Detailed Design Report for the Improvement to the Sewage Lagoon and Solid Waste Disposal Facility The Hamlet of Kugluktuk, Nunavut

Prepared by

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File No: N-O 09755

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Government of Nunavut
Project Management Division
Department of Community and Government Services
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Attention: Mr. Navjit Sidhu, B.Sc., E.I.T.
Project Officer
Community and Government Services – Kitikmeot Region

Re: Detailed Design Report for the Improvement to the
Sewage Lagoon and Solid Waste Disposal Facility
Hamlet of Kugluktuk, Nunavut
File No. N-O 09755

Dear Mr. Sidhu,

Enclosed please find our submission of the Detailed Design Report for the above noted project. As requested, costs have been broken down into two stages as follows:

- **Stage 1** – removal of batteries, incineration of waste oil, and clean-up of the hazardous waste storage area

- **Stage 2** – Construction of sewage lagoon, solid waste disposal site (including landfill, bulk waste areas, and landfarm).

2.0 Application for a Water Board License

Once the Detailed Design has been approved by the Government of Nunavut (GN), Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) will prepare an application to the Water board for approval of the redesigned facilities.

3.0 Tender Preparation

Preparation of tender documents will proceed upon direction of the GN after review of the Detailed Design Report.

It is our understanding, the GN wishes to tender the project in one package, with Stage 1 and Stage 2 components identified to be carried out in difference years.

It is also our understanding, that the excavation transportation and stockpiling at the landfill of the contaminated soil from the pipeline area will be conducted as part of a different project.

If there are any questions or concerns, please do not hesitate to contact us.

Yours truly,

Nuna Burnside Engineering and Environmental Ltd.

James R. Walls, P.Geo. Gerry Popowich, P.Eng.

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1.0 Introduction

The Department of Community and Government Services, Government of Nunavut (GN-CGS) retained Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) to provide engineering services for the planning and design of sewage treatment and solid waste facilities for the Hamlet of Kugluktuk, Nunavut. The scope of work for the project was outlined in a proposal by Nuna Burnside entitled "Sewage and Solid Waste Facilities Design, Kugluktuk, Nunavut", dated September 2005. The proposal was prepared in response to a Request for Proposals issued by the Department of Community and Government Services of the Government of Nunavut, dated September 2005.

The purpose of this Detailed Design Report is to expand upon the selected alternatives outlined in the “Schematic Design for Improvements to the Sewage Lagoon and Solid Waste Disposal Facility” (December 2005) herein referred to as the Schematic Design Report. Upon acceptance by the GN-CGS, this Design Report, along with the Operations and Maintenance Plans for each of the facilities and the Canadian Environmental Assessment Act (CEAA) Screening Report included in the appendices, will be submitted for regulatory approvals. This Detailed Design Report and Design Drawings will also serve as the basis for the preparation of documents for the Tender of the construction phase.

1.1 Scope of Work

The scope of work outlined in the Nuna Burnside proposal, which was approved by the GN, include seven phases:

- Phase 1 – Project Initiation Phase
- Phase 2 – Preliminary Design
- Phase 3 – Detailed Design Phase
- Phase 4 – Construction Document Phase
- Phase 5 – Bidding or Negotiation Phase
- Phase 6 – Contract Administration and Construction Inspection Phase
- Phase 7 – Warranty Period/Post-Construction Monitoring.

This report details the work conducted to date, and provides the detailed design for the facilities (Phase 3 above).

1.2 Description of Selected Preferred Alternatives

A schematic design report was prepared for the Hamlet, which outlined options to improve the sewage disposal, and solid water disposal infrastructure that would meet the needs of the community over a 20-year planning period. The options and preferred alternative are discussed below:

1.2.1 Sewage Lagoon

The schematic design report concluded that the exiting lagoon and current operational methods are not currently causing a significant environmental impact, if the wetland area is considered part of the treatment facility. However, the existing facilities and operations are not in compliance with the Nunavut Water Board license and Territorial regulations.

A review of potential options included:

- Do nothing – not legal and environmental negligent
- Move the facility – costly and no compelling reason to move locations
- Upgrade the existing lagoon with a new larger lagoon, and incorporate the wetland treatment area as part of the treatment system – most cost effective and environmentally proactive option that will comply with Nunavut regulations.

1.2.2 Waste Disposal Facility

Landfill

An investigation of the existing municipal solid waste disposal area indicated it was not causing a significant environmental impact, but has only a few years capacity remaining at the current operational filling practice. There were also several aspects are out of compliance with the Water Board license. A review of potential options included:

- Do nothing – does not meet the Nunavut Water Board license requirements and Territorial regulations
- Move the site – expensive and no compelling reason to move site
- Expand and rehabilitate the existing site – most cost effective option to meet 20 year planning requirements in an environmentally proactive fashion in compliance with Nunavut regulations.

Bulky Materials Area

The Bulky Metals Area is not currently or expected to, cause a significant environmental impact. It is operating in compliance with Nunavut regulations. The growing site of the facility is a concern from a planning and aesthetics viewpoint. A review of potential options included:

- Nothing – a potentially viable option depending on the desires of the Hamlet site will continue to expand
- Move the facility – expensive and there is no completing reason to move
- Ship scrap out of Hamlet – prohibitively costly
- Bury some or all at the landfill – a cost effective, practical, and environmentally proactive solution in accordance with Nunavut regulations.

Waste Oil and Hazardous Materials Area

Hamlet staff have done a good job segregating waste oil and hazardous materials, and stockpiling them in a segregated area. The area is unsecured and open to unauthorized dumping. Although there is currently no evidence of a significant environmental impact, the site is very vulnerable to a spill and a potentially significant impact. The facility is not licensed or secured in accordance with regulations. The options evaluated included:

- Do nothing – not acceptable from a regulatory and environmental protection view point
- Move facility – moving wastes to a more secure facility is an excellent short term solution, but provides no long term solution
- Ship out of community – the simplest and most environmental sound option, but is not cost effective or necessary for all materials
- On site treatment – suitable for some materials such as waste oil and paint, but not suitable for other material such as batteries.

The most cost effective and environmentally proactive option in accordance with Nunavut regulations would be to:

- Incinerate oil and glycol in a waste oil incinerator
- Reuse and recycle waste paint, and dry out remainder, then landfill
- Ship waste batteries out of the Hamlet to a southern recycling facility.

To handle these wastes in the future, a Hazardous Waste Depot cost has been included in the rehabilitation of the landfill site. The facility would be operated within the controlled area of the Solid Waste Disposal Site and under the Nunavut Water Board license.

Contaminated Soil Stockpile

An investigation of the contaminated soil stockpile revealed that permafrost has re-aggraded into the pile. Sampling of near surface soil indicates low levels of petroleum hydrocarbons. The stockpile is not currently causing a significant environmental impact. The site is not controlled and not a licensed waste disposal site. Sample results indicate the soil would be acceptable as landfill cover. Options evaluated included:

- Do nothing – site is uncontrolled and not licensed
- Move the stockpile to another site – should only be moved once to its final destination
- Ship soil out of Hamlet – cost prohibitive and not necessary
- Move soil to landfill as cover material – cost effective environmentally proactive option that meets Nunavut regulations.

1.3 Outline of Detailed Design Report

Section 1 – Provides an introduction to the project, a description of the scope of work involved and briefly summarizes the selected preferred alternatives.

Section 2 – Summarizes the pertinent background information from previous reports, provides a description of the community, discusses historical climate data, presents historical and projected population data, defines common design criteria for the three facilities, and discusses the agency review process.

Section 3 – Outlines the existing sewage storage and treatment system with a summary of its condition based on the site assessments. Furthermore, this section presents the anticipated effluent discharge criteria, and the treated effluent parameters prior to discharge from the lagoon. Section 3 also describes the details of an additional sewage lagoon and the concept of including a wetland area that provides both storage and some treatment of the sewage.

Section 4 – Provides a synopsis of the existing solid waste management facilities and identifies current deficiencies. The section also presents the design details of the selected preferred alternative for solid waste management.

Section 5 – Presents the Class 'B' estimates for the capital costs associated with constructing the three facilities.

Section 6 – Provides a summary of the environmental screening process and of the outcome.

It is important to note that throughout the main report there are design drawings that provide a general overview of location and characteristics of the proposed design of the preferred alternatives related to the existing infrastructure. Larger detailed design drawings of each facility including typical details also accompany this report. Furthermore, the appendices to this report provide detailed design calculations, as well as the Operation and Maintenance Plans for the proposed facilities, which include:

- Environmental Emergency Contingency Plan
- Quality Assurance/Quality Control Monitoring Plan.

2.0 Background Information

2.1 Previous Reports

The following is a list of background information that was reviewed as part of the preparation of the Detailed Design Report.

Schematic Design Report – completed by Nuna Burnside Engineering and Environmental Ltd. in December 2005. This study established population projections and the corresponding servicing capacity required for this community. This report presented and evaluated several options that were considered for these facilities.

Water License (NWB3KUGO308) – provided by the Nunavut Water Board, stipulates the terms and conditions that the Hamlet must follow in the construction, monitoring, and operation and maintenance of the water supply and solid waste facility sewage infrastructure (Appendix A).

Inspection Reports – prepared by Indian and Northern Affairs Canada (INAC) assessing the current facilities and their compliance with the issued Water License along with any additional health and safety concerns that were observed. Reports for the following dates were available: October 29, 1996; December 1, 1998; December 1, 2002; August 26, 2002; August 3, 2003 and July 19, 2004.

2.2 Community Information

2.2.1 Location

The Hamlet of Kugluktuk (formerly known as Coppermine), is situated on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River, at latitude 67°49'N, longitude 115°06'W, as shown on Figure 1.

2.2.2 Existing Infrastructure and Facilities

Community infrastructure includes:

- A water treatment plant, which draws water from the Coppermine River and stores it for treatment
- Trucked water to holding tanks in each building
- A sewage lagoon which receives trucked sewage collected from holding tanks in each building
- Sewage treatment via an exfiltration lagoon to a wetland discharging north to the ocean

- A solid waste disposal facility, which includes a bulky metals disposal area, a contaminated soil pile, a waste oil and liquid waste storage area, and a battery and other materials storage area
- Several rock and sand quarries
- Diesel powered generators
- Two wind generators (one partially dismantled and the other currently off-line)
- Barge landing area.
- The Hamlet is predominately residential with a few small commercial establishments including a hotel, several construction contracting businesses, grocery store, and a variety of other small businesses. Hunting and fishing in the traditional manner is still a prime occupation for many of the inhabitants. Community buildings include a high school, an elementary school, arena, swimming pool, Hamlet office, public works yard, GN offices, and police station.

2.2.3 Climate Data

Kugluktuk is affected by Arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The mean annual air temperature is -12°C. Monthly averages range from -31°C in February to 10°C in July. Kugluktuk receives about 249 mm of precipitation per year, of which 134 mm falls as rain between June and September. Prevailing winds are from the east in summer and from the southwest in winter. The mean wind speed is approximately 15 km/hr. Climate details are included in Appendix B.

2.2.4 Population Data

The community has a population of approximately 1585, with an approximate 1.5 percent projected growth rate.

2.3 Geology and Morphology

2.3.1 Terrain

The ground surface consists of bedrock and glacial deposits. Boulder and cobbles cover some areas. Much of the surface is covered with turf consisting of various grasses, sedges, and moss underlain by a thin (10 cm to 30 cm) layer of topsoil and/or peat.

The land area around Kugluktuk is underlain by permafrost estimated at several hundreds of meters thick. There is no permafrost under major water bodies such as Coronation Gulf. A deep zone of non-permafrost probably exists as a talik beneath the Coppermine River. The depth of the active layer over most of the land area is dependent on vegetation cover, soil type, and moisture conditions. Test pitting in the vicinity of the sewage lagoon and landfill found the top of the permafrost in early October to be approximately 0.9 m below surface.

2.3.2 Bedrock Geology

Figure 3 displays the bedrock geology of Kugluktuk. The bedrock in the area consists of Proterozoic fine grained sedimentary and meta-sedimentary (shale) of the Rae Group. These have been intruded by the Coronation Sills, which are composed primarily of granular gabbro.

A northeast trending ridge of bedrock dominates the topography from Heart Lake to the mouth of the Coppermine River.

Both gabbro and shale have been quarried locally for construction materials.

2.3.3 Surficial Geology

Figure 4 displays the surficial geology of the Kugluktuk area. The area is dominated by the effects of isostatic rebound following the last glaciation, and deposits related to the discharge of the Coppermine River.

East of Kugluktuk (between the sewage lagoon and the ocean) is an area of raised beach ridges comprised of well sorted medium grained sand. More varied fine to coarse sediments are found in the Hamlet and along the west side of the Coppermine River. Sand is quarried at a pit located near the west end of the runway. Another area used for extraction of sandy construction material is located near the east end of the runway.

2.3.4 Local Geological Resources for Construction

As discussed elsewhere in this report, the evaluation of the sewage lagoon and solid waste facility included examining local sand pits and rock quarries. In addition, test pitting was conducted in the area of the facilities, as shown on Figure 5. Test pit logs are included in Appendix C. The results of the geotechnical analysis of selected soil samples are included in Appendix D.

The results of the test pitting and soil testing program indicates that there is approximately 1.0 m of surficial medium grained, well sorted sand overburden, that could be excavated to supply construction material in the immediate vicinity of the facilities. Very little coarse grained material or fine clay rich material was located locally. Local contractors indicate coarse aggregate is available from off shore islands, and must be trucked to the community during the winter from the Seven Mile Island quarry.

Approximately 10,000 m^3 of unsorted blast rock is stockpiled in the Gabro Quarry, approximately 300 m west of the Bulky Metals area, as shown on Figure 3. The quarry face is in good condition, and there is a huge remaining resource of rock, which could be blasted for production of coarse aggregate or rubble materials.

The well sorted medium sand overburden could be easily pushed into piles on berms using a bulldozer. Geotechnical assessment of the local medium grained sand would be

suitable for berm construction, provided it was densely compacted, remained unsaturated and protected from erosion. Compaction would need to be carried out using specialized equipment, and ongoing testing and monitoring or the placed materials would be required (refer to Appendix D.)

In summary, there appears to be sufficient geotechnical resources in the immediate proximity of the sewage lagoon and solid waste disposal facility, to meet expected construction needs providing the detailed design takes into account the nature of the local materials.

2.4 Design Criteria

Both facilities have common design criteria that must be satisfied when implementing improvements. The common criteria is as follows:

Population Projection – The upgrades to the facilities must meet the projected needs of the community for a 20 year design life following commissioning of the works (projected to be 2007).

Arctic Conditions – The facilities must be designed to operate in and withstand extreme cold temperatures and other harsh climatic conditions such as prolonged daylight during the summer months, which may degrade, installed liners.

Cost Effective – All designs must be cost effective to implement, both in terms of the capital and operation and maintenance costs.

Simplicity – The upgrades must be simple to operate yet effective.

Environmentally Sound – The proposed design solutions should reduce environmental impact and ideally enhance the conditions at the proposed sites and surrounding areas

2.5 Agency Review

As part of the approval process, it is our understanding the GN/Water Board would circulate the detailed design to the following agencies, if required:

- Indian and Northern Affairs Canada (INAC)
- Nunavut Water Board (NWB)
- Office of the Fire Marshall, Nunavut
- Department of Community and Government Services – Technical Services Division, Government of Nunavut.

The project also conforms to the requirements of the following regulatory agencies:

- Environment Canada (EC)
- Department of Fisheries and Oceans Canada (DFO).

A Water License is required by the Nunavut Water Board for the construction and operation of water, sewage, and solid waste facilities in the territory of Nunavut. The Hamlet is operating the facilities under the current water license NWB3KUGO308, which expires on November 30, 2008. The license includes requirements for regular sampling and reporting. The license also provides sewage quality criteria for the point of discharge.

3.0 Sewage Storage and Treatment Facility

3.1 Background

At present, the Hamlet of Kugluktuk operates a single-cell sewage lagoon with the effluent discharged to a natural wetland, which eventually discharges into the Coronation Gulf. This existing sewage lagoon is located approximately 4 km West South-West of the community (Schematic Design Report / Figure 2). It is accessed from the community by Coronation Drive, and is located out of sight of the community in close proximity to the solid waste landfill facility and the bulky metals disposal area. It is adjacent to the waste battery and waste oil storage area. There are no documented complaints of related odors from the lagoon.

Sewage is collected daily by a tanker truck from holding tanks located at the houses and occupied buildings, including the commercial and institutional buildings. The sewage is collected from the holding tanks via external discharge ports on the exterior wall of these building. The truck operated by two Hamlet staff transport the sewage to the lagoon and the operator discharges the sewage from the truck onto one of two culverts used as a spillway. The spillway is used to prevent bank erosion during discharge operation of the sewage into the lagoon.

Currently, the sewage is temporary contained within the lagoon, and discharges via a berm to a small intermittent stream along a natural meandering course over 1.5 km to Coronation Gulf. This stream traverses through a natural occurring wetland, which currently provides some level of treatment to the effluent being discharged from the lagoon.

The existing unlined lagoon was constructed in 2003 by Hamlet staff during a heavy equipment operator-training course. The lagoon area is approximately 60 m by 40 m with an approximate depth of 2 m. The estimated interior area is 2,324 m^2 and with a depth of 2.0 m, the volume is estimated to be 4,648 m^3. The lagoon is currently providing a high degree of solids retention, although during the Summer, there is rapid flow-through the berm (exfiltration). This is mainly due to the berm being constructed partially of rock. The water levels in the lagoon are therefore not significantly above the natural surface water level in the drainage stream. With this continued exfiltration the majority of the lagoon volume is unusable.

3.2 Existing Conditions

Decanting of the sewage lagoon is scheduled to occur at the end of the summer, just prior to freeze up. Effluent is to be discharged directly from the lagoon onto the ground at the other side of the lagoon berm. This is considered to be the point of discharge under the

Operating License. The only treatment provided for determining compliance with the Water Board guidelines takes place within the lagoon itself.

The current effluent quality criteria for sewage discharged by the Hamlet of Kugluktuk is prescribed in the Water License NWB3KUG0308 issued on November 20, 2003. The License expires on November 30, 2008. The effluent criteria as monitored at the lagoon discharge position is presented below in Table 3.

The Schematic Design Report evaluated three options:

- Do nothing
- Move the treatment facility to another location
- Upgrade the existing lagoon with a new larger lagoon, with the incorporation of the wetland treatment area.

These options were presented, discussed and analyzed in detail in the Schematic Design Report / Section 5.10.

The recommendation concluded that considering access, available land, site constraints, the remoteness of the present site to the community, availability of suitable soils, simplicity of operation and the anticipated costs, ***the community should continue to use a lagoon-based system for sewage treatment and consider a new lagoon to be constructed adjacent to the existing lagoon.***

Table 3: Nunavut Water Board Effluent Discharge Quality Criteria (As applied to the Hamlet of Kugluktuk)

Parameters	NWB License Limits (mg/L)
Biological Oxygen Demand (BOD)	120
Total Suspended Solids (TSS)	180
pH	6-9
Fecal Coliforms (FC)	1 x 10^6 C.F.U./ 100 ml
Oil and Grease	No visible sheen

3.3 Requirements for a Sewage Lagoon in Nunavut

The requirements for the design and operation of lagoons in Nunavut can be found in the following documents:

- G. W. Heinke, D. W. Smith and R. Gerard, 1990. *Guidelines for Disposal of Sewage in Coastal communities of the NWT*
- *Nunavut Water Board Guidelines for the Discharge of Treated Municipal Waste Water in the NWT*, 1992
- *Cold Regions Monograph*, 3rd Ed., 1992
- G.W. Heinke, D. W. Smith and R. Finch, 1998. *Guidelines for the Planning, Design and Operation and Maintenance of Sewage Lagoon Systems in the NWT*.

It should be noted that, although these documents were developed prior to the division of Nunavut from the North West Territories (NWT). These documents are generally accepted by the regulatory agencies in Nunavut.

3.4 Sewage Quantity and Projected Quality Generation Rates

In trucked service communities, it is normally assumed that the sewage generated is equivalent to the water consumption. Accordingly, the daily and annual sewage generation rates for the Hamlet of Kugluktuk are assumed to be equal to the water consumption rates.

As referenced previously, the Government of Nunavut has adopted the standards of the Government of the North West Territories (NWT) Department of Municipal and Community Affairs. The NWT has developed a standard for water consumption in communities of less than 2,000 residents on trucked services. This consumption rate can be estimated with the following formula:

Water Use (L/person/day) = 90 L/person/day x (1.0 + 0.00023 x population)

Where the factor 0.00023 multiplied by the population represents the commercial and industrial water use. The rate of 90 L/person/day is used, as recommended for a community of less than 2,000 people.

Based on the above criteria,. The projected annual volume of sewage generated at the end of 10 years (2016) is 101,578 m^3, while the 20-year (2026) annual volume is 126,113 m^3.

Table 4 provides a summary of the sewage generation rate for the Hamlet of Kugluktuk.

The design objective is to establish an appropriate design for the treatment of the sewage, the amount of sludge that will be produced and the concentration of the treated discharge. Table 5 summarizes the assumptions made in the calculations.

