; gloves (nitrile - not latex) must be worn.

All employees shall:

- Receive the appropriate safety training
- Wear the appropriate personal safety equipment
- Not endanger themselves or others at any time
- Report unsafe practices
- Notify other employees or site users when they are acting in an unsafe manner

9.2 Lagoon Emergencies, Accidents and Near Misses

All **accidents, injuries,** or **near misses** should be reported to the Lagoon Operator, Municipal Services Manager and the appropriate safety official of the Hamlet of Cambridge Bay. For all **accidents, injuries,** or **near misses:**

- Investigate the incident immediately
- Find out the cause
- Make a complete accident report
- Take immediate measures to correct the cause and prevent it reoccurring
- Have a safety meeting with employees as soon as possible after the incident

During any lagoon emergency, the press will likely become aware and cover the story. The MSM or SAO will be the only spokespersons for the Hamlet of Cambridge Bay and/or Municipal Services / Public Works.

9.2.1 Accidents

All accidents at the lagoon shall be investigated and an Accident Report Form for the incident shall be completed. Traffic accidents occurring at the site shall be reported to the RCMP if applicable. Complete the form providing as many facts as possible; provide only the facts. Do not place blame or fault, and include the following information as required on the form:

- Who was involved?
- Which vehicles were involved?
- What were the personal injuries, if any?
- What property was damaged?
- Which agencies or individuals responded to the accident?
- Date, time, weather conditions, witnesses, and other pertinent information.

9.3 Medical Emergencies

All injuries, even minor ones, should be considered important and should be reported as a safety incident to the Lagoon Operator. Possible contamination or infection from pathogenic microorganisms exists with every contact with the sanitary sewage.

First Aid should be applied in a manner that is appropriate to the nature of the injury. If the injury requires medical assistance, the individual should be taken to a medical emergency centre.

A medical doctor should be consulted for all injuries that could result in infections as a result of working with sanitary sewage. This includes injuries such as cuts and scrapes, or skin punctures.

If the person injured on-site is a customer or visitor, Lagoon Operator's employees shall provide any assistance necessary and appropriate First Aid.

NOTE: FOR ALL MEDICAL EMERGENCY OCCURRENCES AN ACCIDENT/INCIDENT REPORT MUST BE COMPLETED AND FILED, WITH A COPY SENT TO THE HAMLET SAFETY OFFICIAL.

9.4 Personal Decontamination Procedures

In instances where workers accidentally come in contact with wastewater, the following procedures are to be followed. Normal preventative health care vaccinations should be kept up to date by all those working on the sewage lagoon system. Check with a physician as to the recommended vaccinations (usually includes typhoid and paratyphoid).

Skin Contact

- Wash thoroughly with soap and water. See a physician if any sign of irritation occurs.

Eye Contact

- Flush eye(s) with a gentle stream of water for 15 minutes (use eye wash station with distilled water). See physician, without exception.

Cuts and Abrasions

- All cuts and abrasions should be treated immediately to prevent possible contamination, regardless of whether actual contact with wastewater occurs.

9.5 Contacts

This section provides a list of those individuals to be contacted under various conditions. **NOTE: In all accidents that involve injuries and/or alcohol, call the RCMP.**

If an accident occurs on-site, contact:

- Lagoon Operator;
- Hamlet of Cambridge Bay safety official;
- Hamlet of Cambridge Bay – Municipal Services / Public Works;
- Any employees which may be impacted; and
- Nearby employees who are trained to respond to this type of emergency.

In case of injuries, contact:

- The nearest hospital/ambulance
- The RCMP (in case of fatality)
- Lagoon Operator
- Municipal Services Manager

9.6 Telephone Numbers

- Hamlet of Cambridge Bay Municipal Services / Public Works: (867) 983-4666 or (867) 983-4657
- Nunavut Department of Environment – Cambridge Bay Conservation Office: (867) 983-4164
- RCMP: (867) 983-0123
- Fire Department: (867) 983-4016
- Nursing Station: (867) 983-4500
- Hazardous Waste Spill 24 Hour Hotline: 1-867-920-8130

9.7 Staff Training

Additional considerations with regards to working around water and ice, and especially open water in cold environments are of critical importance. Lagoon Operations Staff should be trained in safety procedures for working around water as well as cold stress prevention.

