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Nunalingni Kavamatkunillu Pivikhaqautikkut
Department of Community and Government Services,
Ministère des Services communautaires et gouvernementaux
Technical Services Division
Iqaluit, Nunavut

Thomas G. Livingston, P.Eng.
Regional Municipal Planning Engineer
Ph: 867-983-4156 Fax: 867-983-4124

July 10, 2007

<u>Re: Response to Review of Application of Water License fo the Hamlet of Kugaaruk</u>

Phyllis Beaulieu
Nunavut Water Board
PO Box 119
Gjoa Haven, NU

Dear Ms. Beaulieu,

Enclosed is the response to your commentary to our original dated June 20, 2006 submission to the Nunavut Water Board for <u>that portion of the water license involving sewage discharge to inland habitat.</u> The former license # NWB3PEL9803 expired in 2003. The Department of Community and Government Services of the GN (CGS) understands that the NWB already has a great deal of background information that is not necessary to this application, and this extraneous information may give the appearance that there are inconsistencies. CGS wishes to make it clear that earlier versions of design options are to be considered as a normal part of the iterative engineering process (and our attempt at providing information on the application to the Board prior to the full application being made) – but should not be confused with the final design submission and application. For this reason, CGS requests that the information included herein supersedes all previously-received portions of this submission. Any information germane to the application is included herein.

It is important to note that Elwood Johnson, SAO of Kugaaruk, has apparently recently applied to the NWB for that portion of the water license having to do with fresh water withdrawal from the Kugajuk River (see Appendix G). If CGS can be of assistance in unifying the two portions of the license application, we will be glad to do so.

The lagoon in Kugaaruk has been under-capacity for years. Since it was first built, it has been prone to numerous failures. The original berms were un-engineered, and installed without appropriate consideration for structural stability, or construction techniques. The berms were originally placed on either bedrock or native soil using pit run granular sources without appropriate compaction. No provision was made for sealing the bedrock/berm interface or the bedrock/native soil interface. Nor was the berm lined, so seepage through the berm was continuous throughout the year. The lagoon was also undersized, and prone to overtopping. There was no provision to decant the lagoon, nor was there an overflow structure.

Please note that, at the request of CGS, Dillon Consulting had responded to the questions raised on the first application on February 26, 2007. Included in this were responses by AMEC Earth and Environmental, the geotechnical consultant involved in the project. However, at that time I had decided that more direction by the NWB and other regulatory agencies was necessary before I could authorize the release of Dillon's answers.

At the present time however, due to subsequent meetings with the newly-staffed administration of the Water Board and other agencies, I have a clearer idea of some of the perceived difficulties, and hopefully can address them in one document.

The appended design calls for the rehabilitation and improvement of the existing lagoon. The lagoon as it now exists cannot meet the community's current needs. The new system is designed to provide sufficient hydraulic capacity to provide for the hamlet's sewage requirements for up to 20 years. This will be a far better solution for the interim than what exists at present, and will gain the GN time to institute further field studies. At some point in the near future the GN will be in a position to build a larger lagoon at a different location if that is what is needed. In addition, the design addresses seven issues that are of concern to lagoon systems:

1. **Retention time capacity:** The Government of Nunavut had explored the idea of lining the entire lagoon – berm and floor. They had estimates from the contractor that were acceptable. However, when the actual quotation was prepared, the cost was almost three times the estimate – far beyond the reach of the budget allocation. Rather than cancel the contract, CGS has asked Dillon Consulting to provide a design that will accomplish the same goal of annual retention time, but at a price that is possible. The design that our consultants have produced calls for all berms to be lined with a geosynthetic clay liner (GCL). This liner will be keyed into the permafrost and bedrock to a depth of a minimum of two metres below existing ground – thus well below the active layer (0.9 to 1.5 m). The specifications for the GC liner are placed in Appendix I. A geotechnical engineer (AMEC) will supervise the installation of the liner trench and the installation of the liner. The design by Dillon Consulting, working with AMEC Earth and Environmental, will ensure 365 days of retention time, allowing an autumn decant.
2. **Berm slope stability:** AMEC Earth and Environmental has undertaken a finite element analysis of the berm under various failure scenarios, and has determined the berm, as designed, will have the following factors of safety:
   - Case 1: Modeled as if there were no water pressure within the soil. This can be viewed as similar to a lined berm, which would be impermeable. FS = 1.9
   - Case 2: Modeled as if a portion of the berm is frozen, but there is an active layer of permafrost on the downstream slope that thaws seasonally. FS = 1.8
   - Case 3: Modeled as if the berm might slide across the berm/native soil interface. FS = 3