Table 4: Projected Sewage and Sludge Generation Rate for the Hamlet of Kugluktuk

Planning Year	Calendar Year	Total Population	Projected Sewage generation (lpcd)	Projected Volume (litres/day)	Projected Volume (litres/year)	Projected Sludge Volume (m^3/annum)	Cumulative Sludge Volume (m^3)	BOD (mg/l)	TSS (mg/l)	T-PO_4 (mg/l)	TKN (mg/l)	Faecal Coliforms (C.F.U./100ml)
0	2006	1585	136.5	216,281	78,942,629	28.9	28.9	329.8	351.8	16.9	87.9	6.96E+07
	2007	1618	137.2	222,012	81,034,472	29.5	58.4	328.0	349.8	16.8	87.5	6.92E+07
	2008	1653	138.0	228,145	83,273,074	30.2	88.6	326.0	347.8	16.7	86.9	6.88E+07
	2009	1686	138.8	233,980	85,402,593	30.8	119.4	324.3	345.9	16.6	86.5	6.85E+07
	2010	1720	139.6	240,043	87,615,768	31.4	150.8	322.4	343.9	16.5	86.0	6.81E+07
5	2011	1760	140.5	247,245	90,244,352	32.1	182.9	320.3	341.7	16.4	85.4	6.76E+07
	2012	1793	141.2	253,242	92,433,157	32.7	215.6	318.6	339.8	16.3	85.0	6.73E+07
	2013	1827	142.0	259,472	94,707,414	33.3	248.9	316.9	338.0	16.2	84.5	6.69E+07
	2014	1859	142.8	265,385	96,865,621	33.9	282.9	315.2	336.2	16.1	84.1	6.65E+07
	2015	1893	143.5	271,719	99,177,554	34.5	317.4	313.5	334.4	16.0	83.6	6.62E+07
10	2016	1928	144.3	278,295	101,577,760	35.2	352.6	311.8	332.5	15.9	83.1	6.58E+07
	2017	1965	145.2	285,308	104,137,484	35.9	388.5	309.9	330.6	15.8	82.6	6.54E+07
	2018	2000	146.0	292,000	106,580,000	36.5	425.0	308.2	328.8	15.8	82.2	6.51E+07
	2019	2041	146.9	299,911	109,467,392	37.2	462.2	306.2	326.7	15.7	81.7	6.47E+07
	2020	2076	147.7	306,725	111,954,570	37.9	500.1	304.6	324.9	15.6	81.2	6.43E+07
15	2021	2107	148.5	312,835	114,184,737	38.5	538.6	303.1	323.3	15.5	80.8	6.40E+07
	2022	2139	149.2	319,082	116,465,007	39.0	577.6	301.6	321.7	15.4	80.4	6.37E+07
	2023	2171	149.9	325,470	118,796,633	39.6	617.2	300.1	320.2	15.3	80.0	6.34E+07
	2024	2203	150.7	332,002	121,180,905	40.2	657.4	298.7	318.6	15.3	79.6	6.30E+07
	2025	2236	151.4	338,683	123,619,146	40.8	698.2	297.2	317.0	15.2	79.2	6.27E+07
20	2026	2270	152.2	345,514	126,112,716	41.4	739.7	295.6	315.4	15.1	78.8	6.24E+07
	2027	2304	153.0	352,501	128,663,012	42.0	781.7	294.1	313.7	15.0	78.4	6.21E+07
	2028	2339	153.8	359,648	131,271,469	42.7	824.4	292.6	312.1	15.0	78.0	6.18E+07
	2029	2374	154.6	366,958	133,939,561	43.3	867.7	291.1	310.5	14.9	77.6	6.15E+07
	2030	2409	155.4	374,435	136,668,802	44.0	911.7	289.6	308.9	14.8	77.2	6.11E+07
25	2031	2445	156.2	382,084	139,460,748	44.6	956.3	288.0	307.2	14.7	76.8	6.08E+07

Table 5: Assumptions for the Calculation of Effluent Concentrations of BOD, TSS, T-PO_4, TKN and Fecal Coliforms

Parameter	Generation Rate
Sludge Generation Rate	50 grams/person/day
BOD Generation Rate	45 grams/ person/day
TSS Generation Rate	48 grams/ person/day
Total-PO_4 Generation Rate	2.3 grams/ person/day
TKN Generation Rate	12 grams/ person/day
Fecal Coliform Generation Rate	9.50×10^{10} CFU/100 mL/ person/day

Based on these assumed parameters, the projected annual and cumulative sludge volumes and the design concentrations of Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Total phosphate (T-PO_4), Total Kjeldahl Nitrogen (TKN) and fecal coliforms (FC) in the lagoon effluent can be calculated, and are shown in Table 4.

3.5 Lagoon Storage Volumes Required

A lagoon with sufficient capacity to retain the estimated annual generated sewage volume for projected 20th year is required.

In addition to sewage generated by community from the Hamlet of Kugluktuk, the volume of precipitation and the rate of evaporation must also be considered in establishing the capacity of the lagoon. It may be assumed that water evaporates from a sewage lagoon at the same rate as from a lake. It is also assumed that sublimation rates, evaporation from a frozen surface, are not significant factors. The impact of runoff is not considered a factor, as the lagoon berms will be above grade.

The annual evaporation rate for the Hamlet of Kugluktuk is estimated at approximately 200 mm/year. Climate normal data from the Environment Canada website was obtained, indicating that the average annual precipitation for the Hamlet of Kugluktuk is 249.4 mm/year (Schematic Design Report - Appendix A). This net addition of approximately 49 mm/year of precipitation over the surface of the lagoon will contribute to the total volume requirement of the lagoon. With the proposed design of 223 m x 223 m lagoon, the surface area would be 49,729 m^2 and the net addition from precipitation would be 2,437 m^3/year. This volume needs to be accounted for in the lagoon design.

The volume of accumulated sludge must also be considered in determining the total storage. Calculations for the various years are presented in Table 4. The projected accumulated sludge volume at year 20 is approximately 740 m^3.

The total lagoon volume required in year 2026, with allowances for net precipitation and cumulative sludge accumulation over 20 years is:

Volume of sewage in year 20 (12 months retention)	126,113 m^3
Volume of accumulated sludge by year 20	740 m^3
Annual volume of precipitation	2,438 m^3
Total Volume Required (Rounded)	**129,291 m^3**

Volume available in existing lagoon 4,648 m^3

As the existing lagoon will not be operational in the future, there is no credit / zero volume to be added.

As a result the proposed new lagoon will be designed to contain:

Minimum Operational Volume of **129,873 m^3**

The dimensions of the proposed new lagoon:
223 m Length
223 m Width
4 m Total Depth
3 m Liquid Depth

The dimensions and layout of this proposed lagoon is shown in Figure 6.

3.6 Meeting Effluent Discharge Criteria

The following assessment is provided with regards to meeting the effluent criteria specified in the existing NWB license.

Two scenarios are considered. The first scenario looks at the quality of effluent that is expected when a new lagoon is commissioned. The second scenario considers the effluent quality at the end of the design period.

After the lagoon expansion is commissioned, the sewage generation is anticipated to be approximately 63 percent of the 20-year design flow, and therefore there will be a higher efficiency of treatment.

Table 6 compares a 70 percent reduction in the sewage characteristic parameters, based on published treatment efficiencies for similar systems. These values are compared to the

levels specified by the operating license. Based on these assumptions, additional treatment is warranted, particularly as the Fecal Coliforms (FC) show high values.

Table 6: Estimated Effluent Quality Assuming a 70 Percent Lagoon Carbon-Removal Efficiency (2006)

Regulatory Parameter	Raw Sewage (2006)	Expected Lagoon Effluent Quality (2006)	Expected Lagoon Effluent Quality Prior to Wetland Treatment with 70 Percent Carbon Removal	NWB License Limits
BOD (mg/L)	329.8	329.8	< 98.9	120
TSS (mg/L)	351.8	351.8	< 105.5	180
T-PO_4 (mg/L)	16.9	16.9	< 5.1	N/A
TKN (mg/L)	87.9	87.9	< 26.4	N/A
FC (CFU/dL)	6.96×10^7	6.96×10^7	$< 2.09 \times 10^7$	1×10^4

As the sewage volume increases, so will the depth of storage along with the volume of sludge accumulation within the lagoons. Treatment efficiencies will be correspondingly reduced. Conservatively, the rates of reduction for carbon-based parameters could be as low as 25 percent. Under these conditions, the effluent quality shown in Table 7 is expected.

Table 7: Estimated Effluent Quality Assuming a 25 Percent Lagoon Carbon-Removal Efficiency (2026)

Regulatory Parameter	Predicted Raw Sewage (2026)	Expected Lagoon Effluent Quality (2026)	NWB License Limits
BOD (mg/L)	295.6	< 221.7	120
TSS (mg/L)	315.4	< 236.6	180
T-PO_4 (mg/L)	15.1	< 11.33	N/A
TKN (mg/L)	78.8	< 59.1	N/A
FC (CFU/dL)	6.24×10^7	$< 4.68 \times 10^7$	1×10^4

In order to meet the Nunavut Water Board (NWB) licensing requirements, additional treatment is warranted. This can be provided by means of the wetland treatment area that exists between the proposed lagoon treatment system and the final outlet to Coronation Gulf.

It is anticipated that during the first few years into the 20-year period (Design period of 2006 to 2026), the wetland treatment area will evolve into an integrated and operating microbial and terrestrial plant environment capable of providing additional treatment with some decrease of effluent concentration and disinfection.

It is anticipated that this wetland treatment area will be capable of providing treatment to the concentrations shown in Table 8. The predictive model describing the assimilative capability of this wetland treatment area was developed by the Alberta Department of the Environment (ADE), and is illustrated in Schematic Design Report/Appendix E. The model accounts for a temperature correction to an average temperature of 5ºC, a conservative value.

Table 8: Estimated Wetland Treatment Area Effluent Quality at Final Discharge Point Compared to Nunavut Water Board License Limits and Anticipated Guidelines

Regulatory Parameter	Expected Lagoon Effluent Quality (2026)	NWB License Limits	Anticipated NWB Guidelines	Minimum Wetland Area Required to Meet Anticipated NWB Guidelines (ha)	Expected Effluent Quality from use of the 15 ha Wetland Treatment Area
BOD (mg/L)	<221.7	120	45	8.9	< 45
TSS (mg/L)	< 236.6	180	45	0.4	< 45
T-PO_4 (mg/L)	< 11.33	N/A	1	31.7	< 1
TKN (mg/L)	< 59.1	N/A	10	13.9	< 5
FC (CFU/dL)	< 4.68×10^7	1×10^4	2×10^2	26.4	< 2×10^2

The wetland area required to provide the level of treatment for the effluent to the anticipated Nunavut Water Board regulatory parameters, based on the predictive model developed by the ADE, are given in Table 8. It should be noted that the T-PO_4 reduction to meet the anticipated Nunavut Water Board Guideline levels requires a significantly greater wetland treatment area in comparison to other parameters of interest. Based on the above, the minimum wetland treatment area required is approximately 32 ha. The existing wetland area available at present is approximately 15 ha. This is comprised of the 10 ha located north of the existing lagoon, plus 5.1 ha located west of the discharge point of the proposed new lagoon.

For the potential future, there is the availability and use of 30 ha (29.9 ha) of wetland treatment area located further west of the proposed new lagoon that contains two streams/creeks flowing towards Coronation Gulf.

3.7 Preferred Design Alternative

The recommended strategy for design choice was described in the Schematic Design Report/Section 5.9.2.4.

The preferred design alternative to upgrade the current sewage treatment system for the Hamlet of Kugluktuk includes the development of a new sewage lagoon cell and the employment of the 15 ha wetland treatment areas.

The following section describes the design details of this recommended option and detailed calculations are provided in Appendix E.

3.8 Sewage Storage and Treatment System Detailed Design

3.8.1 Sewage Lagoon

The proposed lagoon cell will be sited immediately south southwest of the existing lagoon. The existing lagoon will be retained 'as is' and continue to be in operation until the new lagoon is constructed and in operation. A partial common berm will be shared between the two lagoon cells, as will the access road leading up to the present truck turnaround area at the existing sewage lagoon. This configuration will minimize the land use for road access and also construction requirements for the new cell.

In Appendix E (Detailed Design Calculations of New Sewage Lagoon), a description of the calculations to determine the capacity required in addition to the existing lagoon are provided. A lagoon with 129,873 m^3 usable volume capacity is required and this can be achieved with the following configuration:

- Length – 223 m
- Width – 223 m
- Total Depth (includes 1m freeboard) – 4 m
- Required free board allowance – 1 m
- Allowance for solids accumulation at bottom of lagoon – 0.3 m
- Entire base of lagoon is flat
- Slope of berms **inside** of lagoon – 3:1
- Slope of berms **outside** of lagoon – 3:1
  Outside berms to match the existing ground elevations as indicated on drawings.
- Top width of berm – 3.0 m.

The berms for this new lagoon cell will be constructed with the material excavated from site preparation. As part of the design analysis, the estimated volume of 'cut' and 'fill'

for the earthworks for the lagoon cell was minimized by establishing calculated bottom elevation and alignment of the sewage cell construction at the selected site.

Estimated volume of 'Cut '	–	99,684 m^3
Estimated volume of 'Fill '	–	97,233 m^3
Fill/Cut	–	97 percent

This should significantly reduce the amount of material to be imported from other locations. It should be noted that if there is a requirement for rock material during the construction stage, a rock quarry is located less than a kilometer to the east of this selected site.

The following Figures 7 and 8 provide details on the proposed new lagoon.

Figure 7 contain sections A-A, B-B and Detail C showing the lagoon floor, berms, slopes, swales and the outlet pipe.

Figure 8 contain several details such as the gate-valve on the discharge outlet chamber and associated galvanized hand-rail with removable safety chain , berm construction, overflow detail, etc.

This proposed new lagoon cell is to remain unlined except for the top and inside slopes of the berms.

3.8.2 Class B Cost Estimate

The dimensions and the berm requirements for a new sewage lagoon adjacent to the existing lagoon was calculated. A schematic layout is displayed on Figure 6, showing the location, orientation, and shape as part of the detailed design.

Class B costing will include constructing the lagoon, as shown on Figure 6, with the following details:

- Minor roadwork will be needed to reach the discharge point on the new lagoon. The existing access road leading to the existing sewage lagoon will be widened (westwards) which will also have a truck off-loading pad adjacent to the two culverts discharging into the new sewage lagoon
- The 3:1 interior side slopes will be covered with a 40 mm HDPE Arctic liner keyed into the permafrost at the base and draped over the top of the berm
- The purpose of the liner is to prevent exfiltration through the sand berms at least until permafrost has re-aggraded into the berms
- The liner will be held in place on the top of the berm by blast rock
- Blast rock will be used to armour the outside face of the berm
- The existing lagoon will remain in place and continue to have road access as the new lagoon is being constructed

- Approximately 1,000 linear metres of ditching will be constructed around the lagoon to divert surface water
- Fencing will be provided around the new sewage lagoon. The perimeter fence will be located on top of the berm, comprising of a galvanized chain-link fence at 1.8m high. Fence posts will be set approximately 3m apart with concrete footings set into the permafrost (at least 1.5m depth). There will be a gate at each of the discharge culverts, and both are located next to the truck off-loading pad
- No material fees for on site soil and locally obtained rock
- Excavation of overburden from the bottom interior footprint (set at 25.45m) will provide approx. 99,684 m^3 of 'cut' material. There is a requirement of approx. 97,233 m^3 of 'fill' volume. Approximately 950 linear metres of berm will be constructed
- Excess material (approximately 2451 m^3) could be used for landfill cover, road base or graded into the natural landscape
- Blast rock to hold the liner in place and armour the outside slope face of the berms will be placed 0.2 m deep.

Costs for the construction of the new lagoon are based on machine and material costs provided by local contractors. Machine time of \$20/m^3 is based on mobilizing a bulldozer and excavator and using other equipment currently available in the community. Main unit costs are shown below. Details are shown in Appendix I.

• Fencing		\$ 70,880
• Gates		\$ 4,000
• Granular 'A' & 'B' for truck pad and roads		\$ 33,750
• Discharge Flume – Support walls, piping, and valve		\$ 26,400
• Supply and place signage		\$ 5,000
• Exfiltration berm		\$ 2,400
• Site Construction	- Cut & Fill, contouring	\$ 500,000
	- Surface of lagoon berm	\$ 242,220
	- Road rerouting, transport of rock	\$ 250,000
• 40 mm HDPE Artic liner – min.19,965 m^2 @ \$40/m (Transport and installation)		\$ 798,600
Subtotal		**\$1,933,250**
Contingency (approximately 15 percent)		\$ 298,988
Total		**\$2,223,238**

The following cost was evaluated, but in our opinion it is not anticipated that this cost will be incurred:

If the entire lagoon was lined, the liner costs would increase significantly. At this point it is not anticipated it will be required. The costs for a 40 mm HDPE liner for the entire lagoon would be 60,000 m^2 @ \$40/ m^2 (installed) = \$2,400,000.

3.8.3 Lagoon Effluent Discharge

The effluent from the lagoons will be decanted each year as per the Operation and Maintenance Plan. The effluent will be decanted by gravity evenly across the adjacent tundra wetlands to create an expanded engineered wetland area for final polishing treatment of the discharged lagoon effluent as the flow meanders towards Coronation Gulf. The effluent control out of the lagoon will be via a gate-valve with a manual gear-actuator leading to the 300 mm diameter P. E. discharge pipe. The discharged effluent flows on to the rip-rap on filter-cloth located at the bottom of the outside slope.

3.8.4 Wetland Treatment Area and Exfiltration Berm

A wetland treatment area of at least 32 hectares (ha) has previously been described as an essential component of the proposed treatment system. Since a naturally occurring wetland already exists in the area, the intention is to allow the lagoon effluent to discharge over land in a sheet flow fashion and allow vegetation and other biological systems characteristic to wetland areas to develop. This is similar to the approach used by the existing lagoon system.

The wetland area will be achieved by the construction of an exfiltration berm made of native rock type material located just beyond the toe of the berm to the west side of the lagoon. At the toe of the slope of this exfilitration berm will be a 200 mm perforated drainage pipe capped on either ends. Note that the perforations will be spaced further apart where the piping connects into the outlet piping and closer together on either end. This is designed to achieve the desired sheet flow pattern and will enhance the treatment effectiveness of the wetland.

3.8.5 Tanker Truck Offloading Area, Road Access and Fencing

The truck off loading area will be reconstructed in order to allow the tanker trucks to back-up and discharge into the lagoon cell. A 3,000 mm diameter smooth-wall culvert will be cut into half lengthwise and laid down on the berm of the new lagoon cell to act as a spillway and prevent erosion of the berm during the off-loading of the trucks. There will be two spillways, approximately 5 meters apart, to provide access for two trucks at the same time.

The existing road leading to the present sewage lagoon will be used, but widened to 9 m at the approach to the off-loading location next to the spillways. The access road leading to Heart Lake which is located to the south-east of the proposed lagoon will be relocated further south for a length of approximately 240 m to provide a minimum distance of 30 m from one side of the sewage lagoon.

The entire perimeter of the lagoon site will be fenced with access gates at the truck off-loading point and the effluent discharge outlet. The fence will be chain-link, galvanized steel, 1.8 m high with approximately 3 m inter-post distance. The posts will be fixed in

concrete that reaches into the permafrost, estimated to be at a depth of approx. 1.5 m. The outlet pipe will be 300 mm diameter P.E. with flow-control via a gate-valve.

3.8.6 Site Drainage and Grading

The entire site will be re-graded to ensure that there is positive drainage away from the sewage lagoon. A cut off drainage trench will be constructed around the perimeter of the proposed lagoon cell to ensure the diversion of surface water around the site and minimize the potential for surface water from flowing into the sewage lagoon cell. Slopes are 3:1 to ensure that surface water does not enter into the lagoon with the exception of the truck discharge area. The natural drainage patterns will be utilized as much as possible in order to reduce the amount of excavation required in the existing ground. The elevation of the berms, particularly the two located to the south and east, will be increased to a minimum of 0.5 meters above the elevation of the existing ground in order to create a drainage pattern for all surface water run-offs coming from the access road. This will be done using excess material excavated from the construction of the lagoon.

3.8.7 Signage

This design also includes the provision of proper site signage. A sign will be posted at the entry to the facility indicating the following:

- Name of the Facility (i.e. Hamlet of Kugluktuk Sewage Treatment Facility)
- Trespassing Prohibited (i.e. “Danger - Keep Out’)
- Health Hazard
- Emergency Contact Information (Hamlet of Kugluktuk Operations Department, phone number, etc.).

Signs will be posted at appropriately spaced intervals along the perimeter of the proposed wetland treatment area. These signs will indicate the following:

- Name and Purpose of the Facility (i.e. Wetland Treatment Area)
- Trespassing Prohibited (i.e. “Danger - Keep Out’)
- Health Hazard
- Emergency Contact Information (Hamlet of Kugluktuk Operations Department, phone number, etc.).

Finally, a sign will be placed at the final discharge point of the sewage treatment facility. This will be at the location where sampling will occur in order to monitor the compliance of effluent from the sewage treatment system to the regulations imposed by the NWB water license. It is anticipated that the sign will included the following information:

- Name of Facility
- Surveillance Network Monitoring Program Location Code.

All signs will be in both English and Inuktitut, and will include the logos of the Hamlet of Kugluktuk and of the Government of Nunavut.

4.0 Solid Waste Disposal Facility

Solid waste in the Hamlet of Kugluktuk generally falls into the following catagories:

1. **Hazardous Wastes** – including batteries, waste oil, waste antifreeze, and other materials not suitable for landfilling

2. **Bulky Metals** – equipment machinery and metal materials no long deemed salvageable or recyclable by the Hamlet

3. **Municipal Solid Waste** – the remaining waste materials.

Currently facilities to dispose of these wastes consist of:

- The Solid Waste Disposal Facility, which includes
  - The Bulky Materials Disposal Area
  - Landfill

- A disposal area for hazardous wastes and contaminated soils located next to the sewage lagoon.

The location for these areas is shown on Figure 2.

The Solid Waste Disposal Facility has been in use for approximately 15 years, and currently operates under Water Board License NWB3KUGO308 issued November 20, 2003, which expires on November 30, 2008. A copy is included in Appendix A.

Solid waste disposal in Nunavut is regulated by the Nunavut Water Board. The following guidelines are applicable:

- Northwest Territories, Municipal and Community Affairs, "*Guidelines for the Planning, Design, Operations, and Maintenance of Modified Solid Waste Sites in the Northwest Territories*", dated April 2003

- Public Health Act, "*Consolidation of General Sanitation Regulations*", R.R.N.W.T., 1990.

Management of hazardous waste must be in accordance with:

- "*Environmental Guideline for General Management of Hazardous Waste in Nunavut*", Government of Nunavut, January 2002

- "*Environmental Guidelines for Waste Batteries*", Government of Nunavut, January 2002

- "*Environmental Guidelines for Waste Antifreeze*". Government of Nunavut, January 2002.

4.1 Landfill

4.1.1 Description

The existing landfill covers an area of approximately 1.2 ha. It is surrounded by a fenced enclosure with two un-gated access points off the road to the sewage lagoon. Fencing is approximately 1.5 m high and is of post and wire construction that is generally in good condition.

The landfill was developed on a slope, however, as filling progressed vertically, a tipping face gradually developed. The area containing waste is approximately 8,220 m^2 and the quantity of waste is estimated to be 12,330 m^3.

Currently, operations involve tipping the waste that arrives off a ramp into a 1.5 m deep pit. After being tipped, the waste is ignited and burnt. Residual materials and ash are subsequently crushed and pushed out of the pit to another area of the site by a loader on a regular basis. The waste is further compacted through the process of progressively pushing it with a loader and eventually incorporating into the working face.

Cover is applied irregularly and an inspection of the waste indicates cover materials (soil) may be only approximately 10 percent of the waste content. There is a lot of exposed waste visible at the surface and no cover material was stockpiled on site at the time of the site visit.

Hamlet staff indicated they had no significant problems with operating the area, and no concern about blown litter, scavengers, surface water flow, or other issues. They collect litter from the site perimeter occasionally, but reduce the chance for blown litter by keeping the waste in the pit and burning it regularly (daily).

With regards to these practices, we note the following issues:

- The area is reaching capacity and there is not sufficient space for additional filling;
- There is no mechanism to minimize the runoff of contaminated water from the area;
- Less cover is applied to the area than optimum; and
- Filling appears to be undertaken without an overall plan or strategy.