The policies included in this manual and its appendices are not intended to be comprehensive and complete with regard to the Safety Plan, OH&S requirements, or Emergency Procedures.

The operator has the responsibility to make sure that all aspects of sewage waste management are conducted safely.

10. Fires

10.1 Fire Prevention

Fire risks at the Sewage Lagoon site are limited to those associated with the portable pumping equipment operation and fueling. Additional concerns arise from the fire risks at the landfill. In this case the Lagoon Operator shall defer the responsibility for emergency response to the MSW Landfill Operator and the MSW Emergency Response protocols.

NOTE: FOR ALL FIRE OCCURANCES AN INCIDENT REPORT MUST BE COMPLETED AND FILED, WITH A COPY SENT TO THE HAMLET SAFETY OFFICIAL

10.1.1 General Fire Response Procedures

All fires shall be treated as serious.

All fires shall be reported as an emergency situation. Should an emergency occur, employees shall report to the primary marshalling area. Should the primary marshalling area be inaccessible, employees shall report to the secondary marshalling area or alternate safe site as directed by the Lagoon Operator.

10.1.2 General Instructions

DO NOT PANIC. The greatest danger lies not in fighting the fire, but in the panic that arises from a fire. Spend a few minutes getting a handle on the situation. A landfill or vegetation fire will not travel fast, so a few minute delay is not going to make any difference to the outcome of the fire; a fuel fire associated with the decant pump is unlikely to expand beyond its available fuel source. Go through the steps to notify the appropriate authorities and follow the basic steps in the fire control plan, including:

- Contact other nearby employees including landfill employees
- Notify the Fire Department and tell them the location and type of fire and whether or not there is risk of the fire spreading out of the immediate area
- When the Fire Department arrives, follow their instructions
- Do not fight fire alone
- Do not place yourself or others in danger while fighting the fire

10.1.3 General Fire-Fighting Guidelines

In case of a fire at the lagoon, evacuate personnel and visitors as required and follow the protocols established in the MSW Emergency Response Plan. For fuel fires, see the next sections.

10.1.4 Small Contained Fires

- Do not attempt to fight a fire alone
- Secure the area and re-direct customers to a safe area
- Work with other site staff to extinguish the fire ONLY if safe to do so

If the fire becomes uncontained, follow the procedures identified below.

10.1.5 Uncontained Fires

- Do not attempt to fight the fire
- Follow evacuation procedures
- Call the Fire Department at (867) 983-4016

11. Emergency Response

11.1 Introduction

The lagoon emergency response plan sets out appropriate procedures to address foreseeable emergencies. In the event of an emergency, guidance and site emergency response can be obtained from the following sources:

Table 11-1: Emergency Contact Information

Emergency Contacts	Contact	Location	Telephone	Fax
AANDC	Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-8445
Hamlet of Cambridge Bay	SAO	Cambridge Bay	(867) 983-4658	(867) 983-2193
Government of Nunavut	Regional Engineer	Cambridge Bay	(867) 983-4156	(867) 983-4123
Environment Canada	Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	-	Cambridge Bay	(867) 983-4016	(867) 983-4003
RCMP	-	Cambridge Bay	(867) 983-0123	(867) 983-2498
Community Health Center	-	Cambridge Bay	(867) 983-4500	-

The key elements of this plan are:

1. What is the nature and severity of the emergency?
2. What is to be done?
3. Who does it?

As the lagoon and the Municipal Solid Waste Facilities share the same general site, emergencies at the landfill can also require emergency response at the Sewage Lagoon. Familiarity with the MSW Emergency Response Plan is considered a critical component of the Sewage Lagoon Emergency Response Plan. Emergency procedures outlined for the MSW Facility shall be followed where applicable for the Sewage Lagoon Facility (e.g. an evacuation event for the MSW Facility is also an evacuation event for the Sewage Lagoon).