   The GN has a contract in place to have Dillon provide full time inspection of the berm works. This includes testing of the berm material for proctor values and compactive effort.

3. **Capacity to meet community needs:** The rehabilitation will increase the capacity of the lagoon to meet the needs of the community over the next fifteen to twenty years. This will give the Government of Nunavut time to allocate sufficient funds in our Capital Plan to enable a completely new lagoon system at a location that is acceptable from engineering, economic, and culturo-societal points of view. During this time, further tests can be undertaken to better understand the area's surficial geology as well as the effluent quality from the improved lagoon/wetland system.

4. **Effluent quality:** Samples taken from various points in the lagoon and along the path of the effluent in early July and late August show that the lagoon, even in its present condition, is performing its job remarkably well, and is meeting the requirements of the license that expired in 2003. We are confident that the rehabilitated and improved lagoon will meet or exceed these values. On the basis of the improvements we are confident that the lagoon/wetland system will meet new values we are proposing of 45/45/10 (BOD/TSS/Ammonia-N).
5. **Monitoring:** While on site during construction, our consultants will be training staff of the hamlet in the proper procedure for taking effluent samples at the various sampling points we are proposing, as well as at the original PEL-3.
6. **QA/QC during construction:** During critical times in the construction process of the rehabilitated and improved lagoon we have budgeted for a professional engineer from Dillon Consulting and AMEC to be on site to ensure that the work is being done according to the specifications. The engineer will make sure that such aspects as compaction, berm slope, liner placement, liner key, and all other important aspects of the design be adhered to.
7. **O&M and Spill Contingency:** Furthermore, our consultants will prepare an O&M manual and a spill contingency plan for hamlet crews to follow during operation of the lagoon.

On June 26 CGS Project Officer Navjit Sidhu, P. Eng, put up posters around the hamlet of Kugaaruk indicating what the GN's plans were about the lagoon and giving his name and office number should anyone have any questions or concerns. This was also posted in Inuktitut. Samples of each language are placed in the Appendix.

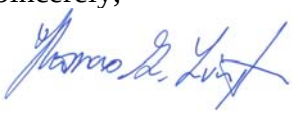
This submission is in two parts, with Appendices following each Part:

Part 1 is the Detailed Design Report prepared by our consultants, Dillon Consulting of Yellowknife. This includes all drawings and information that are necessary to understand the design of the rehabilitation and improvement.

Part 2 consists of the letter from the Nunavut Water Board to CGS dated November 14, 2006, within which is included the GN's and our consultants' answers. To provide continuity and clarity, the answers to questions1-3, in a different colour, are embedded in the text of the November 14 letter. In addition, four letters have been received by the NWB from three external review organizations. INAC (June 6, 2007) has sent two letters. Environment Canada sent a letter on June 7, 2007, and the GN Department of Environment sent a letter dated June 1, 2007. CGS has provided a response to the main points contained in these letters in Part 2 also. The letters are contained in Appendix J.

Should you require any further information, please contact me.

Sincerely,



Thomas G. Livingston, P.Eng.

cc: Canute Krejunark, Mayor of Kugaaruk
Navjit Sidhu, P.Eng, Project Officer
Gary Strong, P.Eng, Dillon Consulting Ltd.