The current practice of burning the waste is not considered a good management practice, and is illegal in many parts of Canada. However, it is generally accepted in Nunavut[1]. Given the site conditions, most notably the climate and the potential for scavengers (i.e., bears) we understand the Hamlet's position that options other than burning are not practicable. Options could be supplied at a later time, if requested.

The preferred alternative involves site expansion, initial improvements of the site and overall improvements in the operational procedures to address the issues noted above, and to accommodate the waste in a more efficient and environmentally friendly period during the 20-year design period. Calculations for the expected municipal solid waste quantity required for the Hamlet solid waste landfill site are displayed on Table 9 and are based on:

- A generation rate of 0.012 m^3/person/day, based on existing filling rates and NWT standards
- A projected population growth rate of 1.5%
- An estimate of approximately 16% of all wastes being non-combustibles, based on typical waste composition rates in NWT
- A 40% reduction in combustible waste due to open burning, based on estimates used throughout the NWT
- A reduction of 50% due to compaction of the waste, based on observations of the waste
- Application of cover material at 4:1 fill to cover ratio.

4.1.2 Recommended Design Improvements

The recommended design improvements are summarized on Figure 9 and described in the sections that follow.

The facility will be expanded to an area of 3.0 ha (from the current 1.2 ha), which will include capacity for the municipal solid waste disposal area, hazardous waste disposal area and the landfarm.

A 2 m high landfill perimeter berm will be constructed around the entire estimated extent of the facility (sized to accommodate the larger quantity). This will demarcate the final extent of the waste and cover and allow for controlled and organized development of the area. The top of the landfill perimeter berm will be 1 m wide, and the inside slope (landfill side) will be at 2:1, while the outside slope will be 3:1. The landfill perimeter berm will be constructed using sand from within the landfill footprint itself and will be capped with blast rock from the quarry.

[1] Section 27 of the *Public Health Act* for Nunavut states:

> *Every incorporated municipality shall provide adequate waste disposal grounds for the disposal of all garbage…and shall cause such waste materials to be burned, buried or covered with a layer of earth ….*

Table 9
Waste Quantities

Waste Generation Rates Table
Key Assumptions

Starting Year: 2006 Population Growth Rate: 1.5%

Pre-2007 quantity in Landfill 12,330 m3

Planning Year	Calendar Year	Projected Population [people]	Annual Volume of Solid Waste [m^3]	Cumulative Volume of Solid Waste [m^3]	Annual Volume of Combustible Solid Waste [m^3]	Annual Volume of Combustible Solid Waste After Burning [m^3]	Annual Volume of Uncombustible Solid Waste [m^3]	Total Annual Volume of Uncombustible and Combusted (Burned) Solid Waste [m^3]	Annual Volume of Compacted Waste [m^3]	Annual Volume of Cover Material [m^3]	Total Annual Volume of Compacted Waste and Cover Material [m^3]	Cumulative Landfill Volume [m3]
0	2006	1585	6942.3	6942.3	5831.5	3498.9	1110.8	4609.7	2304.8	461.0	2765.8	15,095.81
	2007	1618	7086.8	14029.1	5952.9	3571.8	1133.9	4705.7	2352.8	470.6	2823.4	17,919.21
	2008	1653	7240.1	21269.3	6081.7	3649.0	1158.4	4807.5	2403.7	480.7	2884.5	20,803.68
	2009	1686	7384.7	28654.0	6203.1	3721.9	1181.5	4903.4	2451.7	490.3	2942.1	23,745.74
	2010	1720	7533.6	36187.6	6328.2	3796.9	1205.4	5002.3	2501.2	500.2	3001.4	26,747.12
5	2011	1760	7708.8	43896.4	6475.4	3885.2	1233.4	5118.6	2559.3	511.9	3071.2	29,818.31
	2012	1793	7853.3	51749.7	6596.8	3958.1	1256.5	5214.6	2607.3	521.5	3128.8	32,947.08
	2013	1827	8002.3	59752.0	6721.9	4033.1	1280.4	5313.5	2656.8	531.4	3188.1	36,135.18
	2014	1859	8142.4	67894.4	6839.6	4103.8	1302.8	5406.6	2703.3	540.7	3243.9	39,379.12
	2015	1893	8291.3	76185.7	6964.7	4178.8	1326.6	5505.4	2752.7	550.5	3303.3	42,682.39
10	2016	1928	8444.6	84630.4	7093.5	4256.1	1351.1	5607.2	2803.6	560.7	3364.3	46,046.74
	2017	1965	8606.7	93237.1	7229.6	4337.8	1377.1	5714.8	2857.4	571.5	3428.9	49,475.64
	2018	2000	8760.0	101997.1	7358.4	4415.0	1401.6	5816.6	2908.3	581.7	3490.0	52,965.63
	2019	2041	8939.6	110936.6	7509.2	4505.5	1430.3	5935.9	2967.9	593.6	3561.5	56,527.16
	2020	2076	9092.9	120029.5	7638.0	4582.8	1454.9	6037.7	3018.8	603.8	3622.6	60,149.76
15	2021	2107	9229.3	129258.8	7752.6	4651.6	1476.7	6128.2	3064.1	612.8	3676.9	63,826.70
	2022	2139	9367.7	138626.5	7868.9	4721.3	1498.8	6220.2	3110.1	622.0	3732.1	67,558.80
	2023	2171	9508.2	148134.7	7986.9	4792.1	1521.3	6313.5	3156.7	631.3	3788.1	71,346.88
	2024	2203	9650.9	157785.6	8106.7	4864.0	1544.1	6408.2	3204.1	640.8	3844.9	75,191.78
	2025	2236	9795.6	167581.2	8228.3	4937.0	1567.3	6504.3	3252.1	650.4	3902.6	79,094.35
20	2026	2270.0	9942.5	177523.7	8351.7	5011.0	1590.8	6601.9	3300.9	660.2	3961.1	83,055.46
	2027	2304	10091.7	187615.4	8477.0	5086.2	1614.7	6700.9	3350.4	670.1	4020.5	87,075.99
	2028	2339	10243.1	197858.5	8604.2	5162.5	1638.9	6801.4	3400.7	680.1	4080.8	91,156.82
	2029	2374	10396.7	208255.2	8733.2	5239.9	1663.5	6903.4	3451.7	690.3	4142.0	95,298.87
	2030	2409	10552.7	218807.9	8864.2	5318.5	1688.4	7007.0	3503.5	700.7	4204.2	99,503.05
25	2031	2445	10710.9	229518.8	8997.2	5398.3	1713.8	7112.1	3556.0	711.2	4267.2	103,770.29
	2032	2482	10871.6	240390.4	9132.2	5479.3	1739.5	7218.8	3609.4	721.9	4331.3	108,101.54
	2033	2519	11034.7	251425.1	9269.1	5561.5	1765.5	7327.0	3663.5	732.7	4396.2	112,497.76
	2034	2557	11200.2	262625.3	9408.2	5644.9	1792.0	7436.9	3718.5	743.7	4462.2	116,959.93
	2035	2595	11368.2	273993.5	9549.3	5729.6	1818.9	7548.5	3774.2	754.8	4529.1	121,489.02
30	2036	2634	11538.7	285532.3	9692.5	5815.5	1846.2	7661.7	3830.9	766.2	4597.0	126,086.05
	2037	2674	11711.8	297244.1	9837.9	5902.8	1873.9	7776.6	3888.3	777.7	4666.0	130,752.04
	2038	2714	11887.5	309131.6	9985.5	5991.3	1902.0	7893.3	3946.6	789.3	4736.0	135,488.02
	2039	2755	12065.8	321197.4	10135.3	6081.2	1930.5	8011.7	4005.8	801.2	4807.0	140,295.03
	2040	2796	12246.8	333444.2	10287.3	6172.4	1959.5	8131.9	4065.9	813.2	4879.1	145,174.15
35	2041	2838	12430.5	345874.7	10441.6	6265.0	1988.9	8253.8	4126.9	825.4	4952.3	150,126.46
	2042	2881	12617.0	358491.6	10598.2	6358.9	2018.7	8377.7	4188.8	837.8	5026.6	155,153.06
	2043	2924	12806.2	371297.8	10757.2	6454.3	2049.0	8503.3	4251.7	850.3	5102.0	160,255.05
	2044	2968	12998.3	384296.1	10918.6	6551.1	2079.7	8630.9	4315.4	863.1	5178.5	165,433.57
	2045	3012	13193.3	397489.4	11082.3	6649.4	2110.9	8760.3	4380.2	876.0	5256.2	170,689.77
40	2046	3057	13391.2	410880.5	11248.6	6749.2	2142.6	8891.7	4445.9	889.2	5335.0	176,024.81

percentage remaining after burning 0.6

A water retention area will be constructed in the north portion of the area to facilitate temporary storage and testing of any potentially impacted runoff from the area. The water retention area has been sized to contain a 30 mm storm event or equivalent quantity of snow runoff. Native materials (sand) will be excavated to a depth of 1 m and banked up around the perimeter. A 2 m deep invert (i.e., gap) will be cut into the landfill perimeter berm at the lowest point to facilitate water drainage into the water retention area. A 0.5 m deep drainage invert will be constructed at the north side of the berm.

The existing fence along the north, west and east side of the area will be temporarily removed and relocated or replaced. The fence will be constructed along the landfill perimeter berm at a height of 1.5 m, and excavated into the native materials a distance of at least 750 mm.

Signs will be posted within the landfill that indicate that there shall be no Salvaging of Waste.

4.1.3 Recommended Operational Improvements

Improved operational procedures are detailed in the Operation and Maintenance manual (Appendix G2), which achieve the following objectives:

- Organizes and controls development of the landfill to reduce the size and therefore the potential impacts
- Optimizes the amount of cover required and the time needed to cover the material.

The progressive development of the landfill is shown schematically on Figures 9 through 13. General maintenance activities are required to ensure that the site remains in good operating order. This involves repairing damaged features, cleaning the site, and monitoring. A report will be prepared and submitted to the Nunavut Water Board once per year.

4.2 Bulky Materials Disposal Area

4.2.1 Description

The Bulky Materials Disposal Area has been a repository for vehicles, heavy equipment, tanks, piping, drums, boats, and miscellaneous metal materials for over 15 years. To encourage reuse/recycling, Hamlet staff have recently created segregated areas for tires, appliances, bicycles, ATV's, snowmobiles and others. Public use of the area for reuse and recycling is encouraged. An examination of the area revealed very little materials that should have been stored or disposed of elsewhere. The approximate footprint of the Bulky Material Disposal Area is estimated to be 6,340 m^2 in size.

Staff indicated that most of the vehicles were not drained of fluids prior to being placed. However there was no evidence (staining, odours, vegetation stress, etc.) to suggest the site is causing a significant environmental impact.

4.2.2 Recommended Improvements

There is a large quantity of materials on site that would not be suitable for reuse due to the age, condition or nature and the community has indicated that they would like to reduce the amount that is visible. To achieve this, the existing materials within the Bulky Materials Disposal Area will be buried in a Bulky Materials Burial Pit (Figure 14). Burial in a dedicated area (as opposed to commingling with municipal solid waste) will facilitate future excavation and reuse, should the value of metals rise and it become economically viable. Future bulky materials will continue to be placed in the Bulky Materials Disposal Area, until a sufficient quantity has accumulated to facilitate another burial (assume in 5 to 10 years).

It is possible that during this burial some materials may be disposed of which may be suitable for reuse. Efforts should be made by the community to segregate any materials that may have a future use prior to the burial (e.g., recently placed material).

The Bulky Materials Burial Pit will be excavated to the west of the existing bulky materials disposal site and a ramp will be constructed such that vehicles can access the pit. Using grapples, loaders or any other equipment feasible, the scrap and bulky materials will be picked up and moved or dragged into the pit. Large solid pieces of metal (i.e., tanks, automobiles) should be moved as the first stage and placed along the south side of the disposal pit. Tires should be relocated next and placed across the bottom of the remainder of the pit. This deeper burial of tires reduces the likelihood of tires migrating to the surface, as tires have a tendency to ‘float’ to the surface due to ice and frost action. Loose bulky metal, such as sheets of steel, should be placed over the tires and towards the north end of the pit and pushed against the larger pieces.

Once the material has been placed, the pit will be covered with native soils (sand). This will involve progressively blading or pushing the stockpile that was developed during the excavation of the pit and the contaminated soils stockpile. If there is not sufficient sand, it may be necessary to excavate materials from an offsite source. A perimeter ditch will be constructed around the south, west and east pit boundaries, and will be lined with blast rock. Because there will likely be considerable differential settlement, and the potential for the development of potentially dangerous sink holes, the pit will be surrounded by a post and wire fence.

4.2.3 Recommended Operational Improvements

Once the burial is complete, the Bulky Materials Disposal Area will continue to operate in the basically the same manner as it has in the past, with the following minor operational improvements:

Staff should inspect vehicles and equipment on a regular basis and drain fluids or hazardous materials from the vehicles as required.

Inspected vehicles or equipment should be tagged to indicate that it has undergone an inspection and has been drained.

Periodically (every five to ten years) a bulk burial of the metals that may no longer be salvaged may be conducted to reduce visual impacts.

Bulky Materials Burial Pit should be inspected yearly and rutting or erosion should be repaired as required.

4.3 Hazardous Wastes Storage Area

4.3.1 Description

Hazardous materials, including drums of oil, antifreeze, batteries, and paint are currently stockpiled in a lined, and bermed area shown on Figure 2. There is also a stockpile of contaminated soils adjacent to the area.

The stockpiling and storage of hazardous materials in a lined central location is generally considered a good operating practice, in that these wastes are not entering the environment (either through dumping, or via leaching within the landfill.) The lined and bermed storage area provides secondary containment, further minimizing the potential for impact. However, storage is not a permanent solution, and wastes must be removed and properly disposed of on a regular basis. In addition, the community should discourage access to this area, in that these materials are hazardous and may impact the environment.

Management of hazardous waste must be in accordance with the "*Environmental Guideline for General Management of Hazardous Waste in Nunavut*", Government of Nunavut, January 2002, and the "*Environmental Guidelines for Waste Batteries*", Government of Nunavut, January 2002.

The main issues with the current Hazardous Waste Disposal Area are summarized below:

- It is currently located in the area proposed for use as for the Sewage treatment facility
- It is not in a central location with respect to Solid Waste Management
- The hazardous waste disposal area is used for permanent disposal, whereas it should be just temporary storage until wastes can be moved to a permanent disposal location.

To address these issues, the following actions will be completed.

4.3.1 Recommended Design Improvements

A new Hazardous Waste Storage Area will be constructed within the perimeter of the Solid Waste Disposal Facility so that wastes are managed from a central location. A perimeter fence will surround the area, to discourage public access. The area will be lined with an HDPE geomembrane and surrounded with a perimeter berm. The bermed area will contain approximately 30 m^3, which exceeds 110% of the assumed storage capacity.

A locker will be installed within the Hazardous Waste Storage Area and be outfitted with equipment to use in the event of a spill. This would comprise adsorbent pads, adsorbent booms, a fire-extinguisher and standard first aid equipment. The locker would remain locked and be secured to the fence to discourage theft.

4.3.2 Recommended Operation Improvements

The current method of storing wastes on skids stacked no higher than 2 drums should be continued. However, hazardous wastes must be removed from the community more frequently. All wastes that have accumulated such as oils, fuels, batteries, antifreeze, solvents that cannot be rendered safe for landfilling or cannot be reused will be removed from the community and shipped to a proper disposal facility. Materials must be contained, manifested, and arrangements must be made with a shipper to back haul the materials to a licensed waste disposal site. In between backhauls the wastes must be safely stored.

Effluent that accumulates within the bermed area (likely to comprise mostly snowmelt and rainwater with small amounts of residual products) must be pumped out on a regular basis and disposed of in the sewage lagoon.

Contractors that are working in the community, or delivering materials should not be allowed to dispose of wastes in the hamlet of Kugluktuk without appropriately compensating the community for the eventual disposal.

If hazardous waste is generated which is suitable for landfarming (i.e., if a spill occurs that generates hydrocarbon contaminated soils), then this waste may be incorporated into the landfarm (see below). Soils may be temporary stored in drums or in a lined stockpile with the landfill site until there is space within the landfarm to facilitate placement.

4.3.3 Removal of Existing Inventory

It is recommended that the existing inventory be removed and treated in the following manner:

- Drums of Oil – consume in a waste oil incinerator
- Waste Batteries – backhaul from site when resources become available. Store in the interim in a secure location
- Waste Paint – offer for reuse, and if not wanted open and dry out. Residue can go to the landfill
- Other Hazardous Materials – stockpile in a secure manner at the landfill site until cost effective shipment south can be arranged.

4.4 Landfarming Area

4.4.1 Description

To the west of the sewage lagoon is a pile of hydrocarbon-impacted soil, locally referred to as a "landfarm". The area consists of an approximate 30 ml HDPE lines and geotextile cloth placed directly on the native soils or in a shallow excavation. Approximately 620 m^3 of hydrocarbon-contaminated soil from a pipeline spill that occurred in town has been placed on the liner and an approximate 20 ml HDPE cover was placed over the soil.

Currently the top cover has partially blown off and has degraded due to wind and age. Permafrost has re-aggraded into the pile, so less that 1 m of the surficial layer was thawed during our site inspection in early October 2005. Based on measured dimensions and the assumption that the soil is piled on a liner placed on the original ground surface, the contaminated soil volume is estimated at 620 m^3.

Testing of the stockpile indicates that the upper layer of soil contains low levels of petroleum hydrocarbons that are below the stringent O.Reg. 153 Table 2 Standards and below the CCME criteria. The soil would therefore be suitable for use as landfill cover. The characteristics of the soil below, approximately 1.0 m below surface, is unknown because it was frozen and could not be sampled.

Hamlet and GN staff indicated an area in the Hamlet have indicated there is an additional quantity of hydrocarbon impacted soil (approximately 500 m^3) in town that require removal and disposal.

4.4.2 Recommended Design Improvements

Generally, the main processes that remediate hydrocarbon contamination from soils in a landfarm-type treatment system are volatization (through aeration) and aerobic degradation via naturally occurring bacteria. The current landfarm is not efficient, in that the soils are permanently frozen and compacted, and it is therefore unlikely that either of these two processes are occurring throughout the pile, in locations other than the surficial soils.

A new landfarm area will be constructed to treat the remainder of the stockpile (if necessary) as well as residual contaminated material within the town. The landfarm will

consist of a bermed dedicated area 20 m by 60 m in area in which soils will be loosely placed to a maximum height of 500 mm. The area will be lined with an HDPE geomembrane and surrounded with a perimeter berm. The upper surface of the stockpile should remain uncovered to facilitate air contact.

4.4.3 Recommended Operational Improvements

Once the landfarm is constructed and filled, the soil will be tilled on a regular basis (minimum once per month during the summer), to ensure that there is adequate air contact. This can be done using local equipment such as a rubber tire backhoe, which would excavate and drop the soils to loosen and aerate. The backhoe will operate from the east side of the site towards the west such that after the soils have been tilled they are no longer driven on.

Once per year the material should be tested for CCME hydrocarbon parameters. A total of 4 samples will be collected and submitted for analysis. If samples met regulatory standards, they should be used as cover within the landfill and additional material be placed within the landfarm area.

4.5 Water Board License Requirements

Nunavut Water Board License No. NWB3KUGO308 (Appendix A) has several requirements with respect to solid waste disposal. These are described in the following sections.

4.5.1 Annual Report

The license requires the submission of annual reports. Provided that the site is managed as outlined in the Operational and Maintenance plan (Appendix G), annual reports will be submitted. The format for the Annual Report is included as Appendix H.

4.5.2 Operations and Maintenance (O&M) Plan

The license requires an Operation and Maintenance manual be produced. This is included as Appendix G2.

4.5.3 Improved Surface Water Management

The license requires that measures be taken to prevent standing water from escaping at the toe of the waste. Design improvements included as part of the preferred concept, such as at the perimeter berm and the water retention area should provide adequate containment and encourage infiltration; or result in storage such that the water can be tested.

4.5.4 Waste Composition Study

The license recommended that a waste composition study be completed. This has been completed, and is included within the Schematic Design Report.

4.5.5 Spill Contingency Plans

The license requires completion of spill contingency plans. These are included in the attached O&M Plans.

4.5.6 Segregation of Waste Oil and Batteries from Municipal Solid Waste

The license recommends the segregation of waste oils and batteries from municipal solid waste. The detailed design includes a separate hazardous waste storage area to facilitate this segregation.

4.5.7 Installation of Fencing

The license recommended the installation of fencing. This has been included in the final preferred alternative.

5.0 Cost Estimates

A Class "B" cost estimate was determined based on the design of each of the facilities described in this document. Appendix I provides tables with the details of the cost estimates.

The following key assumptions were made to develop these cost estimates:

- Capital costs for each of the facilities include construction, supply, delivery and installation of necessary materials and equipment
- The capital cost estimates do not include other management expense such as operation and maintenance for the facilities, the collection and trucking of wastes to the sewage lagoon or landfill, nor do these include community, training, community liaison, etc.
- Costs are based on the equipment and manpower currently available in the community as per the Hamlet's municipal service rates by-law and discussions with the Hamlet's Senior Administrative Officer (SAO)
- All equipment and material on the site that are in good condition will be salvaged and incorporated or utilized in the construction to the fullest extent possible.

These assumptions together with the detailed design drawings were used to determine the corresponding costs estimates for each facility as presented below. The total estimated cost to undertake the improvements to the sewage lagoon, and solid waste facilities to meet the objectives of this project is included in Appendix I.

6.0 Environmental Screening

A Canadian Environmental Assessment Act (CEAA) Environmental Screening Report (ESR) was completed for the sewage treatment lagoon and the solid waste disposal facility. The ESR following INAC's 2005/2006 CEAA Screening Report format to identify potential concerns and provide appropriate procedures to avoid or mitigate potential adverse efforts on the environment. The Environmental Screening Decision Form for each of the facilities is presented in Appendix J.

The screening decision number for both facilities (sewage, and solid waste) is "01" which means that the project may proceed since al potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant.