The emergency response plan addresses the following items:

- Fires (Section 10)
- Accidents and Medical Emergencies (Sections 12.1, 12.2, 12.3)
- Environmental and Operations Contingencies (Section 12.4)

11.1.1 Emergency Plan Updates

Municipal Services / Public Works of the Hamlet of Cambridge Bay shall review the emergency plan annually and, following an emergency incident, ensure that:

- Emergency response procedures for the lagoon are effective and updated as necessary
- Appropriate individuals are appointed to manage emergency situations
- Regular safety and emergency meetings are held with lagoon employees

11.1.2 Emergency Organization

The key to success of the emergency plan is to have a responsible person in charge of an emergency situation. The Lagoon Operator is designated to have the primary responsibility to manage emergency situations at the lagoon. For emergencies originating at the MSW landfill, the Lagoon Operator will defer authority to the Landfill Operator, if these are different people.

The Lagoon Operator will have **complete authority** over the site for the duration of the emergency. To ensure an efficient and effective response to any emergency that may occur:

1. Operating personnel should obtain proper training,
2. Emergency response drills should occur regularly, and
3. The emergency response plan should continually be reviewed and updated

11.1.3 Lagoon Operator's Responsibilities in Case of Emergency

The Lagoon Operator's responsibilities include to:

- Declare the emergency
- Review and update the emergency response procedures at regular intervals
- Ensure that all emergency response procedures are appropriate
- Respond to all emergencies and contact appropriate emergency response agencies
- Establish and maintain control of the emergency situation prior to the arrival of appropriate emergency response agencies
- Direct personnel and any site visitors to either leave the site or proceed to a safe marshalling area
- Liaise with the emergency response representatives upon their arrival
- Complete necessary documentation with respect to emergencies

The Lagoon Operator shall report any emergency or contingency situation to the MSM. The MSM will contact the appropriate agency concerned to report the incidents; for example environmental or health and safety agencies.

11.1.4 Evacuation Procedures

In the event that an area of the lagoon must be evacuated due to an emergency, lagoon employees and site visitors shall be evacuated. Employees and site visitors shall exit the area and either leave the site or proceed to a designated marshalling area.

The marshalling area is to be designated for each emergency situation according to the nature of the emergency, the location of the emergency and the location of a safe exit route.

11.1.5 Marshalling Areas

Marshalling areas are:

1. Primary: Entry areas to the main landfill site, the Scrap Metal Dump, and the truck discharge, as well as Ovayuk Road.
2. Secondary: alternate areas designated by the Municipal Solid Waste Landfill Operator – should be designated based on prevailing wind direction

When the evacuation is complete, the Lagoon Operator shall proceed to the marshalling area.

The prime consideration for the Lagoon Operator is to ensure that all employees and visitors are safely evacuated from the Sewage Lagoon site. The Lagoon Operator shall:

- Await the arrival of emergency response personnel
- As required, establish perimeter security, conduct searches, and/or take other actions that may be warranted by specific circumstances

It is imperative that all employees and visitors remain at the marshalling area until the Lagoon / Landfill Operator gives permission to return to work areas or to leave the site.

12. Reference Guide

The following tables provide a quick reference guide describing how to prevent and respond to several potential contingency situations that may arise.