PART I

Response to Review of Application of Water License for the Hamlet of Kugaaruk

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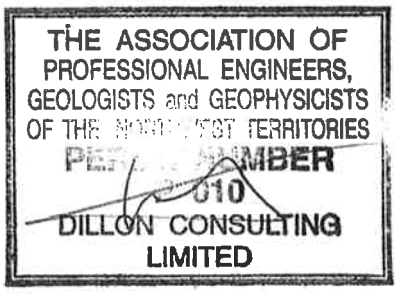
Sewage and Solid Waste Sites, Kugaaruk, NU

Detailed Design, Phase 2

July 2007



Sewage and Solid Waste Sites, Kugaaruk, NU

Public Works & Services, Government of Nunavut

GN Project Number 03-4305
GN Contract Number CT05-3800

Gary Strong, P. Eng - Project Manager

Submitted by
Dillon Consulting Limited

(In reply, please refer to)
Our File: 05-4755-3000

July 10, 2007

Government of Nunavut
Community and Government Services
2nd Floor, Enokhok Building
P.O. Bag 200, Cambridge Bay
NU X0B 0C0

Attention: Navjit Sidhu, BSc., P. Eng.

Detailed Design Report - Phase 2, Kugaaruk Sewage and Solid Waste Facilities Design

Dear Navjit:

Please find attached a copy of the Detailed Design Report for Phase II of the Kugaaruk Sewage & Solid Waste Facility project.

The following report presents the detailed design for the selected lagoon expansion option. Requirements for the application of a new water licence are also summarized.

If you have any questions regarding the information contained within the document, please don't hesitate to contact me.

Yours sincerely,

DILLON CONSULTING LIMITED

Gary Strong, P. Eng.
Project Manager

R:\PROJECTS\DRAFT\054755\Task 4000\Reports\Licencing Efforts During Construction\Submission July 2007\Phase 2 Design Report July 2007.doc

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EXECUTIVE SUMMARY

The Hamlet of Kugaaruk is responsible for the disposal of liquid and solid waste generated from community activities. These facilities are currently operating without a water license. The lagoon is undersized, and exfiltrates throughout the year. The level of exfiltration exceeds the levels that are acceptable to the Hamlet and the regulators. Further, in order to obtain a water licence through the Nunavut Water Board, improvements are required to the sewage lagoon and solid waste site. Upgrades on the sewage lagoon have gone out for tender while work on the improvement of the solid waste sites will follow in the next few years. This report describes the work that is planned for the sewage lagoon only.

The current sewage lagoon exfiltrates treated (primary) sewage into the wetlands below. Phase I of this project attempted to mend the breaches in the berms to allow the community to continue to use the sewage lagoon for another two to three years. The chosen solution involved raising the berm and spreading a layer of bentonite along the inside face of the berm to seal the gaps and cracks that had developed. Construction of Phase I began at the end of the summer in 2006.

Phase II recommended the rehabilitation (reconstruction and expansion) of the existing sewage lagoon to continue to meet the community's sewage treatment needs while the GN develops a longer term plan. The hydraulic capacity of the rehabilitated lagoon will meet the 20 year design based on the MACA model. The berms will be demolished and reconstructed using a synthetic liner and additional capacity will be added to the existing lagoon by blasting and re-contouring the existing topography in the lagoon. A new truck pad, decant system and drainage system are included in the design.

1.0 INTRODUCTION

Dillon Consulting Limited (Dillon) has been retained by the Department of Community and Government Services (CGS), Government of Nunavut, to design waste facility alternatives for the Hamlet of Kugaaruk – formerly known as Pelly Bay. This project has been divided into two phases, the first of which concentrated on achieving regulatory compliance with the existing sewage treatment facility for the immediate future. Phase one work was completed in the fall of 2005. The second phase concentrates on modification, planning, and design for the longer term solutions for the waste facilities. This document presents the tendered design of Phase 2 of the project as developed by Dillon Consulting, in collaboration with representatives from the Department of Community and Government Services.

The Hamlet of Kugaaruk is located 68.52° north latitude and 89.9° west longitude in central Nunavut. This places Kugaaruk along the east coast of Pelly Bay, which is roughly nine hundred and sixty kilometers (960 km) west of the capital of Iqaluit.