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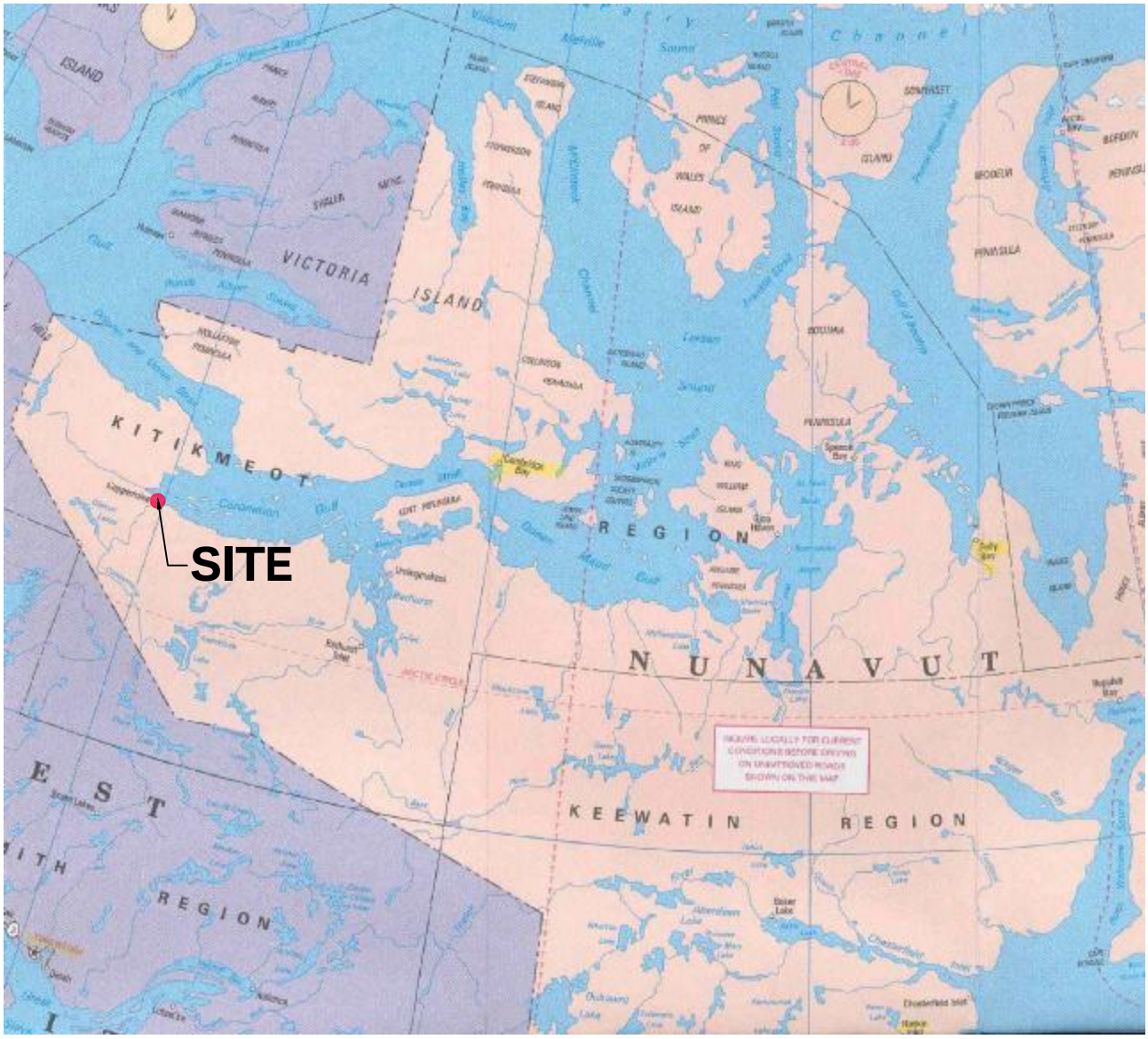
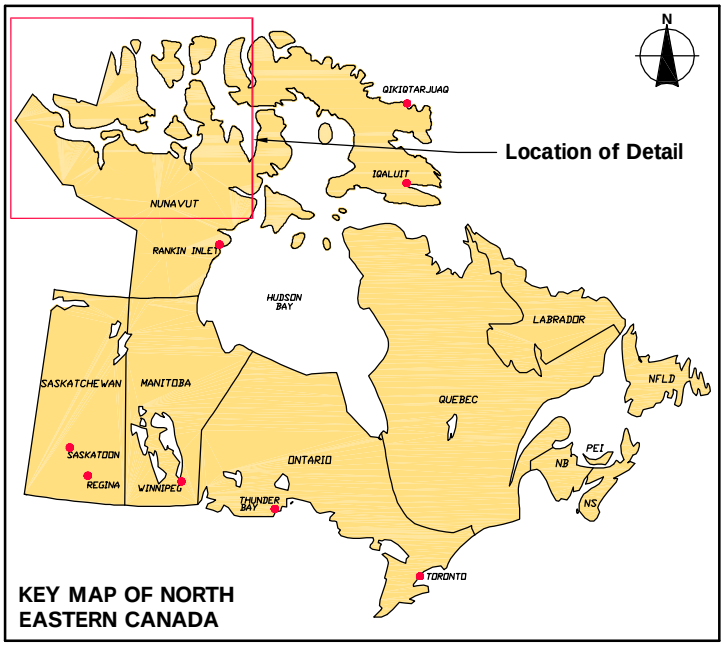
Figures



Map Reference:
Map of Canada
Published by the CAA



KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF KUGLUKTUK, NUNAVUT

DETAILED DESIGN

October 2005
Project Number: N-O 09755.0

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

FEO09754 DD SL.DWG

FIGURE 2

HAMLET OF KUGLUKTUK
DETAILED DESIGN

COMMUNITY PLAN

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
October 2005
Project Number: N-O 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

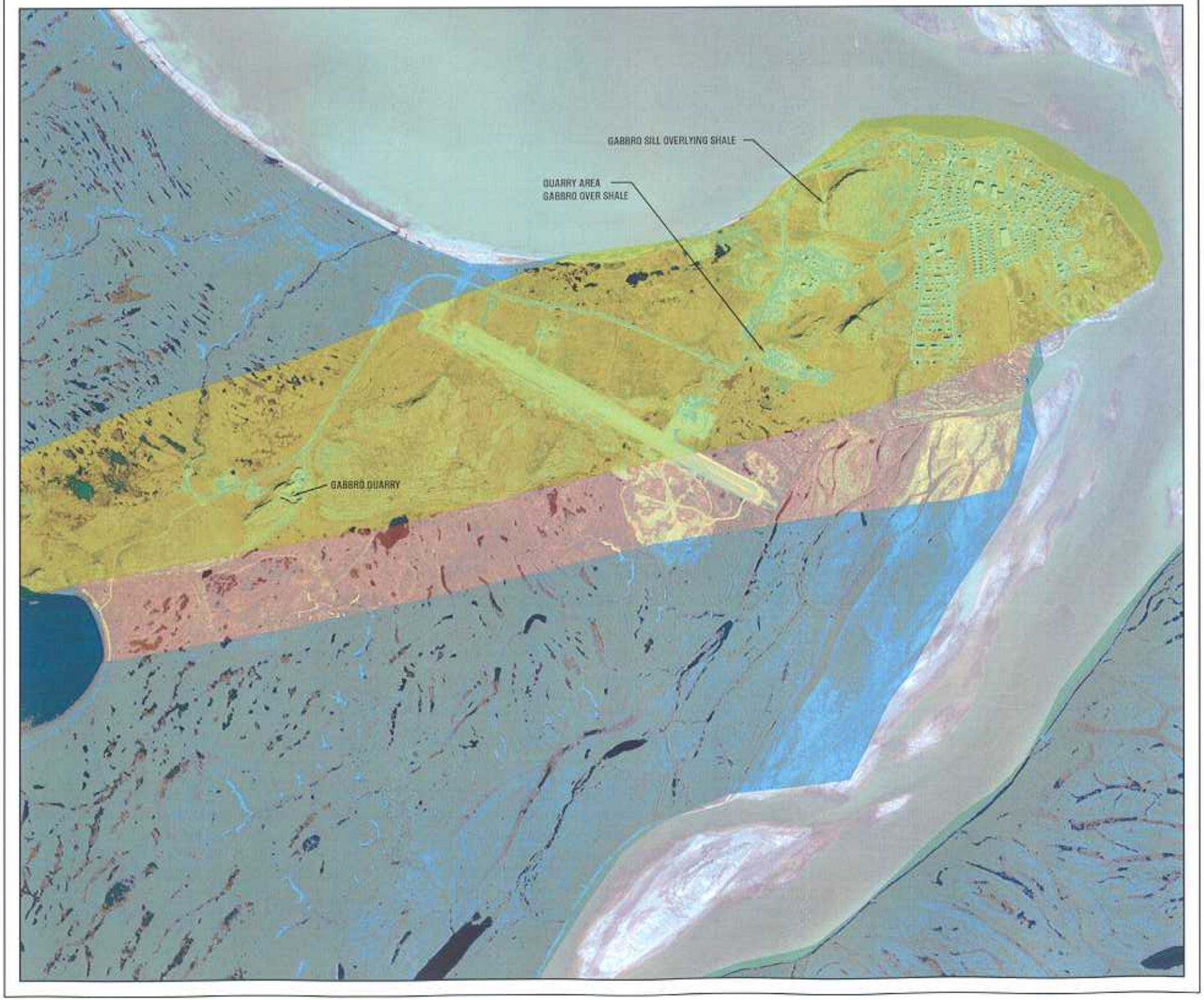


FIGURE 3

HAMLET OF KUGLUKTUK

DETAILED DESIGN

BEDROCK GEOLOGY

Legend

- CORONATION SILLS (and associated dykes): gabbro
- PROTEROZOIC HADRYNIAN RAE GROUP Shaly Sandstone, Siltstone, Shale
- GLACIAL DRIFT

Geology Source: Geological Survey of Canada, "Geology, Coppermine, District of Mackenzie", Map 1337A, Paper 71-39, 1973

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

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Meters

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October 2005
Project Number: N-0 09755-0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

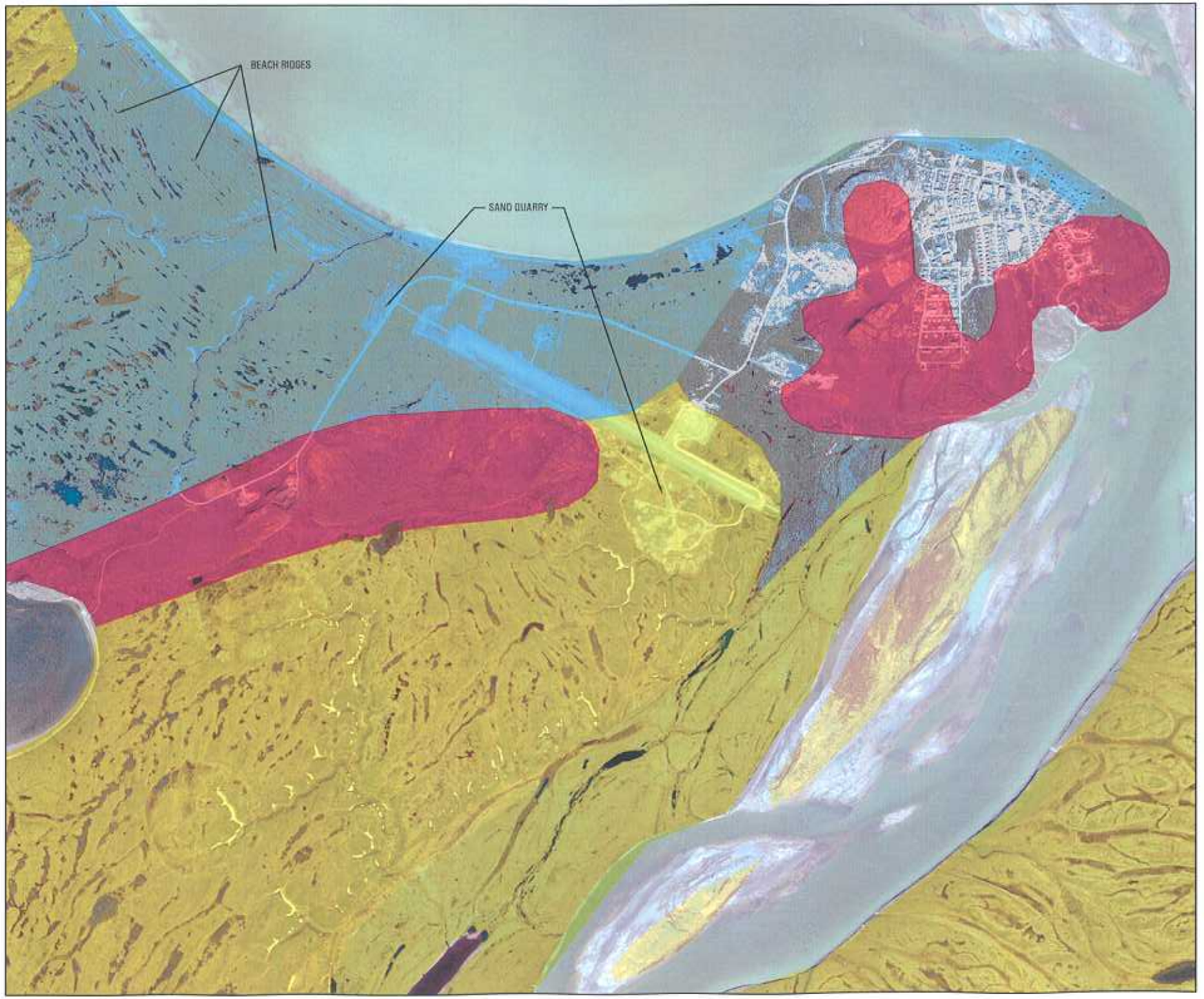

FIGURE 4

HAMLET OF KUGLUKTUK
DETAILED DESIGN

SURFICIAL GEOLOGY

Legend

POST-LAST GLACIATION

- Floodplain Sediments: coarse sand and gravel; 3 to 10 m thick; veneer of pebble and boulder lag common on surface
- Terraced Sediments: fine to coarse sand with minor gravel lenses; wood and peaty material common; 3 to 10 m thick; terrace surfaces commonly gullied or channelled
- Deltaic sediments: boulders, gravel, and sand; 5 to 20 m thick; deeply channelled surfaces with boulder pavements at the bottom of channels
- Littoral Sediments: medium to coarse grained sand with minor gravel; 1 to 5 m thick; blanket deposit with flat to gently undulating surface and with occasional beach ridges

LAST GLACIATION

- Till, washed: boulders and gravel on bedrock surface; 1 to 3 m thick; concentration resulting from washing out of fines by meltwater flow

PRE-QUATERNARY

- Rocks of Middle to Late Proterozoic Coppermine Homocline: sedimentary and volcanic successions; gabbro and diabase sills

Geology Source: 1988: Surficial Geology, Coppermine River, District of Mackenzie, Northwest Territories, Geological Survey of Canada, Map 1645A.

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

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Meters

1:20,000
October 2005
Project Number: N-D 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

Nuna BURNSIDE

FIGURE 5

HAMLET OF KUGLUKTUK
DETAILED DESIGN

SEWAGE LAGOON AND MUNICIPAL SOLID WASTE AREA

Legend

- TEST PIT LOCATION
- SURFACE WATER SAMPLE LOCATION

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

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Metres

1:2000
June 2006
Project Number: N-0 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

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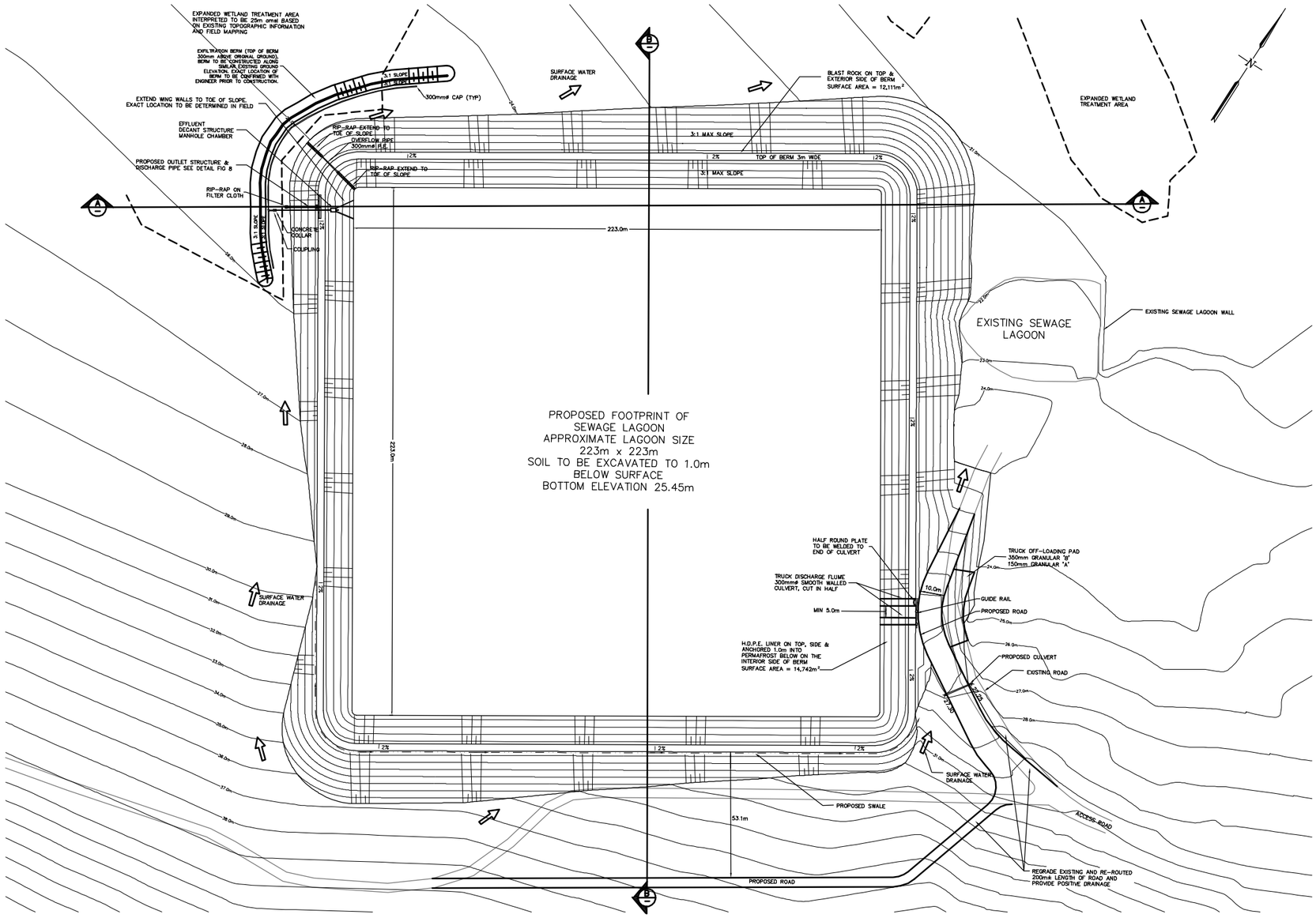


FIGURE 6

HAMLET OF KUGLUKTUK

DETAILED DESIGN

PROPOSED SEWAGE LAGOON PLAN

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

N

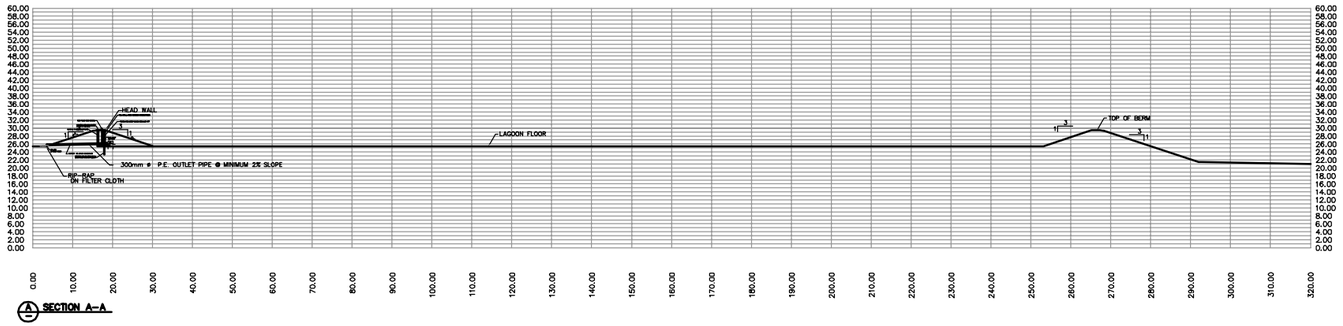
NTS
June 2006
Project Number: N-0 09755.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: J. Hodgson

Verified by: M. Paznar

BURNSIDE



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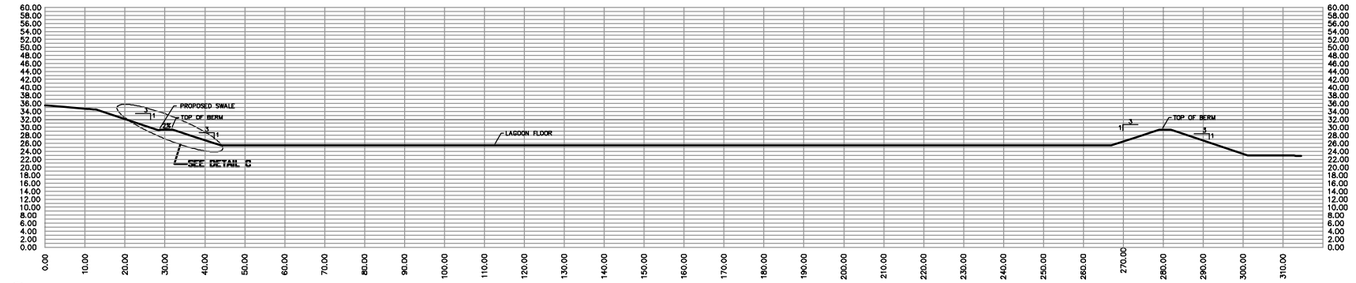

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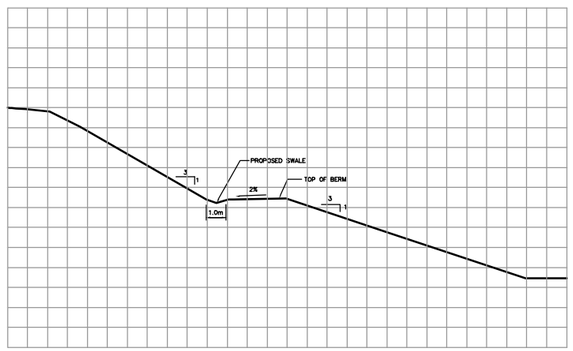


DETAIL C
SCALE 1:100

FIGURE 7

HAMLET OF KUGLUKTUK
DETAILED DESIGN

PROPOSED SEWAGE LAGOON SECTIONS

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

N

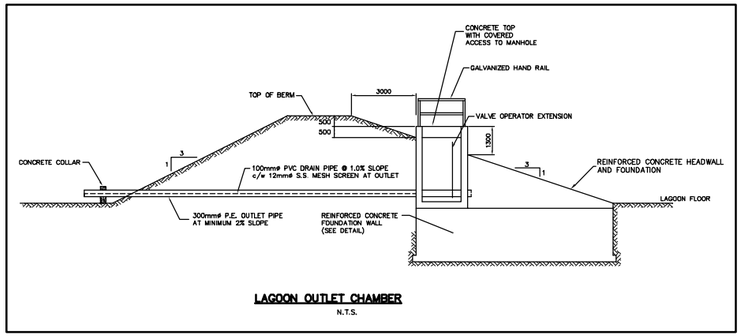
NTS
June 2006
Project Number: N-O 09755.0

Projection: UTM Zone 20
Datum: NAD83

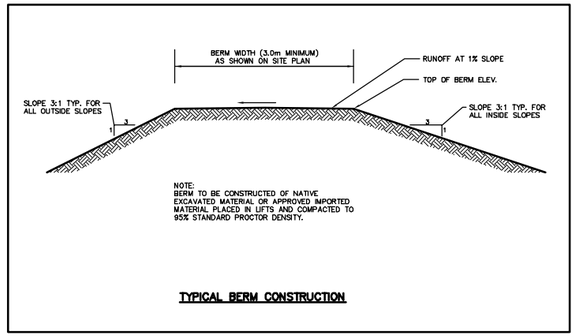
Prepared by: J. Hodgson

Verified by: M. Paznar

NUNA BURNSIDE



LAGOON OUTLET CHAMBER
N.T.S.