12.1 Minor Medical Injuries

Prevention

- Have an appropriate safety plan and procedures
- Provide employee safety and awareness training
- Provide First Aid training

Response Plan

Action	Time Frame	Who?	Resources
Apply appropriate First Aid	Immediately	First Aider	
Recommend that the injured person consult a physician	Immediately	First Aider	
Take the injured person to a medical emergency centre or contact an ambulance service if deemed appropriate	Immediately	First Aider	
Record injury in the daily report	To the end of the work day	Lagoon Operator	Lagoon Operator
Review cause of the injury and prepare appropriate mitigative measures	Within 1 month	Lagoon Operator MSM Hamlet safety official	Lagoon Operator Occupational Health and Safety

12.2 Serious Medical Injury

Prevention

- Have an appropriate safety plan and procedures
- Provide employee safety and awareness training
- Provide First Aid training

Response Plan

Action	Time Frame	Who?	Resources
Assess site conditions for personal safety and safety of others, and take appropriate actions to secure unsafe areas	Immediately	Lagoon Operator First Aiders	Lagoon Operator
Attend to the injured person and apply First Aid	Immediately when safe to do so	First Aider	
Contact: • Ambulance • MSM • Hamlet safety official	Immediately	First Aider Lagoon Operator	
Stay with the injured person until medical assistance arrives	Duration of medical emergency	First Aider	
Record injury in the daily report	By the end of the work day	Lagoon Operator or Designated Alternate	Lagoon Operator
Conduct an investigation to determine the cause of injury and prepare appropriate mitigative measures	Investigate immediately following the incident Complete mitigative measures within 1 month of the incident	Lagoon Operator MSM Hamlet safety official	Site Personnel Occupational Health and Safety

12.3 Vehicle or Equipment Accidents

All vehicle accidents should be reported and an investigation as to the cause should be carried out. Following the investigation, appropriate mitigative measure should be implemented if applicable to avoid future accidents.

Prevention

- Have an appropriate safety plan and procedures
- Provide employee safety and awareness training
- Post and maintain traffic control signs
- Vehicle spotting during heavy traffic situations (assisting vehicles with verbal instruction from outside of the vehicle)

Response Plan

Action	Time Frame	Who?	Resources
Report the accident to the Lagoon Operator	Immediately	All employees	
If damage is minor, have the vehicle driver report the accident to the RCMP	Immediately	Lagoon Operator	
If the damage is significant, call the RCMP	Immediately	Lagoon Operator	
If an injury is involved, call the Hamlet of Cambridge Bay Municipal Services / Public Works (867-983-2782 or 867-983-2183), and implement medical response actions	Immediately	Lagoon Operator	
Secure the area for a follow-up investigation	Immediately	Lagoon Operator	
Record the injury in the daily report	By the end of the work day	Lagoon Operator or Designated Alternate	Lagoon Operator
Conduct an investigation into the cause of the accident and prepare appropriate mitigative measures	Within 1 month of the accident	Lagoon Operator MSM RCMP Hamlet safety official	Occupational Health and Safety

12.4 Environmental and Operational Contingencies

Environmental and Operational contingencies may vary in nature and degree of seriousness. Therefore, actual situations will dictate the appropriate actions and responses that should be undertaken. Generally, the response plan includes the following steps:

- Secure and contain the problem
- Verify and validate the problem
- Investigate the cause and potential risk
- Assess appropriate corrective actions
- Implement the corrective action
- Review operation procedures and preventative measures

12.4.1 Notification

In the event of a non-compliant off-site release, the Lagoon Operator is to immediately contact the MSM and provide information on:

- The nature and status of the release
- Activities and corrective actions being undertaken

12.4.2 Documentation

All incidents and corrective measures undertaken will be documented and maintained in the operating record.

13. Reference Information

The preparation of this O & M manual is based upon the following information sources:

3. "Water License 3BM-CAM0914" for the Hamlet of Cambridge Bay, NU (effective April 30, 2009 and expiring on March 31, 2014)
4. "Guidelines for the Planning, Design, Operation and Maintenance of Wastewater Lagoon Systems in the Northwest Territories - Volume I: Planning and Design and Volume II: Operation and Maintenance", Department of Municipal and Community Affairs, Government of the Northwest Territories, November 1988
5. "Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories:, Department of Municipal and Community Affairs, Government of the Northwest Territories, October 1996