The annual snowfall in Kugaaruk is approximately 125 cm and the annual rainfall is approximately 11 cm. In January the daily mean temperatures is approximately -33^{0}C while in July the daily mean temperature is approximately 6^{0}C. Freeze up usually occurs during the month of November but may happen as early as September or October while spring thaw usually happens between late May and June.

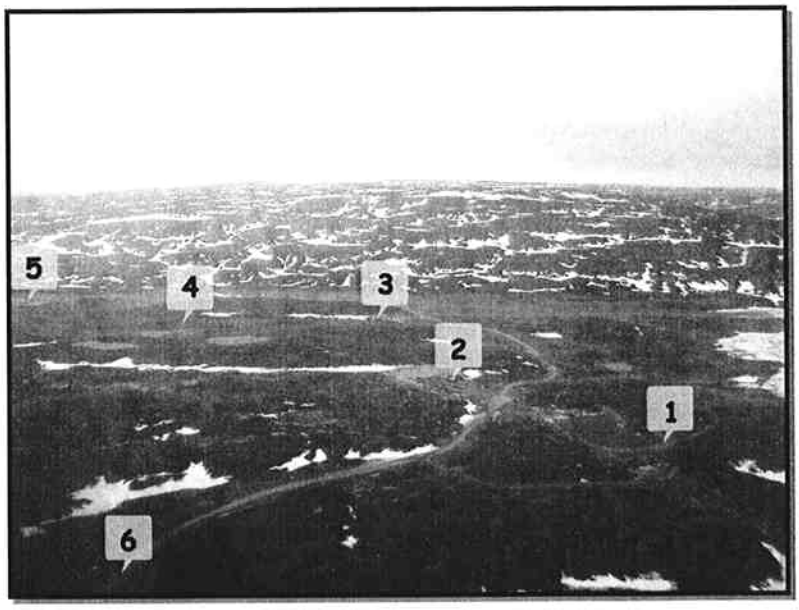

Figure 1.1 Aerial Image of Project Area

1. Sewage Treatment Lagoons and Wetlands, 2. Solid Waste Landfill, 3. Bulk Metal/Hazardous Waste Storage, 4.Area up-gradient of Bulky metal site, 5. Existing Landfarm, 6. Road heading back towards Community.

The community uses trucked services for both water delivery and sewage collection. The Hamlet continues to use a two cell sewage lagoon system that began operation about 14 years ago. The original lagoon was designed as a single cell. The second cell was only constructed later as an ad hoc addition to the system by hamlet crews and does not have much capacity. The system developed leaks and attempts were made to reinforce the berms surrounding the cells in the

summer of 2004. Subsequent to the repairs, the leaking was reduced however the effluent continues to leak from the system at an elevated rate. Dillon Consulting made an initial site visit to the community in July 2005 to assess the breaches in the lagoon berms and to test the quality of the effluent being discharged into the ocean.

Phase 2 of the project is the improvement and rehabilitation of the existing sewage lagoon system, the improvement of the existing solid waste site to a modified sanitary landfill site and the treatment of the bulk metal disposal area. Currently, none of the existing above mentioned facilities is licensed as the Hamlet's previous water license expired on November 1, 1998.

2.0 BACKGROUND

2.1 SCOPE OF WORK

Phase 2 of the project focused on developing a long term solution to eliminate seepage from the sewage lagoon system, increasing capacity of the sewage lagoon system to accommodate the community's sewage disposal needs for the next 20 years, the improvement of the existing solid waste site to a modified sanitary landfill site and the treatment of the bulk metal disposal area.

The reconstructed sewage lagoon facility will consist of a primary storage lagoon with annual discharge of effluent into nearby receiving marine waters. The expansion to the existing sewage lagoon was designed to meet community demand and anticipated effluent standards over the next 5 to 10 years, and will be designed to have a hydraulic retention for the next 20 years.