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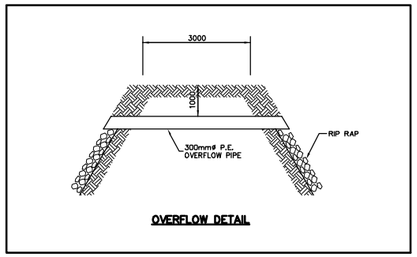

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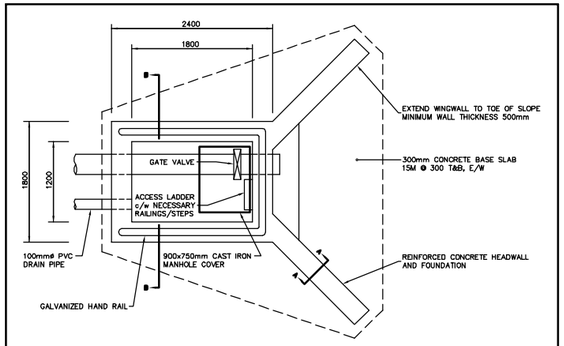
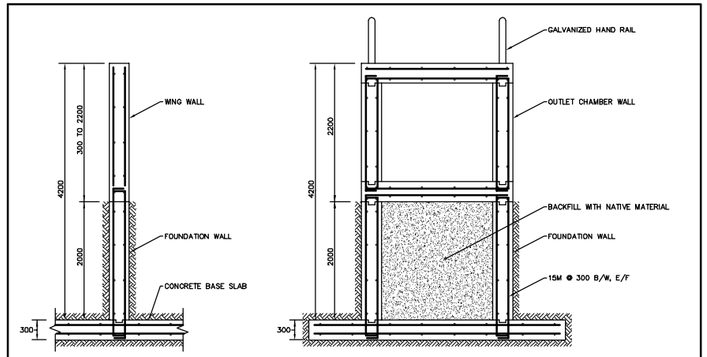
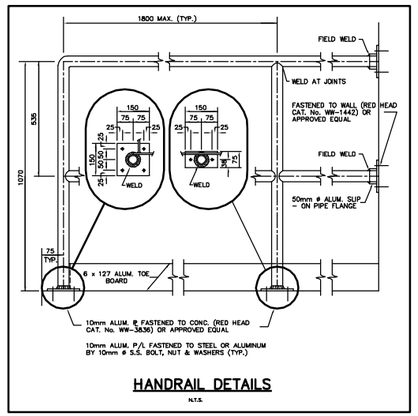


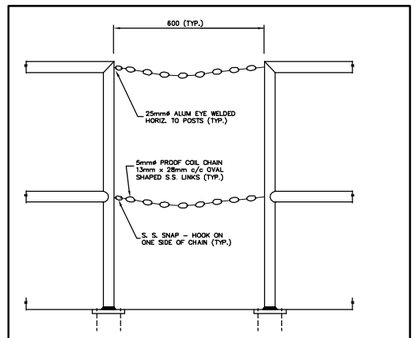
OUTLET CHAMBER
TOP VIEW



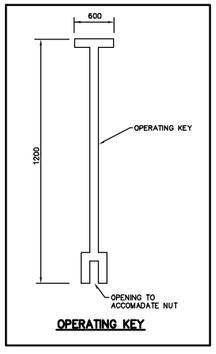
SECTION A–A **SECTION B–B**



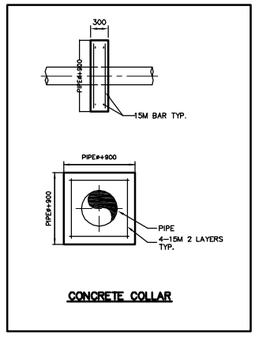
HANDRAIL DETAILS
N.T.S.



REMOVABLE SAFETY CHAIN DETAIL
N.T.S.



OPERATING KEY



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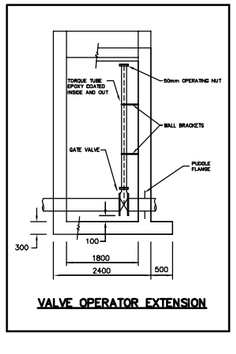
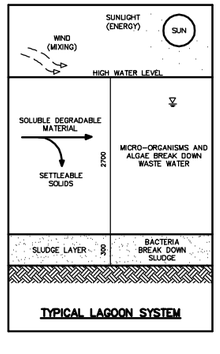
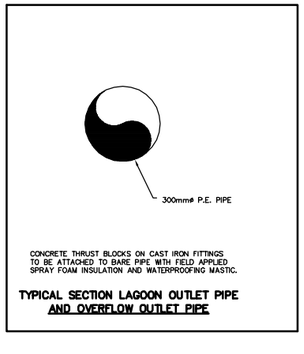


VALVE OPERATOR EXTENSION



TYPICAL LAGOON SYSTEM



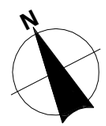
TYPICAL SECTION LAGOON OUTLET PIPE AND OVERFLOW OUTLET PIPE

FIGURE 8

HAMLET OF KUGLUKTUK
DETAILED DESIGN

PROPOSED SEWAGE LAGOON DETAILS

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



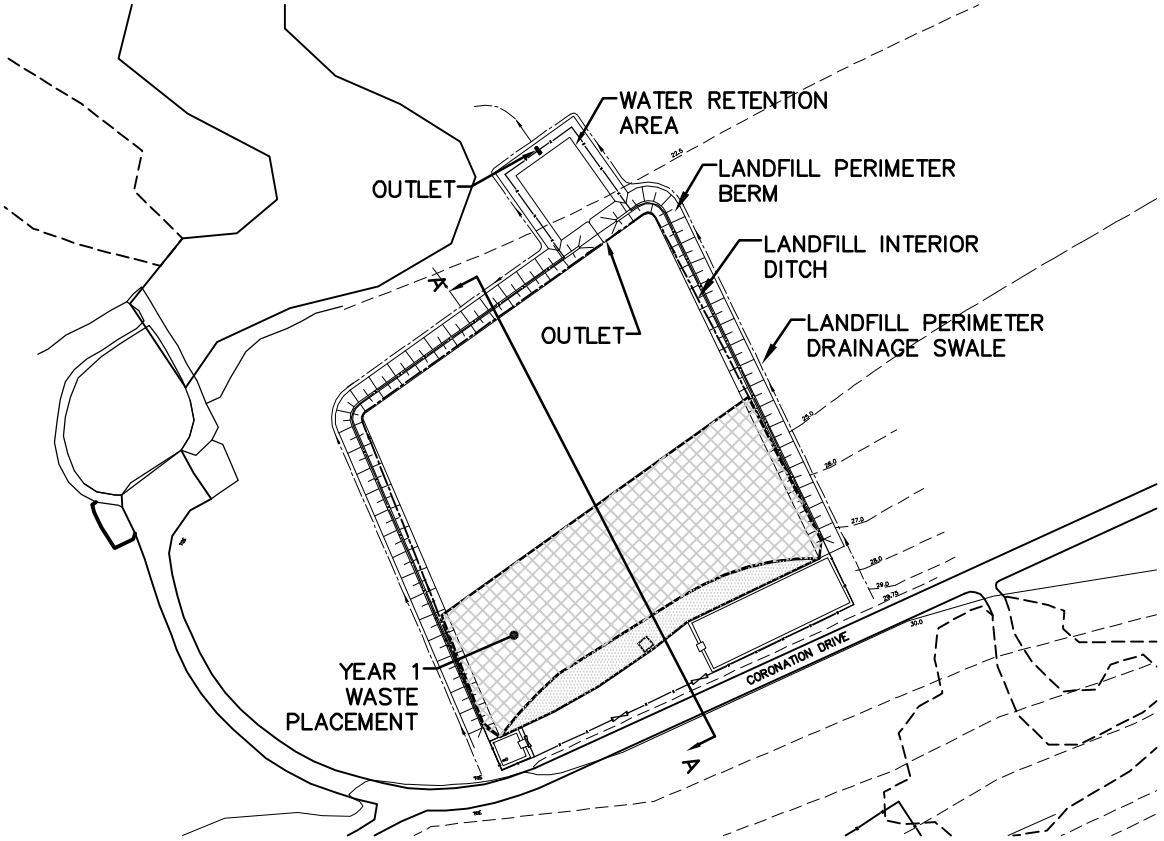
N.T.S.
June 2006
Project Number: N-O 09755.0

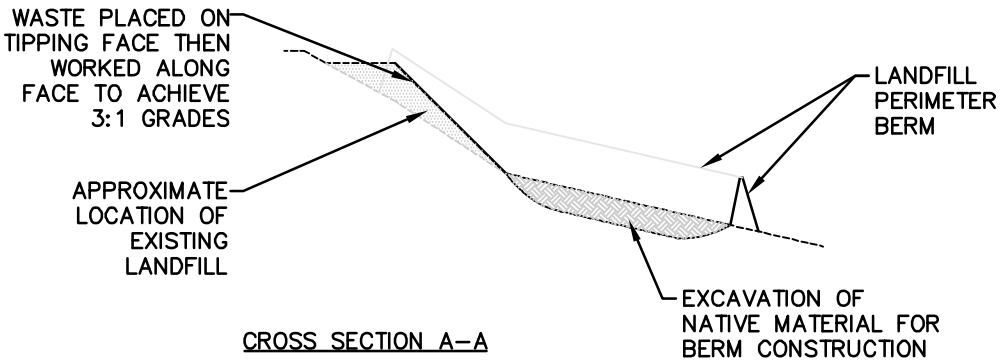
Projection: UTM Zone 20
Datum: NAD83

Prepared by: J. Hodgson

Verified by: M. Paznar

BURNSIDE





CROSS SECTION A–A

FIGURE 9

HAMLET OF KUGLUKTUK

DETAILED DESIGN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 1

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Metres

1:3000

JUNE 2006

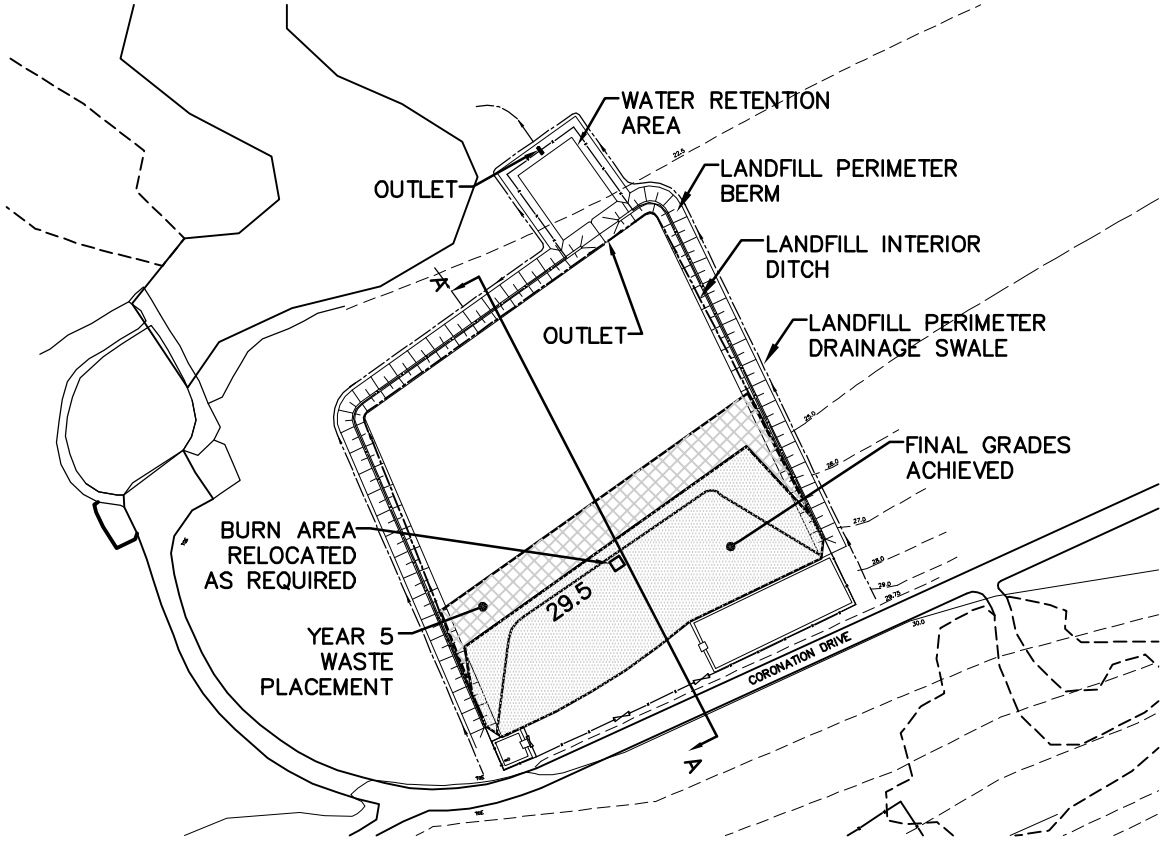
Project Number: N-O 9755

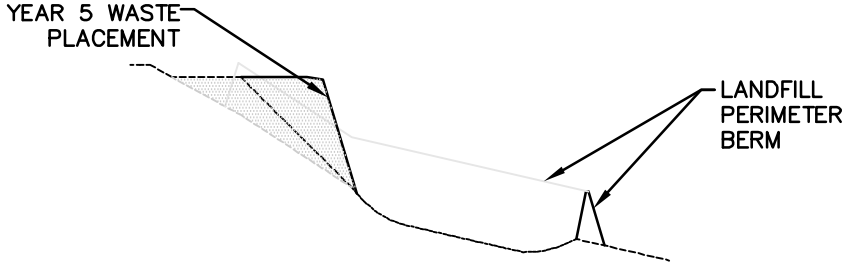
Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG





CROSS SECTION A–A

FIGURE 10

HAMLET OF KUGLUKTUK

DETAILED DESIGN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 5

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Metres

1:3000

JUNE 2006

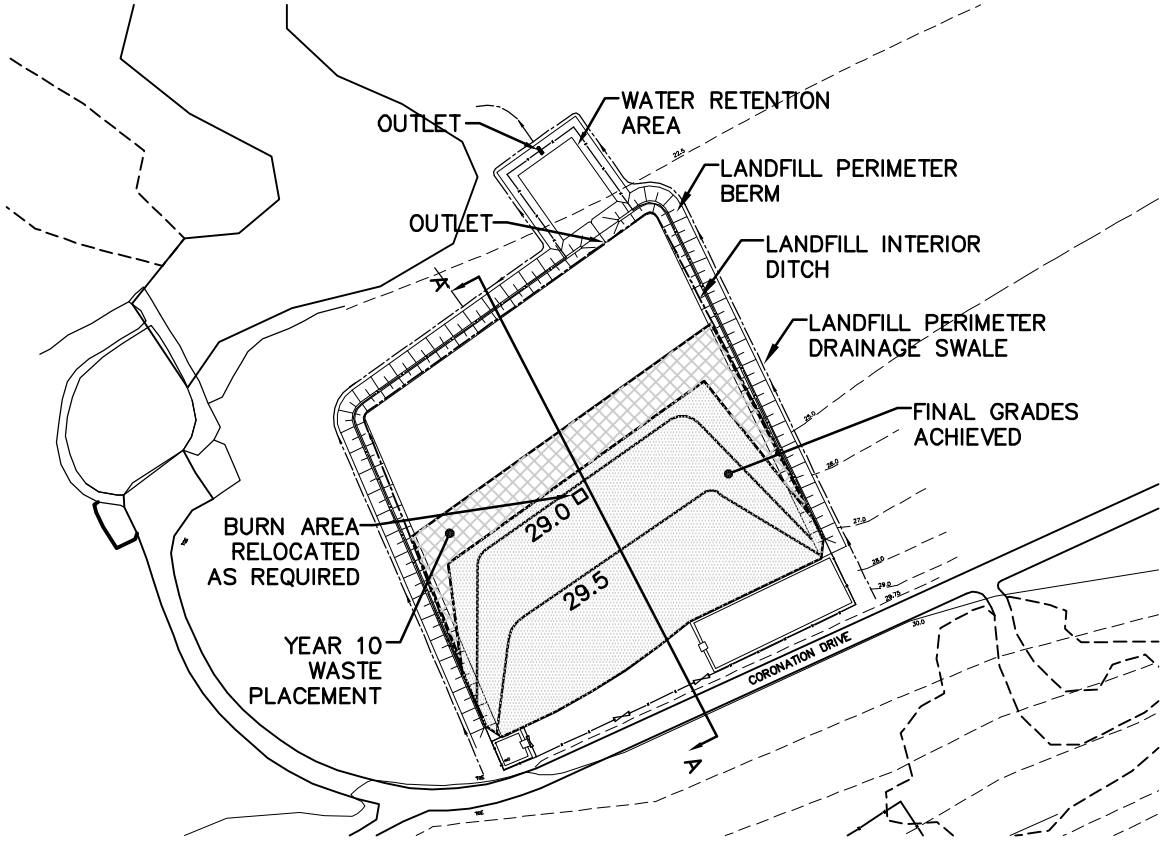
Project Number: N-O 9755

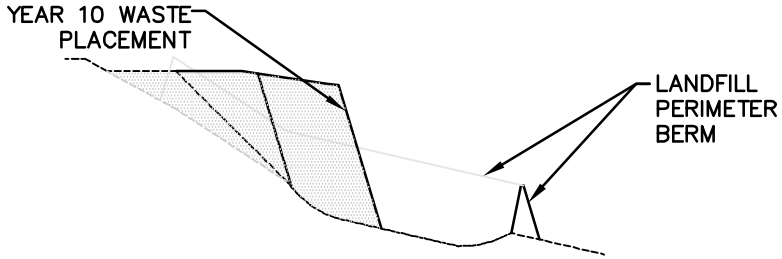
Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG





CROSS SECTION A–A

FIGURE 11

HAMLET OF KUGLUKTUK

DETAILED DESIGN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 10

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000

JUNE 2006

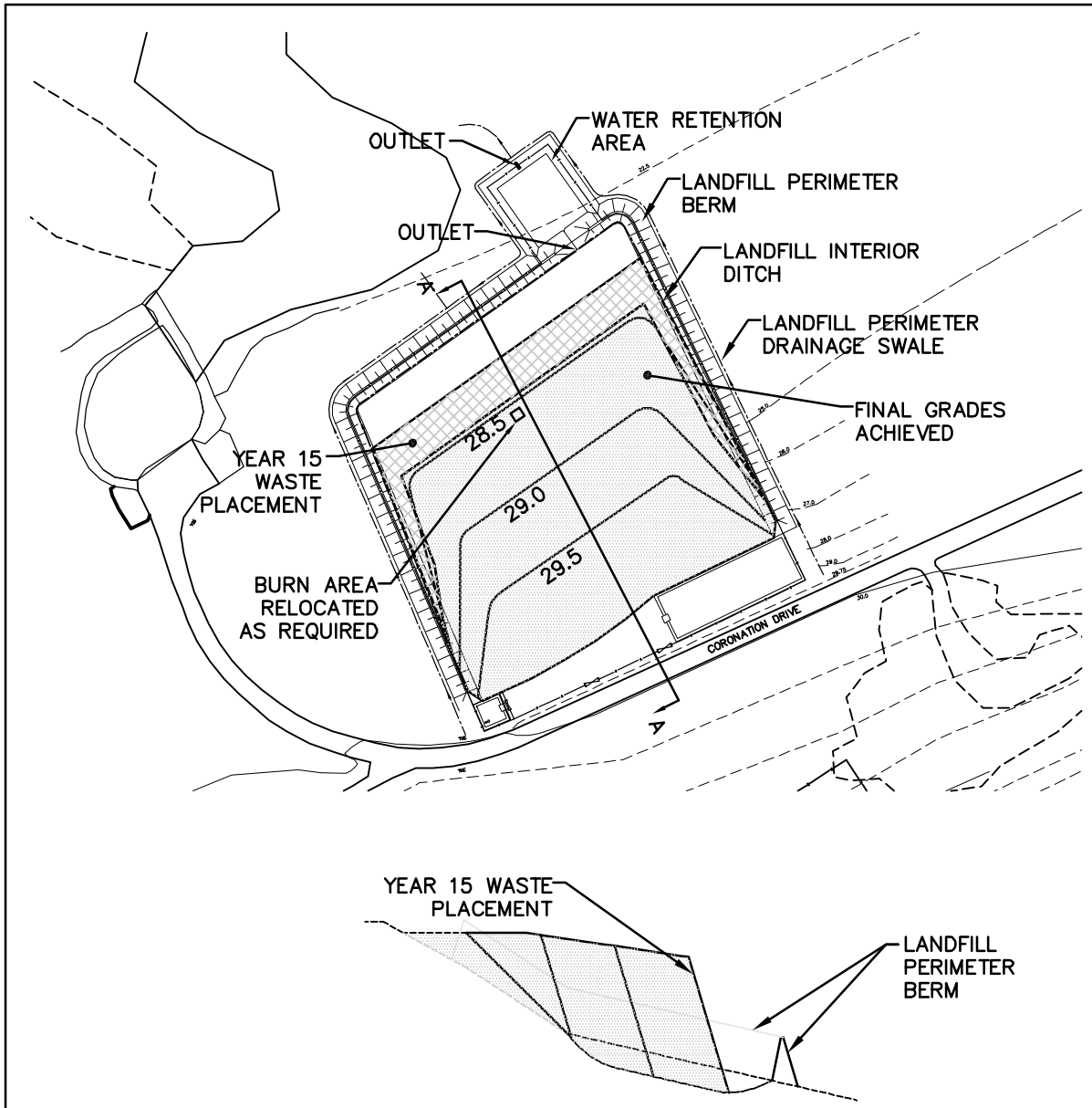
Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG



CROSS SECTION A–A

FIGURE 12

HAMLET OF KUGLUKTUK

DETAILED DESIGN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 15

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000

JUNE 2006

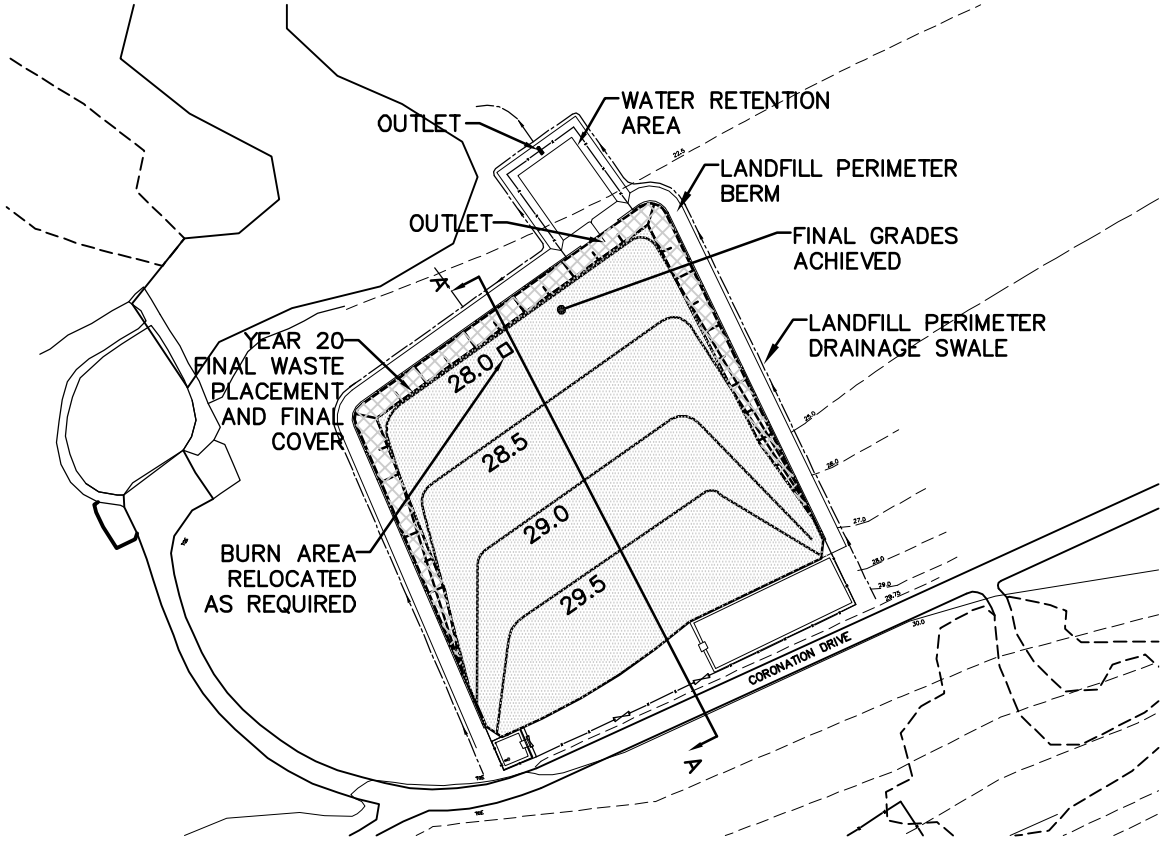
Project Number: N-O 9755

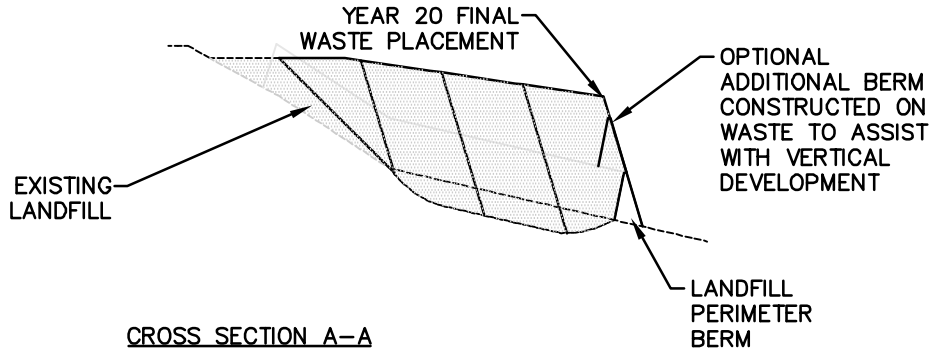
Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG





CROSS SECTION A–A

FIGURE 13

HAMLET OF KUGLUKTUK

DETAILED DESIGN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 20

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000

JUNE 2006

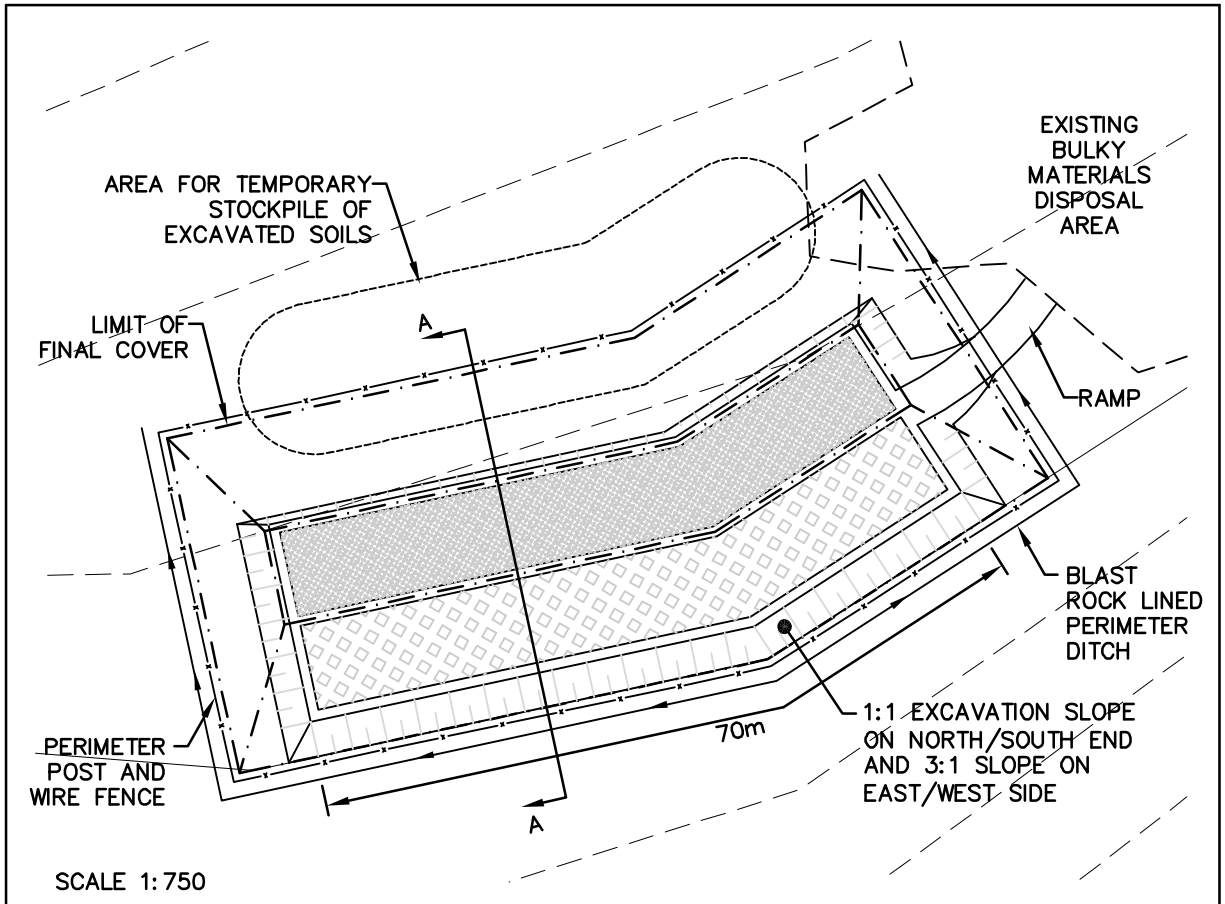
Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

NUNA BURNSIDE

XREF: N-O9755-BASE.DWG



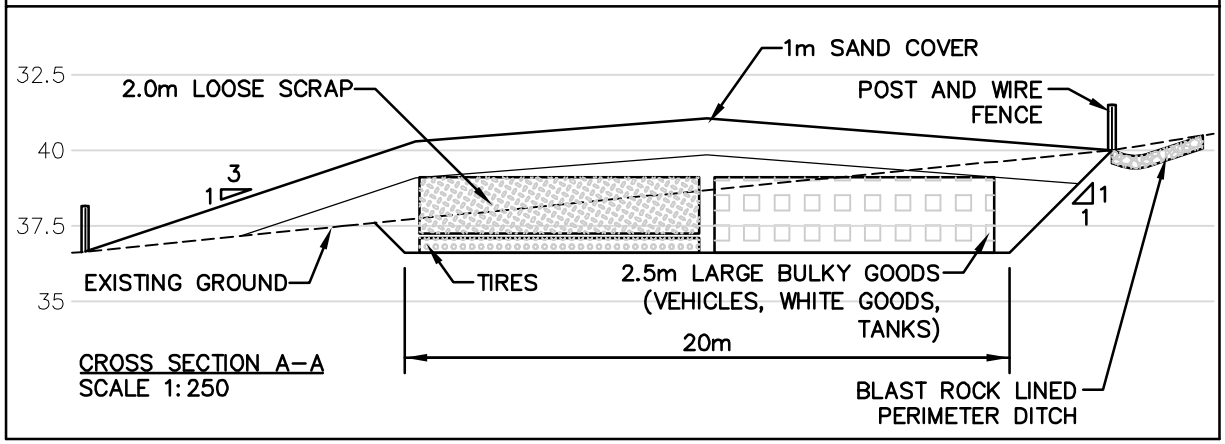


FIGURE 14

HAMLET OF KUGLUKTUK

DETAILED DESIGN

BULKY MATERIALS BURIAL PIT

N

0 10 20 30 40 50 60

Metres

1:750

JUNE 2006

Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG

Appendix A

Nunavut Water Board License

P.O. BOX 119
GJOA HAVEN, NU X0B 1J0
TEL: (867) 360-6338
FAX: (867) 360-6369

kNK5 wmoEp5 vtmpq
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3KUG0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated July 15, 2003, made by:

Hamlet of Kugluktuk

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

DECISION

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

Licence Number NWB3KUG0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-35)

SIGNED this 20th day of November 2003 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

TABLE OF CONTENTS

I. BACKGROUND

Kugluktuk is located immediately west of the mouth of the Coppermine River on Coronation Gulf at 67°50'N, 115°15'W, 595 air km north of Yellowknife. The Hamlet extends inland to cover a rocky knoll. The town site is underlain by Precambrian sedimentary and volcanic rock. Dolomite and shale, interspersed with volcanic rock, form steep outcrops in the vicinity of the settlement. The buildings along the shore are perched on consolidated beach deposits. Directly behind this ridge is a low, marshy area. There are numerous exposed bedrock surfaces in the community. Surficial deposits in the area include talus and deltaic deposits. The angular talus, derived primarily from the mechanical breakdown of dolerite, ranges in size from silt to boulders but is commonly found as course sand or fine gravel. Kugluktuk is underlain by permafrost. The thickness of the active layer ranges from less than 0.5 m to over 1 m in the sandy waterfront area. Permafrost features such as polygonal ground and thaw-related instability affect the raised delta surfaces and strongly influence their drainage characteristics. Grasses, sedges, heather, mosses, and lichens grow in limited soils. Willow and alder thickets are common in wetland depressions. Kugluktuk receives an average of 10.3 cm of rainfall and 100.7 cm of snowfall per year. Mean annual precipitation totals 20.2 cm. July mean high and low temperatures are 13.8° C and 5.6° C. The January mean high and low temperatures are -26.4° C and -33.8° C. The winds are generally south-west and annually average 16.6 km/h.

II. PROCEDURAL HISTORY

On July 15, 2003, an application for the renewal of water license N3L4-1526, was filed by Ferguson Simek Clark Environmental Consultants (Yellowknife) on behalf of the Hamlet of Kugluktuk. The previous water licence was issued by the Northwest Territories Water Board on 1 July 1998 and valid until June 30, 2003. In consideration of the application for renewal the Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement,* on July 23, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

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

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the compliance record of the Applicant. Specifically, the August 9, 2001 DIAND Inspection Report indicated that:

1. The Licensee has failed to produce Annual Reports from 1996-2001;
2. Water supply field pH , turbidity, and iron concentration exceeded the levels recommended in the *Guidelines for Canadian Drinking Water Quality*;
3. Sewage treatment system effluent concentrations of ammonia and phenol exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*;
4. Sewage treatment effluent contained noteworthy concentrations of faecal coliforms (1,470,000 CFU/100ml);
5. Solid waste disposal site effluent concentrations of iron and zinc exceeded the levels; and
6. The sewage treatment system effluent evidenced a significant toxicity, as determined by a MicroTox EC_{50} assessment.

Additionally, the NWB brings to the attention of the Licensee their failure to provide the Board with the as-built plans and drawings for the modifications to the Sewage Disposal Facilities, as required by Part D, Item 3 of Water License N7L4-1526. The Board requests that these as-built plans and drawings be forwarded by the Licensee within ninety (90) days following issuance of this license.

In review of the application, DIAND, has recommended a licence term of five (5) years. The NWB concurs that a term of five (5) years is appropriate, and will allow enough time for the Hamlet to establish a consistent compliance record with the terms and conditions of its licence. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

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

The NWB has also imposed on the Licensee the requirement to produce an Operations and Maintenance Manual for their sewage and solid waste operations. The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is

capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II).

Water Use

The Municipality currently receives water from Coppermine River. Water is treated using membrane filtration, which is accomplished in a twin train Harmsco filtration system, and stored in a 320 m^3 tank. The water receives a chlorine treatment prior to trucked-service distribution. Water consumption is projected to reach 53,475 m^3 *per annum* in 2003 and 60,533 m^3 *per annum* by 2008.

No serious concerns were raised by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Issues related to the quality of water produced by the present water treatment system were identified, but are currently being addressed by the Applicant and the Department of Community Government and Transportation, Government of Nunavut. DIAND has provided specific recommendations regarding volume usage limits, as well as recommending that the Applicant to be required to maintain a monitoring station at the water intake area KUG-1 in order to monitor the volume of water used. The Board concurs with these recommendations, and has set the terms and conditions in the water licence, which govern, water usage accordingly. The Board also recommends that the Hamlet and the Department of Community Government and Transportation take whatever steps are necessary to address the water quality issues identified in the August 9, 2001 DIAND Inspection Report.

Deposit of Waste

Sewage

The Hamlet of Kugluktuk utilizes a Sewage Disposal Facility approximately 5.0 km west of the Municipality. A gravel berm provides limited retention of sewage prior to discharge to an undefined wetland where it receives additional treatment prior to discharge to the marine environment. Specific comments relevant to sewage disposal operations in the Hamlet were provided by DIAND, and Environment Canada. Both DIAND and Environment Canada requested that the Applicant provide information to the NWB on how the Municipality plans to address the operational and environmental issues evidenced in the August 9, 2001 DIAND Inspection Report. Additionally, Environment Canada recommended that a minimum of 1 m of freeboard should be maintained at all retention structures, and that All Terrain Vehicle (ATV) traffic be restricted in the wetland area so as to prevent soil erosion and damage to vegetation from compromising the effectiveness of the wetland treatment of the sewage.

DIAND and Environment Canada also recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. Additionally, DIAND provided recommendations concerning effluent discharge criteria, which are consistent with the *Guidelines for the Discharge of*

Treated Municipal Wastewater in the Northwest Territories (Northwest Territories Water Board; 1992), as well as specific recommendations concerning the Monitoring Program.

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

Solid Waste

The Hamlet's solid waste management site is located approximately 4.5 km from the community. Waste is segregated, with a generic landfill area, a bulky wastes area, and a sealift container for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered on a yearly basis.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND and Environment Canada. Both DIAND and Environment Canada recommended that preventative measures be implemented to prevent standing water noted at the toe of the solid waste site from escaping the facility. Environment Canada also recommended that the Municipality undertake a waste composition study, which will assist the Municipality to plan for the long term waste disposal needs of the community. The Board concurs that the Hamlet should give serious consideration to this recommendation, and recommends that discussions be commenced with the Department of Community Government and Transportation to determine potential assistance which may be available to the Hamlet to undertake such a study.

DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans for their solid waste operations. DIAND and Environment Canada further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. DIAND and Environment Canada recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. Additionally, both Environment Canada and DIAND recommended the installation of appropriate fencing at the bulky waste and hazardous waste disposal sites, so as to improve security on the sites. The Board concurs that the Hamlet should give serious consideration to this recommendation, and in the interim take whatever steps are practicable to implement this recommendation.

LICENCE NWB3KUG0308

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF KUGLUKTUK

(Licensee)

of **KUGLUKTUK, NUNAVUT, X0E 0E0**

(Mailing Address)

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

Licence Number **NWB3KUG0308**

Water Management Area **NUNAVUT 05**

Location **KUGLUKTUK, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **64,000 CUBIC METRES ANNUALLY**

Date of Licence **NOVEMBER 20, 2003**

Expiry Date of Licence **NOVEMBER 30, 2008**

Dated this 20th of November 2003 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Kugluktuk, Nunavut (67°50'N, 115°15'W);

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

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

2. Definitions

In this Licence: **NWB3KUG0308**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"Licensee" means the holder of this Licence;

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

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

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

"Sewage" means all toilet wastes and greywater;

"Sewage Disposal Facilities" comprises the area and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

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

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

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Coppermine River, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2.

PART B: GENERAL CONDITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(i) Chief Administrative Officer:

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

(ii) Inspector Contact:

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

(iii) Analyst Contact:

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

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

PART C: CONDITIONS APPLYING TO WATER USE

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

2. The annual quantity of water used for all purposes shall not exceed 64,000 cubic metres.

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

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

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

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

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

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

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

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

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

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

7. The Licensee shall implement measures to ensure waste from the Solid Waste Disposal Facility does not enter water.

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

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

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

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

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

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

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

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

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

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

    iv. the Board has not rejected the proposed modifications.

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

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

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before March 31, 2004 submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996). This Plan shall specifically address the waste disposal and operational issues related to the Sewage Disposal Facility and the Solid Disposal Facility, which were identified in the August 9, 2001 DIAND Inspection Report.

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

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

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

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

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

    i. take whatever steps are immediately practicable to protect human life, health and the environment;
    ii. without delay seek guidance from the Departments of Community Government and Transportation and Sustainable Development with regards to mitigation and remedial actions required to address the discharge;

ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

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

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

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

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

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

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Monitoring Station	Description
KUG-1	Raw water supply at Coppermine River prior to treatment
KUG-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
KUG-3	Raw Sewage at truck offload point
KUG-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

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

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

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

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

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

6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence.