Suggestions were made for the improvement and upgrade of the existing solid waste facility to allow the current facility to continue to meet the community's solid waste needs over the next 20 years. Similarly, the existing bulk metals facility was examined and suggestions were made to improve operations.

The tender documents for the construction and/or upgrades required for each of the facilities has been prepared and execution of the contract will be carried out in a phased approach with an initial focus on the upgrade of the sewage lagoon. The sewage lagoon will be upgraded to be able to meet the requirements for the application of a new water license that will regulate it. Amendments to the water licence for regulation of the solid waste site and bulky metals site will be carried out at a later date. This design report describes in detail, the design upon which the tender documents were based.

3.0 SEWAGE LAGOON

The Kugaaruk sewage lagoon functions as a facultative lagoon, allowing both aerobic and anaerobic digestion to take place. Generally, these types of lagoons perform well for smaller communities, providing up to 99% removal of coliforms, between 85 and 95% removal of BOD and between 85 and 95% removal of total suspended solids (FSC/INAC, 2003). Sewage is deposited for annual retention and effluent currently meets effluent quality criteria. The following section describes the design considerations for the re-constructed sewage lagoon.

3.1 DESIGN CRITERIA

The Hamlet of Kugaaruk has experienced steady community growth over the latter part of the twentieth century. This growth will naturally continue and must be considered during the design process. The following section outlines a population projection calculated using data from Nunavut Bureau of Statistics and Statistics Canada.

The new sewage treatment system will be designed for a hydraulic loading for the next 20 year life span (2008-2028 Phase II Projection). In order to do so, the sewage generation rates per capita and the population of Kugaaruk for the year 2028 were determined. Predicted population values until the year 2020 were provided by Nunavut Bureau of Statistics (Appendix B). Population values beyond 2020 were predicted using the same growth rate as previous years (20 persons per year), and using a percentage growth rate (2.6%) as illustrated in Figure 3.1. The population for 2028 was predicted to be 1127 persons.

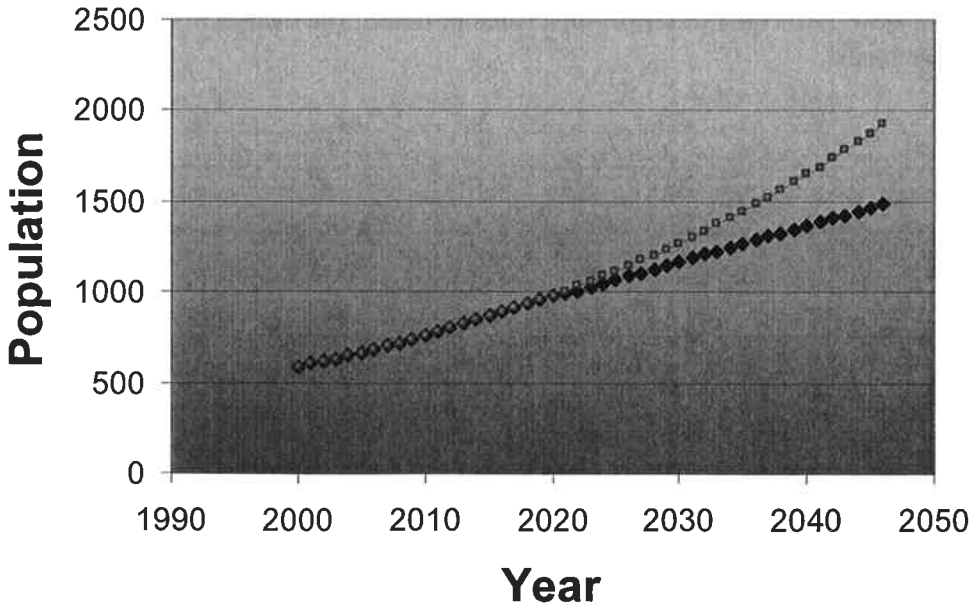

Figure 3.1 Population Growth in Kugaaruk

Data prior 2021 was provided by
Nunavut Bureau of Statistics and data proceeding 2021 was predicted.
Dark blue data points indicate data calculated using a growth rate of
20 persons per year. Red data points indicate data calculated
using a percentage growth rate of 2.6%.

For communities with trucked sewage collection, the amount of sewage generated can be assumed equal to the amount of water consumed. The following formula (Department of Municipal and Community Affairs, Government of the Northwest Territories) is generally used to predict water consumption in Northern communities:

$$Water\ Usage\ (l/c/d) = 90\ l/c/d \times (1.0 + 0.00023 \times population) \quad [1]$$

Based on this information, the lagoon will be designed to treat 46 600 m^3, the annual sewage volume for a population of 1127 persons. Table 3.1 shows the calculated sewage generation for years 2006 – 2028.

Table 3.1 Predicted Sewage Generation 2008-2028

Year	Population	MACA Predicted Sewage Production (L)	MACA Predicted Sewage Production (m3)
2006	682	25917944	25918
2007	701	26740630	26741
2008	719	27525049	27525
2009	737	28314363	28314
2010	756	29152840	29153
2011	779	30175137	30175
2012	802	31205428	31205
2013	823	32153109	32153
2014	844	33107455	33107
2015	867	34160336	34160
2016	889	35174920	35175
2017	911	36196818	36197
2018	934	37272986	37273
2019	957	38357147	38357
2020	979	39401651	39402
2021	987	39779893	39780
2022	1007	40735733	40736
2023	1027	41697587	41698
2024	1047	42665455	42665
2025	1067	43639337	43639
2026	1087	44619232	44619
2027	1107	45605140	45605
2028	1127	46597062	46597

There are currently no existing municipal wastewater guidelines for the Territory of Nunavut. Effluent quality criteria as listed in the *Guidelines for the Discharge of Treated Municipal*

Wastewater in the Northwest Territories (NWT Water Board, 1992) are as follows for wastewater flow that is less than 150 liters per capita per day into a bay of a marine environment:

BOD – 100mg/L
Suspended Solids – 120 mg/L

There are currently no guidelines for ammonia concentration in municipal wastewater in Nunavut. Also, regarding fecal coliforms, "In the case of an open, well flushed marine bay or fjord, bacteriological standards will be of concern only where the discharge might affect a fishery (including shellfish harvesting) or water contact recreation". (NWT Water Board, 1992)

The waters exiting the Kugaaruk sewage lagoon were tested at various locations between the sewage lagoon and the ocean during a site visit in June 2005 as well as by the Government of Nunavut in August 2006. Effluent quality satisfied the above mentioned criteria on both occasions, indicating that treatment at the sewage lagoon is sufficient. The lab results can be found in Appendix C.

3.2 DESIGN OUTLINE

The selected option is intended to provide a long term solution for the community's sewage needs. It involves demolishing the existing berm walls and reconstructing them with an embedded liner to eliminate the seepage currently occurring out of the existing system, as well as blasting rock out of the centre of the lagoon area to substantially increase the capacity of the lagoon and to allow it to continue to meet the community's projected hydrualic volumes for the next 20 years.

The blasted area in the floor of the lagoon will be offset 5 meters from the interior base of the berms and will continue to a specified depth at a slope of 1:12. The rock removal area is shown on drawing 101 in Appendix A.

3.3 CELL GEOMETRY

In order to promote plug flow conditions and to avoid short-circuiting of raw sewage, the storage lagoon will be constructed with an approximate rectangular shape given the existing topography consisting of natural rock outcrops on site. Raw sewage will be discharged from the sewage trucks at one end and treated effluent will be decanted from the lagoon at the opposite end. The berms will be built up with 3:1 slopes on both the inside and outside faces with a 4m roadway running along the top of the berm for access to the lagoon and decant systems.

A synthetic liner will be installed below the inside face of the berms and keyed into the bedrock below to create an impermeable barrier so that no seepage may occur. Details on the liner and installation can be found in the tender drawings in Appendix A and in the specifications.