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

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

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

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

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

Appendix B
Climate Data

Appendix B
Climate Normals for Kugluktuk
Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Temperature: Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-27.8	-27.4	-25.3	-17	-5.3	5.2	10.7	8.8	2.8	-7.2	-19.6	-25.5		C
Standard Deviation	3.8	4.2	3.2	3	3.2	2	2	1.9	1.5	2.5	4.3	3.4		C
Daily Maximum (°C)	-23.7	-23	-20.6	-12.1	-1.4	9.5	15.4	13.1	6	-4	-15.7	-21.4		C
Daily Minimum (°C)	-31.9	-31.7	-29.8	-21.8	-9.2	0.8	6	4.5	-0.4	-10.3	-23.4	-29.6		C
Extreme Maximum (°C)	0.8	-1.2	-0.1	14	19.8	31.1	34.9	29.2	22.6	13.4	2.8	27.4		
Date (yyyy/dd)	1981/16	1980/07	1999/22	2000/06	1994/24	1996/25	1989/15	2000/01	1994/01	1988/06	1983/03	1999/19		
Extreme Minimum (°C)	-46.9	-47.2	-47	-39.7	-30.2	-12.1	0.3	-4.4	-18.9	-35.4	-41	-44.5		
Date (yyyy/dd)	2002/21	1998/20	1979/05	1979/04	1983/03	2000/01	1978/04+	1995/29	2000/26	1996/29	1985/24	1977/12		
Precipitation: Precipitation:														
Rainfall (mm)	0	0	0	0.6	5.8	12.8	36.3	40.8	32.1	5.1	0	0	133.5	C
Snowfall (cm)	15.4	16.5	16	17.8	16.6	2.7	0	0.3	8.1	34.1	19.7	18.6	165.8	C
Precipitation (mm)	11	9.9	10.6	13.3	19.5	15.1	36.3	41.1	39	29.5	12.6	11.5	249.4	C
Average Snow Depth (cm)	35	43	47	48	28	3	0	0	0	9	20	28		C
Median Snow Depth (cm)	36	42	47	49	28	1	0	0	0	9	19	28		C
Snow Depth at Month-end (cm)	38	45	48	42	15	0	0	0	2	17	24	32		C
Extreme Daily Rainfall (mm)	0	0	0	7.4	20.6	27.4	30.5	53.7	28.8	19.3	3.4	0		
Date (yyyy/dd)	1978/01+	1978/06+	1978/01+	1980/27	1992/27	1987/13	1983/10	1982/12	1983/07	1980/08	2001/17	1977/01+		
Extreme Daily Snowfall (cm)	26.2	24.6	8.6	16	21	13	0.4	5	13.5	23	12.4	26		
Date (yyyy/dd)	1988/01	1981/21	2000/27	1980/30	1993/07	1991/05	1985/07	1986/23	1981/22	1981/29	1981/06	1994/25		
Extreme Daily Precipitation (mm)	25.8	9.1	6	16	21.8	27.4	30.5	53.7	28.8	23	12.4	14.8		
Date (yyyy/dd)	1988/01	1981/21	1990/07+	1980/30	1978/25	1987/13	1983/10	1982/12	1983/07	1981/29	1981/06	1994/25		
Extreme Snow Depth (cm)	80	92	104	107	128	64	3	0	23	43	49	73		
Date (yyyy/dd)	1993/30+	1993/22+	1991/31	1991/03+	1993/08	1993/01	1986/01+	1978/01+	1981/24	1995/29	1992/30	1994/26+		

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Days with Maximum Temperature: Days with Maximum Temperature:														
<= 0 °C	31	28.3	31	28.4	18.7	1.1	0	0	2.5	23.1	29.6	30.9		C
> 0 °C	0.05	0	0	1.6	12.3	28.9	31	31	27.5	7.9	0.45	0.08		C
> 10 °C	0	0	0	0.04	0.91	12	25.6	20.8	5.4	0.1	0	0.08		C
> 20 °C	0	0	0	0	0	2.5	6	3.9	0.22	0	0	0.08		C
> 30 °C	0	0	0	0	0	0.09	0.26	0	0	0	0	0		C
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0		C
Days with Minimum Temperature: Days with Minimum Temperature:														
> 0 °C	0	0	0	0	0.95	17.9	31	27.7	14	0.71	0	0		C
<= 2 °C	31	28.3	31	30	30.8	20.7	2.7	7.6	22.7	30.9	30	31		C
<= 0 °C	31	28.3	31	30	30.1	12.1	0	3.3	16	30.3	30	31		C
< -2 °C	31	28.3	31	29.8	27.1	5.1	0	0.59	8.6	27.7	30	31		C
< -10 °C	30.9	28.2	30.9	28	12.8	0.09	0	0	0.39	14.6	28.6	30.9		C
< -20 °C	28.7	26.7	28.5	18.4	2	0	0	0	0	3.1	20	27.9		C
< - 30 °C	20.1	18	16.5	4.7	0.05	0	0	0	0	0.29	6.6	16.2		C
Days with Rainfall: Days with Rainfall:														
>= 0.2 mm	0	0	0	0.35	2.1	6.4	10.2	12.5	10.4	1.9	0.05	0		C
>= 5 mm	0	0	0	0.04	0.27	0.65	2.6	2.4	1.9	0.27	0	0		C
>= 10 mm	0	0	0	0	0.18	0.13	0.78	0.73	0.65	0.09	0	0		C
>= 25 mm	0	0	0	0	0	0.04	0.04	0.23	0.04	0	0	0		C
Days With Snowfall: Days With Snowfall:														
>= 0.2 cm	9.4	9.8	10.7	9.4	6.5	1.6	0.09	0.27	3.9	13.9	11.7	10.1		C
>= 5 cm	0.52	0.65	0.35	0.87	0.86	0.17	0	0.05	0.52	2.1	0.91	0.63		C
>= 10 cm	0.13	0.04	0	0.17	0.27	0.04	0	0	0.09	0.55	0.18	0.25		C
>= 25 cm	0.04	0	0	0	0	0	0	0	0	0	0	0.04		C

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Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Days with Precipitation: Days with Precipitation:														
>= 0.2 mm	8.6	9.1	10	8.9	7.3	7.4	10.2	12.6	12.9	14.5	10.7	9.4		C
>= 5 mm	0.3	0.22	0.17	0.52	1	0.83	2.6	2.4	2.3	1.7	0.18	0.33		C
>= 10 mm	0.04	0	0	0.13	0.45	0.17	0.78	0.73	0.74	0.32	0.05	0.08		C
>= 25 mm	0.04	0	0	0	0	0.04	0.04	0.23	0.04	0	0			
Days with Snow Depth: Days with Snow Depth:														
>= 1 cm	31	28.3	31	30	29.5	9.8	0.7	0	2.4	25.5	29.9	31		C
>= 5 cm	31	28.3	31	29.9	26.1	6.4	0	0	0.7	17.8	29.1	31		C
>= 10	31	28.3	31	29.8	22.8	3.1	0	0	0.39	11.4	25.7	31		C
>= 20	22.9	24.6	26.6	25.7	16.8	1.4	0	0	0.13	4.8	12	20.5		C
Wind: Wind:														
Speed (km/h)	19	18.5	15.6	13.4	13.9	14	14.4	15.5	16.8	17.4	16.8	18.2		C
Most Frequent Direction	SW	SW	SW	SW	E	E	E	E	E	SW	SW	SW		C
Maximum Hourly Speed	93	76	83	72	74	61	67	74	74	80	83	93		
Date (yyyy/dd)	1988/01	1978/08+	1980/03	1984/16	1986/28	1995/26	1991/25	1986/22+	2002/24	1982/27	1994/19	1983/25		
Direction of Maximum Hourly Speed	NW	S	NW	E	NW	NW	N	NW	NW	NW	NW	NW		
Maximum Gust Speed	106	106	106	83	89	74	81	83	85	89	100	104		
Date (yyyy/dd)	1988/01	1978/06	1980/03	1984/16	1986/28	1992/11+	1988/23	1984/10+	1983/28	1982/27	1994/05	1983/26		
Direction of Maximum Gust	NW	SW	NW	E	NW	W	NW	NW	NW	NW	NW	NW		
Days with Winds >= 52 km/hr	1.8	2.7	1.7	0.9	0.6	0.1	0.2	0.8	1.2	1.3	0.9	2.2		C
Days with Winds >= 63 km/hr	0.5	0.8	0.4	0.2	0.3	0	0	0.2	0.4	0.5	0.2	0.7		C

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Degree Days: Degree Days:														
Above 24 °C	0	0	0	0	0	0	0	0	0	0	0	0		C
Above 18 °C	0	0	0	0	0	0.6	3.1	0.8	0	0	0	0		C
Above 15 °C	0	0	0	0	0	1.8	12.3	5.7	0	0	0	0		C
Above 10 °C	0	0	0	0	0.1	13.8	60.3	37.7	2.3	0	0	0		C
Above 5 °C	0	0	0	0	1.9	56.7	178.7	129.1	20.6	0.3	0	0		C
Above 0 °C	0	0	0	0.3	14	160.6	332.2	274.9	100.3	5.2	0	0		C
Below 0 °C	855.2	783.1	782.7	510.1	177.8	6	0	0	15.8	225.4	581.5	790.4		C
Below 5 °C	1010.2	924.5	937.7	659.7	320.7	52.2	1.5	9.2	86.1	375.5	731.5	945.4		C
Below 10 °C	1165.2	1065.8	1092.7	809.7	474	159.2	38.1	72.8	217.9	530.2	881.5	1100.4		C
Below 15 °C	1320.2	1207.2	1247.7	959.7	628.9	297.3	145.1	195.8	365.6	685.2	1031.5	1255.4		C
Below 18 °C	1413.2	1292	1340.7	1049.7	721.9	386	228.9	283.9	455.6	778.2	1121.5	1348.4		C
Bright Sunshine: Bright Sunshine:														
Total Hours		75.8	161.8	221.7	242.5	376.2	342.9	213.2	88.2	52.4	19.7			C
Days with measurable		18	25.8	25.8	25.9	28.6	29.4	27.4	21.1	15.9	9.1			C
% of possible daylight hours		34.8	44.8	47.2	38	52.3	48.7	39.5	22.1	18.1	12.8			C
Extreme Daily	5.2	8.4	12.9	17.2	22.9	24	24	19.1	14.1	10.5	6.4	1		C
Date (yyyy/dd)	1998/30	1980/27	1997/28	1994/28	1985/31	1981/09+	1982/05+	1987/01	2000/01	1988/02	2000/05	1981/01		
Humidex: Humidex:														
Extreme Humidex	0.3	-1.7	-0.3	7.9	19.8	30.3	36.8	36.8	22.7	12.3	2.2	-1.5		
Date (yyyy/dd)	1981/16	1980/07	1999/22	1995/28	1994/24	1996/25	1989/15	1992/02	1994/01	1988/06	1983/03	1999/24		
Days with Humidex >= 30			0	0	0	0	0.5	0.2	0	0	0	0		C
Days with Humidex >= 35			0	0	0	0	0.1	0	0	0	0	0		C
Days with Humidex >= 40			0	0	0	0	0	0	0	0	0	0		C

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Wind Chill: Wind Chill:														
Extreme Wind Chill	-64.3	-64.4	-65	-54.4	-39.7	-15.6	-6.2	-11.8	-22.9	-46.5	-54.1	-61.5		
Date (yyyy/dd)	1990/26	1985/21	1979/05	1979/04	1983/04	1978/09	1985/21	1995/29	1992/25	1996/27	1985/25	1984/09		
Days with Wind Chill < -20	30.7	28.1	30.4	25.5	7.8	0	0	0	0.2	10.5	27.1	30.7		C
Days with Wind Chill < -30	28.4	25.3	27.2	14.7	1.2	0	0	0	0	2.4	18.8	27.1		C
Days with Wind Chill < -40	22.3	18.9	17.2	4.6	0	0	0	0	0	0.2	8.1	18		C
Humidity: Humidity:														
Average Vapour Pressure (kPa)			0.1	0.2	0.4	0.7	1	0.9	0.6	0.4	0.1	0.1		C
Average Relative Humidity - 0600LST (%)			78.4	82.8	87.4	84.1	81.9	87.7	88.8	87	81.5	78		C
Average Relative Humidity - 1500LST (%)			78.4	83	84.1	71.2	64.2	68.4	75.9	84.9	81.1	78.3		C
Pressure: Pressure:														
Average Station Pressure (kPa)	101.6	101.7	101.8	101.8	101.7	101.2	101.1	101	101	101.2	101.4	101.5		C
Average Sea Level Pressure (kPa)	101.9	102	102.1	102.1	102	101.5	101.4	101.3	101.3	101.5	101.7	101.8		C
Visibility (hours with): Visibility (hours with):														
< 1 km	21.2	29.8	18.6	23.6	27.9	9	11.1	5.9	4.8	9.1	11.8			D
1 to 9 km	138.3	129.8	122.9	101.1	74.9	23.2	26	27.7	45	106	97.9			D
> 9 km	584.6	518.1	602.5	595.3	641.2	687.8	706.9	710.4	670.2	628.9	610.3			D
Cloud Amount (hours with): Cloud Amount (hours with):														
0 to 2 tenths	298.4	261.5	290	240.6	171	188.4	146.1	111.1	80.2	105.5	200.2			D
3 to 7 tenths	136	130.8	132.5	120.3	106.3	151.6	181	155.6	105.7	89.9	140.8			D
8 to 10 tenths	309.6	285.4	321.5	359.1	466.7	380.1	416.9	477.4	534.1	548.6	379.1			D

Appendix B
Climatological Information
For Kugluktuk Nunavut

Summary of 2005 Monthly Climatological Information

KUGLUGTUK A
NUNAVUT

Latitude: 67° 49' N **Longitude:** 115° 8' W **Elevation:** 22.60 m

Climate ID: 2300902 **WMO ID:** 71938 **TC ID:** YCO

Monthly Data Report for 2005

Month	Mean Max Temp °C	Mean Temp °C	Mean Min Temp °C	Extr Max Temp °C	Extr Min Temp °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow Grnd Last Day cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
Jan	-22.5	-26.7	-30.9	-5.1	-41.8	0.0	36.0	8.0	21		
Feb	-27.1	-30.8	-34.5	-20.2	-39.6	0.0	9.7	1.5	22		
Mar	-20.7	-25.4	-30.0	-8.2	-39.4	0.0	23.2	3.7	24		
Apr	-8.2	-12.8	-17.4	3.5	-31.2	0.2	33.0	13.5	17		
May	-0.6	-5.3	-10.0	12.1	-19.4	2.4	1.8	3.2	T		
Jun	9.7	5.2	0.6	23.9	-3.1	38.7	T	38.7	0		
Jul	12.6	8.5	4.3	26.2	0.2	69.2	T	69.2	0		
Aug	12.9	8.7	4.4	23.0	-2.2	49.4	0.0	49.4	0		
Sep											
Oct											
Nov											
Sum						159.9	103.7	187.2			
Avg	-3.7	-6.6	-9.5								
Xtrm				26.2	-41.8						

Appendix C
Testpit Logs

Test Pit Logs

TP-1

0 – 0.1 m	Organic layer – black, damp with fine roots
0.1 – 0.8 m	Sand – well sorted, damp to wet., medium grained. Water seepage at 0.5 m below surface.

TP-2

0 – 0.2 m	Organic layer – black, damp with fine roots
0.2 – 0.9 m	Sand – well sorted, medium grained, loose, damp. Clumps of black organics scattered in the san making up approximately 10 percent
0.9 m	Permafrost

TP-3

0 – 0.2 m	Organic layer – black, damp with fine roots
0.2 – 0.8 m	Sand – slightly silty, light brown, well sorted, medium grained, loose, small patches of dark organics within sand, damp to wet. Water seepage into test pit at 0.4 m below surface.

TP-4

0 – 0.1 m	Organic layer – black, damp with fine roots
0.1 – 0.9 m	Sand – light brown, medium – grained, well sorted, damp to wet. Occasional small clump of organics

Sample collected from 0.5 m for geotechnical analysis

TP-5

0 – 0.1 m	Organic layer – black, damp with fine roots
0.1 – 0.8 m	Sand – brown, medium grained, well-sorted, damp, water seepage at approximately 0.7 m. Patches of black damp organics as 0.1 to 0.2 m sized clumps within the sand. Sample collected from 0.5 m for geotechnical analysis.
0.8 m	Permafrost

TP-6

0 – 0.1 m	Organic layer – black, damp with fine roots
0.1 – 0.8 m	Sand – light brown, damp, well sorted, medium grained. Water seepage at 0.7 m
0.8 m	Permafrost

TP-7

0 – 0.1 m	Organic layer – black, damp with fine roots
0.1 – 0.8 m	Sand – light brown, medium, grained, damp, loose, sides caving. Water seeping in at 0.7 m below surface

Sample collected from 0.5 m for geotechnical analysis

TP-MSW-1

0 – 0.2 m	Organic layer – black, damp, turf roots
0.2 – 0.8 m	Sand – well sorted, medium grained, loose, damp to wet. Water infill test pit to 0.2 m below surface. No evidence of landfill impacts
0.8 m	Permafrost

Collected soil sample for geotechnical analysis at 0.5 m. Collected groundwater water sample (MSW-1) for laboratory analysis.

TP-MSW-2

0 – 0.1 m	Organic layer – black, damp with turf roots
0.1 – 0.9 m	Sand – well sorted, medium grained, loose, damp. Water seepage fills test pit to 0.4 m. No evidence of any landfill related impact
0.9 m	Permafrost

Soil sample collected for geotechnical analysis at 0.5 m. Groundwater sample (MSW-2) collected for laboratory analysis.

TP-8

0 – 0.1 m	Organic layer – black, damp
0.1 – 0.8 m	Sand – medium grained well sorted, loose, damp to wet
0.8 m	Permafrost

TP-CON-1

0 – 0.1 m	Organic layer – disrupted by previous surface disturbance
0.1 – 0.9 m	Sand with gravel – fine to coarse grained sand with scattered fine to coarse gravel and occasional cobble. Poorly sorted mixture of glacial deposition of a variety of rock types. Damp, loose, well drained to 0.5 m below surface. Water seepage at 0.5 m below surface
0.9 m	Permafrost

Dug next to contaminated soil stockpile. No evidence of staining, odours or impacts from the stockpiles.

Appendix D

Geotechnical Evaluation

alston associates inc.
consulting engineers

geotechnics
construction materials testing

1 May 2006

Ref. No. 05-090

R.J. Burnside & Associates
15 Townline
Orangeville, Ontario
L9W 3R4

Att: Jim Walls, P.Geo.

Subject: Design and Selection
Construction Material
Retaining Berm
Kugluktuk, Nunavut

Alston Associates Inc. has carried out a review of information provided with regard to the design of a retaining berm that will enclose a sewage lagoon for the community of Kugluktuk. A preliminary design for the berm involves the use of local sandy materials that will be laid and compacted to a height of 3 to 4 m, with the side slopes of the berm being profiled to a gradient of 33% (1V:3H).

Source Materials

The source materials for the berm construction will consist of local sand soils. These primarily consist of medium grain sand. The results of grain size distribution tests carried out on selected samples of this source material are given in Figure Nos. 3 to 9 inclusive. Standard Proctor laboratory compaction tests have been carried out on two samples of this material and the results are reported in Figures 1 and 2. These show a standard Proctor maximum dry density of about 1650 to 1670 kg/m^3. This is a relatively low value of maximum dry density and reflects the poor grading of the sand soil. Using published correlation data for angle of internal friction and density, these tests indicate an angle of internal friction of the soil of about 30°, when it is densely compacted.

Berm Stability

It is understood that the medium sand soil which was subject to grain size distribution and standard Proctor laboratory compaction tests will also provide the supporting base for the constructed berm. It is our expectation that the shear strength of the native soils will be characterized by a 28 to 30° friction angle. On this basis, and presuming that the berm will be constructed using uniformly and densely compacted sand soils, the factor of safety of the berm with respect to global shear failure is expected to be greater than 1.5, on the

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basis that the berm is unsaturated. The Design Brief regarding the berm which was provided to this company indicates that there will be an impermeable polymeric liner laid on the inner face of the retaining berm. Provided that the liner is properly constructed, saturation of the berm is not expected to occur. In this context, it is understood that the area is dry and the precipitation is modest, the source material is permeable and non frost-susceptible. It is expected that the polymeric liner will extend over the entire inner face of the berm from the crest to the toe and will be laid horizontally within the sewage treatment lagoon for a sufficient horizontal width such that piping and internal erosion will not occur in the foundation soil for the berm. It is reasonable to expect that, over a period of time, the central portion of the berm will become frozen and this will reduce the permeability of the soils. At least the near surface zone of the berm will experience freeze-thaw on an annual basis.

The surface of the berm must be protected from erosion by either natural occurrences or by site traffic. This may involve rockfill placed on a sheet of suitable needle punched non-woven geotextile, or other surfaces which are appropriate to the local conditions.

Berm Construction

In order to provide satisfactory performance of the berm throughout its service life, the medium sand soil which is to be used for berm construction must be laid in appropriate lifts and thoroughly, uniformly and densely compacted such that the anticipated shear strength characteristics of the material (friction angle of 30°) will be attained in the compacted fill material. The thickness of each lift and the number of passes which are required to achieve satisfactory compaction will depend on the compaction equipment being used, and the manner of its use. It is expected that the compaction methodology will be determined in a field trial on a test strip of the material. In this context, it is expected that conventional compaction equipment will be used to effect uniform and thorough densification of the sand fill. Assuming that say, an 8 tonne smooth drum roller were to be used for compaction, it is reasonably probable that the berms could be constructed using 300 mm thick lifts with four to six passes of the roller operating at full impact energy and travelling at a speed of not more than 5 km/h being applied to each lift. This test strip will be carried out under engineering control and supervision.

Monitoring of compaction in the fill will be carried out using two methods.

Proctor Needle (ASTM D1558)

The Proctor Needle provides a rapid test in the field for determining the degree of compaction of the material. The test involves a measure of the resistance of the surface of a layer of fill to penetration by a standard needle, which compared to measures taken with that needle on a

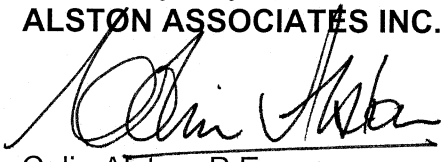
prepared sample of the material in the laboratory. This method is useful in the field for establishing control after a standard procedure for compaction has been established.

Soundings with Dynamic Cone Penetrometer (DIN Standard 4094)

The use of the dynamic cone penetration test (DCPT) carried out using standardized hand sounding equipment is useful in establishing penetration resistance values which can in turn relate to standard correlations to give reliable estimates of angle of internal friction of the soil which will in turn confirm design premises. The equipment that will be used on site involves a drop hammer with a mass of 10 kg, which free falls through a controlled height of 0.5 m. The hammer is used to drive standard rods with a length of 1 m which are scored at 0.1 m depth increments, and a cone with a projected area of 10 cm^2 is attached to the lead rod. The equipment applies a specific work per blow of 50 kJ/m. Soundings with the DCPT will be carried out in the test strip at the time of its construction and will be used in the course of constructing the berms to confirm the engineering properties of those construction materials.

Use of the standard test methods described above, together with an inspection of the construction of the berms to ensure that this work is carried out in conformance with data determined in the field trial, will provide the assurance that the design requirements of the berm are met.

Yours very truly,
ALSTON ASSOCIATES INC.



Colin Alston, P.Eng.

/jt

alston associates inc.
consulting engineers

EMAIL

Fax to	:	Jim Walls, R.J. Burnside & Associates Limited	Fax Number	:	(519) 941-8120
From	:	Jonathan Bond	Date	:	3 November 2005
Ref. No.	:	05-090	Page 1 of 9		
Subject	:	Laboratory Results Burnside File No. FEO 09754 Kugluktuk			

We enclose the Grain Size Distribution Test Reports and Standar Proctor Test Reports for the samples received in our office on 17 October 2005. Originals will follow by mail. Please note that hydrometers testing was not performed on the samples from test pits 4 and 7, as requested, as the tested material is too coarse. Hydrometers, therefore, are not necessary. Also, Atterberg limits were not performed on those same samples as the material is "not plastic".

If you have any questions please do not hesitate to contact our office.