3.3.1 Drainage Swale

The drainage swale will be a trench that will run approximately 1m from the toe of the berm around the outside perimeter of the new sewage lagoon to collect and direct runoff from the berms to the overflow area for collection and sampling purposes. The drainage swale will be field engineered.

3.3.2 Overflow Weir

The emergency overflow weir on the new sewage lagoon will be similar in design to the overflow flume that was installed in the existing sewage lagoon. It serves to provide an outlet for effluent should lagoon levels exceed berm height. It involves a weir lined with synthetic liner followed by rip rap running along the top of the berm and continuing down the outside of the berm to the riprap field in the receiving environment below. Details of the overflow flume can be found on tender drawing 200 in Appendix A.

3.3.3 Discharge Flume

The discharge flume will be located at the end of the truck turnaround pad at the entrance to the sewage lagoon. The sewage truck will use the discharge flume to deposit raw sewage into the lagoon from the truck pad. There will be a treated lumber wheel stop and bollards at the edge of the pad to prevent the truck from backing into the sewage lagoon. From the truck pad, the offload chute consisting of two 800mm diameter nestable culverts will run down the inside slope of the berm to the rip rap field at the bottom of the lagoon. Details of the discharge flume and truck pad can be found on drawing 200 in Appendix A.

3.3.4 Decant System

The decant system will be located at the opposite end of the lagoon to the truck turnaround pad and discharge flume. The lagoon will be annually discharged by emptying effluent into the receiving environment from the discharge end of the lagoon using a 300mm diameter HDPE pipe embedded at the base of the berm. Details of the lagoon drainage outfall system can be found on drawing 201 in Appendix A.

The effluent path from the lagoon to the ocean will remain the same as the existing system. It will run through a short wetland area and then directly into the ocean. The effluent path will be enhanced through the installation of shallow berms and swales to improve retention time and enhance treatment.

3.4 SPILL CONTINGENCY PLAN

Possible sources for sewage spills in Kugaaruk are the sewage trucks, sewage holding tanks in a home or community building, or through a breach of the sewage lagoon walls. In the event of a sewage spill, the personal safety of those involved should be considered first. The source of the spill should be identified and if safe to do so, the source should be shut off or plugged. The area

should be secured so that no vehicles or persons may enter and if safe to do so, the spill should be contained so that it does not spread. The appropriate authorities should then be notified to activate the Spill Recovery Plan and to notify all relevant government departments. They will then proceed with spill containment and collection, preferably using the back-up sewage truck and a loader and all contaminated materials will be disposed of in the soil landfarm. The spill contact area will be treated with lime and covered with soil.

Contact: Earle Baddaloo
Director, Environmental Protection (Iqaluit)
Environmental Protection Service
Department of Sustainable Development
Government of Nunavut
PO Box 1000, Station 1195
Iqaluit, Nunavut X0A 0H0
(867) 975-5900

A full Spill Contingency Plan will be included in the Operations and Maintenance Manual once the new site is complete. A sample Table of Contents for the Spill Contingency Plan can be found in Appendix D.

3.5 LANDFARM

The sludge from the sewage lagoon will need to be collected approximately every five years. It should be treated in a landfarm either within the solid waste facility site or at another designated location.

The landfarm is planned to be designed and constructed as part of the new municipal solid waste facility expansion.

3.6 PACKAGE SEWAGE TREATMENT PLANT

A temporary sewage treatment system will be required to temporarily service the community during construction in the summer. The system will be able to provide the same or better effluent quality as the sewage lagoon and will be discharging along the same effluent path as the existing lagoon; over wetlands to the ocean so there should be no impact to freshwater sources in the area.

The system will use the lower cell of the existing lagoon system. Part of the cell will have a bubble aeration system installed. The aerated cell will have approximately 2 day retention time. The aerated cell will be followed with a 2 day retention cell with no aeration. Decant will occur from the non aerated cell. Trucked sewage will be discharged into the aerated cell. Aeration will occur 12 hours per day.

3.7 MONITORING PROGRAM

3.7.1 Operations

To ensure that construction accomplishes the desired goal, an ongoing sampling program should be implemented. This program was developed and implemented during the first phase of the project with longer term ongoing sampling projected for the second phase of the project. As recommended in the terms of reference issued by CGS and Dillon, a local member of the community will be trained on the proper operation and procedure methods used in a sound sampling program. This includes quality and safety training that will ensure the highest quality data.

3.7.2 Analysis

All samples will undergo the same analysis to ensure that seepage is minimized and aeration is occurring throughout the flow path of the wetlands. Once collected, the samples will be shipped and will undergo the same analysis. This includes the following tests;

- Biochemical Oxygen Demand (BOD_5)
- Fecal Coliforms
- Total Suspended Solids (TSS)
- Ammonia

3.7.3 Sample Points

Sample collection locations will follow practice and locations used during the initial site visit. It is critical from a quality perspective that sample collection be performed from an area of lower concentration to an area of higher concentration of contaminants; therefore, a sample will be collected in the following locations respectively;

1st. Ocean Outfall – This includes a moderate flowing location near the end of the existing wetlands.

2nd. Mid slope of Wetlands – One of the few ponding areas near the midpoint of the wetlands.

3rd. Base of Lower Berm – Any point below the lower lagoon's berm that will give a good indication of filtration when compared to upstream samples.

4th. Lower Lagoon – Similar to the base of the lower berm sample, this point will give a good indication of filtration when compared with the upper lagoon's results.

5th. Two Locations within Upper Lagoon – These two samples can be collected from the north and south end of the lagoon to ensure mixing is occurring.

3.7.4 Schedule and Cost

The samples will be collected and analyzed on a bi-monthly basis. With holding times for BOD and Coliform samples of forty-eight hours (48 hrs), it is important that scheduling of sampling

coincides with First Air Cargo's schedule. This includes flights at 15:25 on Tuesdays, Wednesdays, Fridays, Saturdays, and Sundays. All samples will be shipped to;

Enviro-Test Laboratories
Edmonton Office
Attn: Sample Receiving
9936-67th Avenue
Edmonton, AB T6E 0P5

Table 3.2 lists costs associated with the program's analysis.

Table 3.2 Lab Analysis Costs

Parameter	Analytical Cost*
BOD_5	$37.50
Fecal coliforms	$22.50
Total suspended solids	$13.50
Ammonia	$15.00
Disposal Fee per Sampling Location	$1.50

*Based on prices from Enviro-Test Laboratories in Edmonton.

For 6 samples, the total cost would be: $540 + GST + Shipping
Shipping Cost for cargo of this nature per shipment from Kugaaruk to Edmonton is approximately $150

For bi-monthly samples on all sample points during water flow season (May – October) and under ice samples on just two lagoon sites completed monthly (November – April) over 3 years, the total cost would be: $30,780 + GST

3.7.5 Equipment

Sample bottles and coolers will be sent to the community by Enviro-Test Laboratories. Proper Health and Safety equipment will include latex gloves for each sample location and rubber boots.

4.0 REFERENCES

FSC, 2003. Municipal and Community Affairs Guidelines for the Planning, Design, Operation and Maintenance of Modified Solid Waste Sites in the NWT, Report prepared Ferguson, Simek, Clark Engineers and Architects

FSC, 2003. Indian and Northern Affairs Canada Best Available Technology for Sewage Treatment in the North, Report prepared by Ferguson, Simek, Clark Engineers and Architects

GNWT, 1988. Municipal and Community Affairs Guidelines for the Planning, Design, Operation and Maintenance of Wastewater Lagoon Systems in the NWT (Volumes 1 and 2). Report prepared by G.W. Heinke, D.W. Smith and G. R. Finch

GNWT, Municipal and Community Affairs Guidelines for the Siting of Solid Waste Disposal Sites in the Vicinity of Community Airports in the NWT

Northwest Territories Water Board, 1992. Guidelines for the Discharge of Treated Municipal Wastewater in the NWT.