Regards

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markham, ontario
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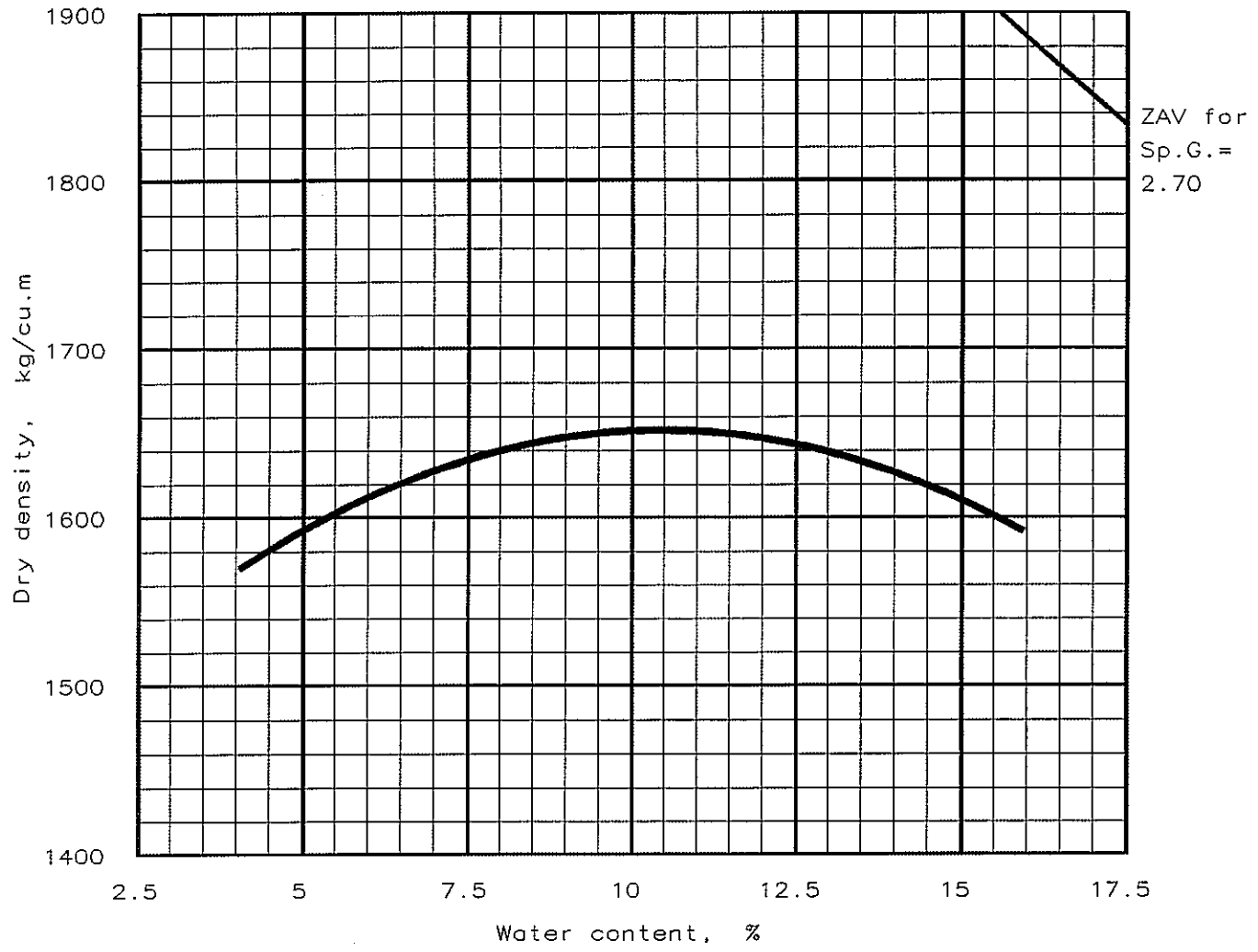
fax (905) 474-2825
e-mail alston@alston.ca

STANDARD PROCTOR TEST REPORT



Test specification: ASTM D 698-91 Method A, Standard
Oversize correction applied to each point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.70			0.00 %	

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 1652 kg/cu.m Optimum moisture = 10.5 %	1652 kg/cu.m 10.5 %	brown SAND

Project No.: 05-090
Project: Burnside Project # FEO 09754 Kugluktuk
Location: Test Pit 4

Date: 3 November 2005

Remarks:

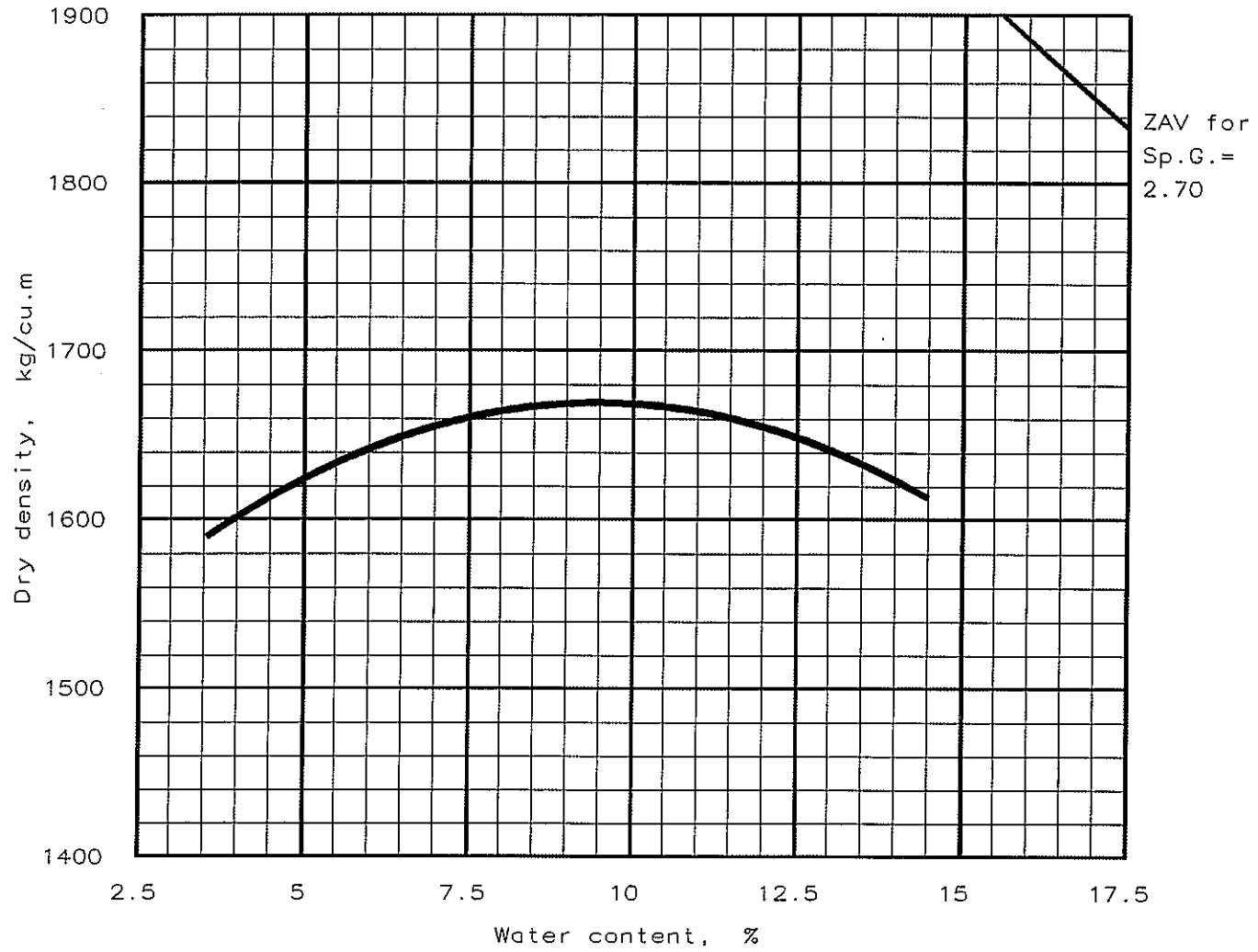
Prepared for:
Burnside Environmental

STANDARD PROCTOR TEST REPORT

alston associates inc.

Fig. No. 1

STANDARD PROCTOR TEST REPORT



Test specification: ASTM D 698-91 Method A, Standard
Oversize correction applied to each point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.70			0.00 %	

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 1670 kg/cu.m Optimum moisture = 9.5 %	1670 kg/cu.m 9.5 %	brown SAND

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
Location: Test Pit 7

Date: 3 November 2005

Remarks:

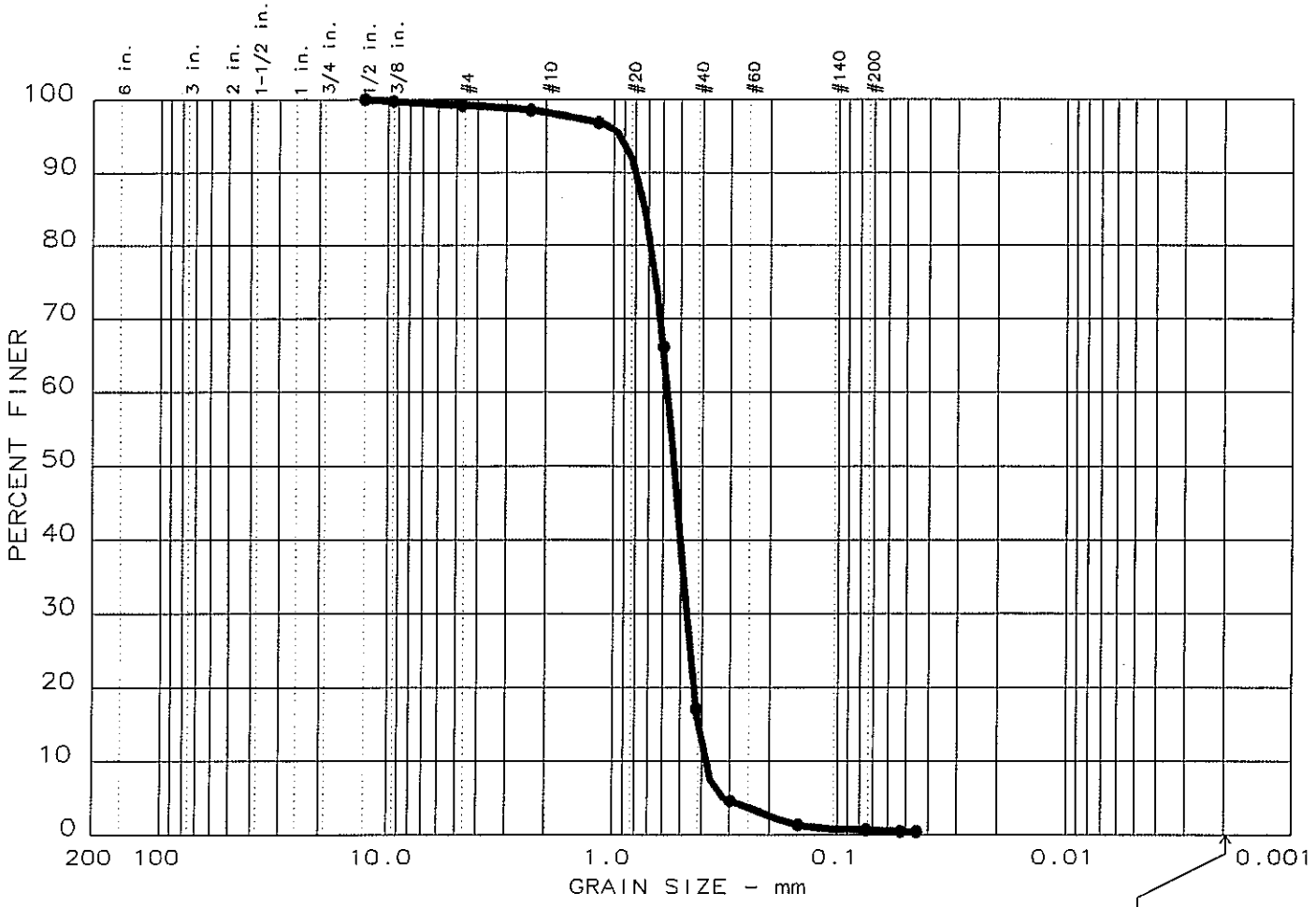
Prepared for:
Burnside Environmental

STANDARD PROCTOR TEST REPORT

alston associates inc.

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	1	0.0	0.8	98.5	0.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.73	0.57	0.54	0.471	0.4150	0.3868	1.00	1.5

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND		

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
● Location: G0V-1

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

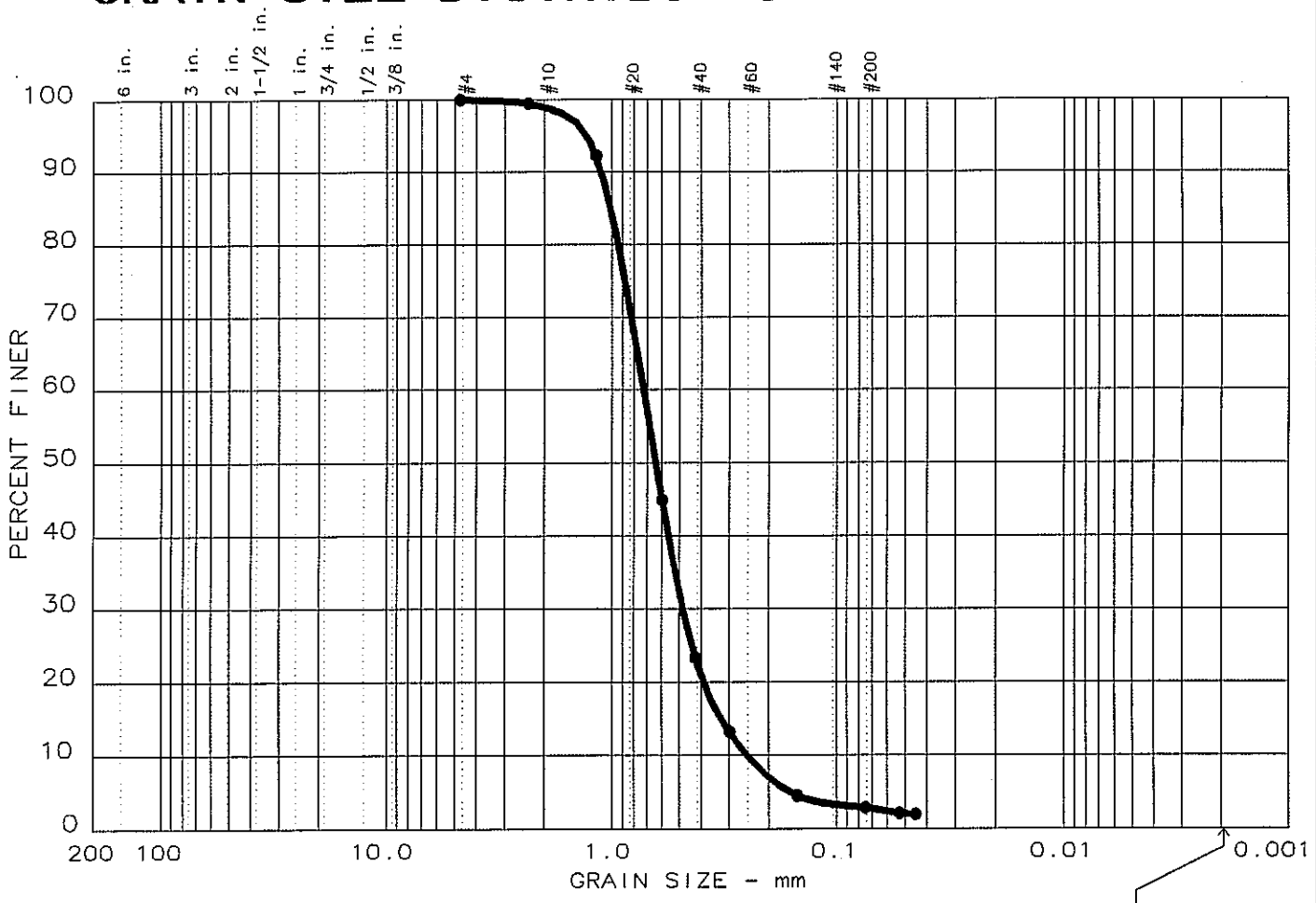
Remarks:

Prepared for:

Burnside Environmental

Figure No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	2	0.0	0.0	97.2	2.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			1.02	0.72	0.64	0.483	0.3262	0.2475	1.30	2.9

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, trace silt		

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
● Location: MSW-1

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

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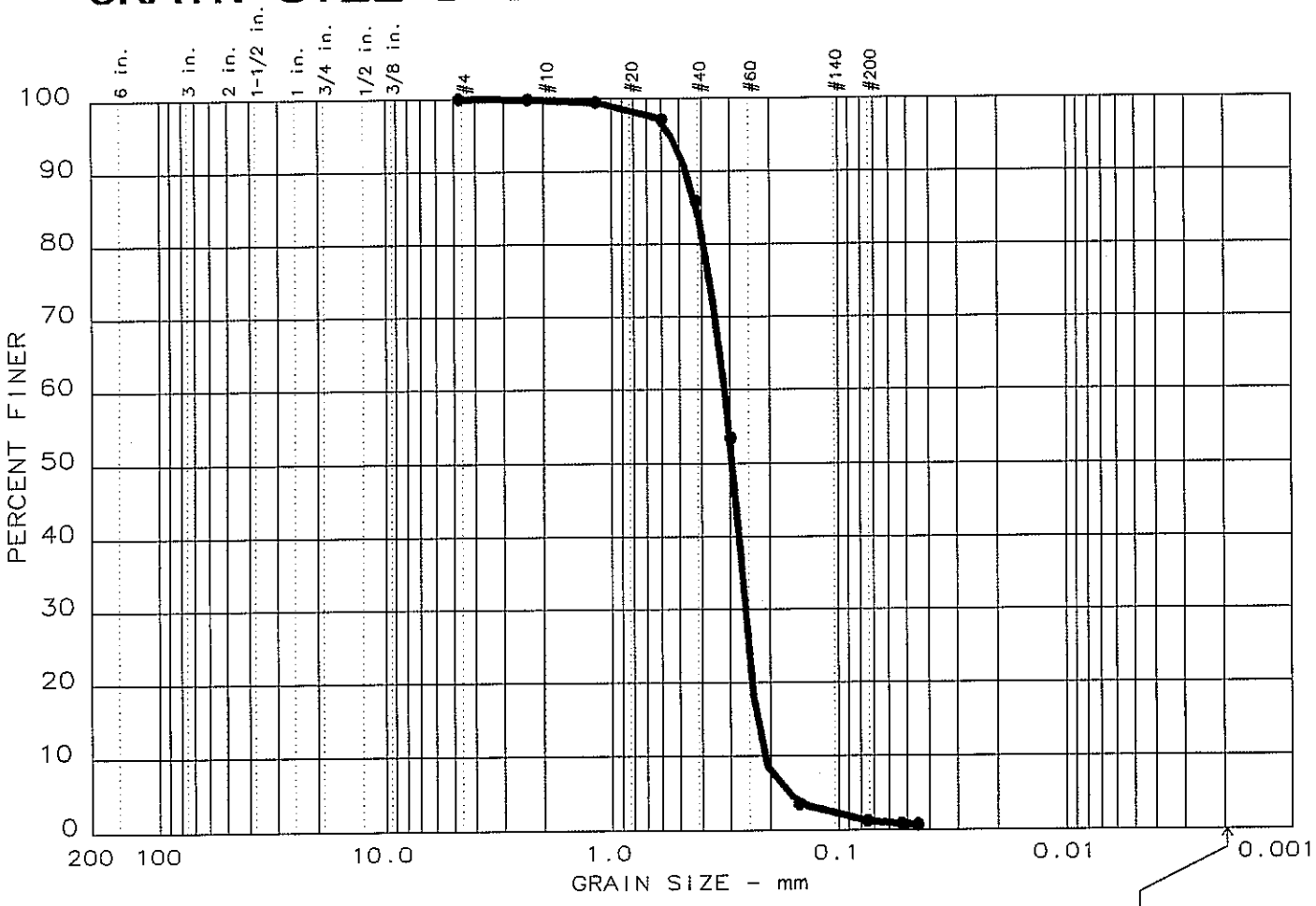
Remarks:

Prepared for:

Burnside Environmental

Figure No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	3	0.0	0.0	98.8	1.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.42	0.32	0.29	0.257	0.2331	0.2226	0.94	1.4

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, trace silt		

Project No.: 05-090
Project: Burnside Project # FEO 09754 Kugluktuk
● Location: MSW-2

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

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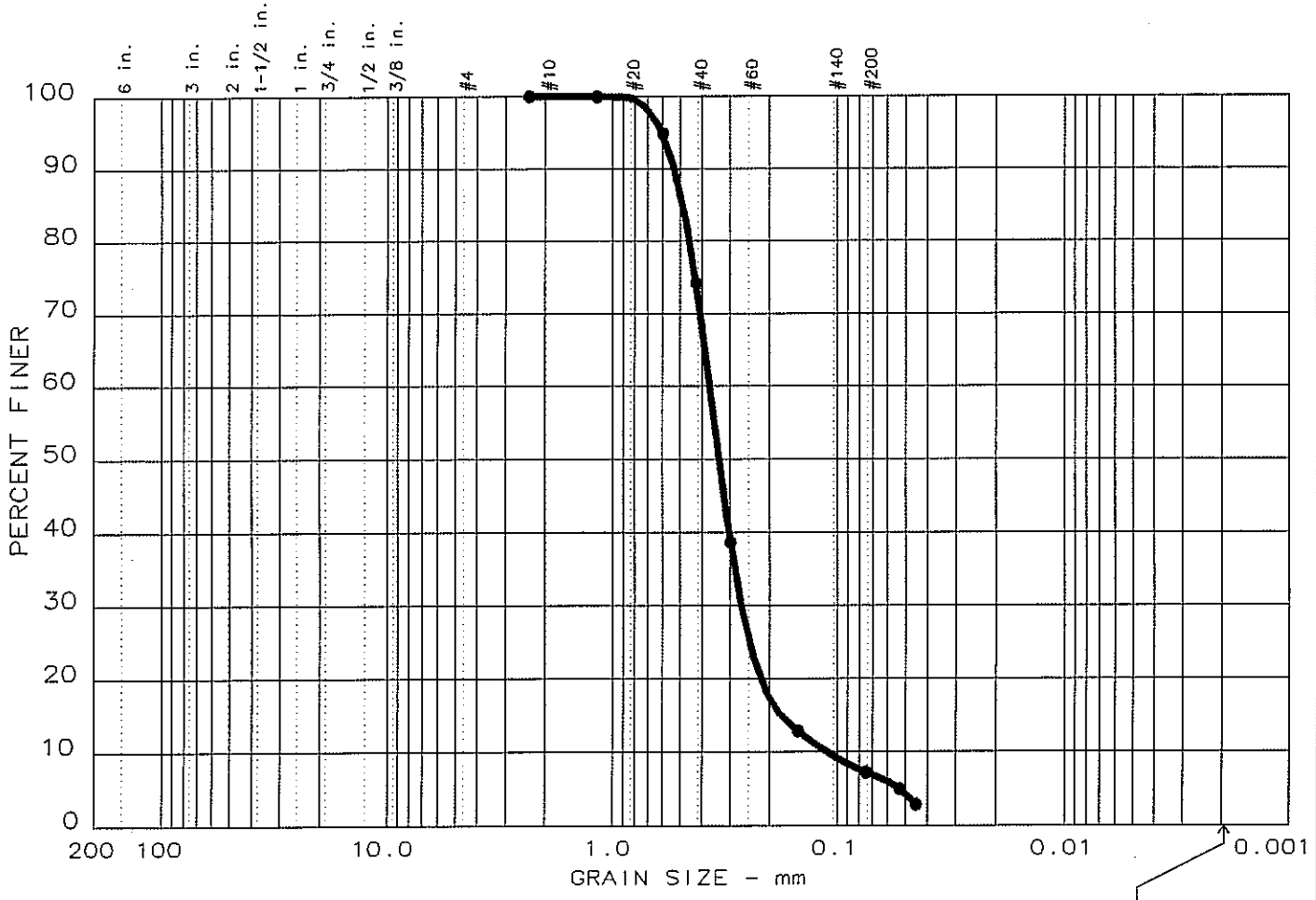
Remarks:

Prepared for:

Burnside Environmental

Figure No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	4	0.0	0.0	92.8	7.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.49	0.37	0.34	0.268	0.1770	0.1104	1.76	3.3

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, trace silt		

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
● Location: Test Pit 3

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

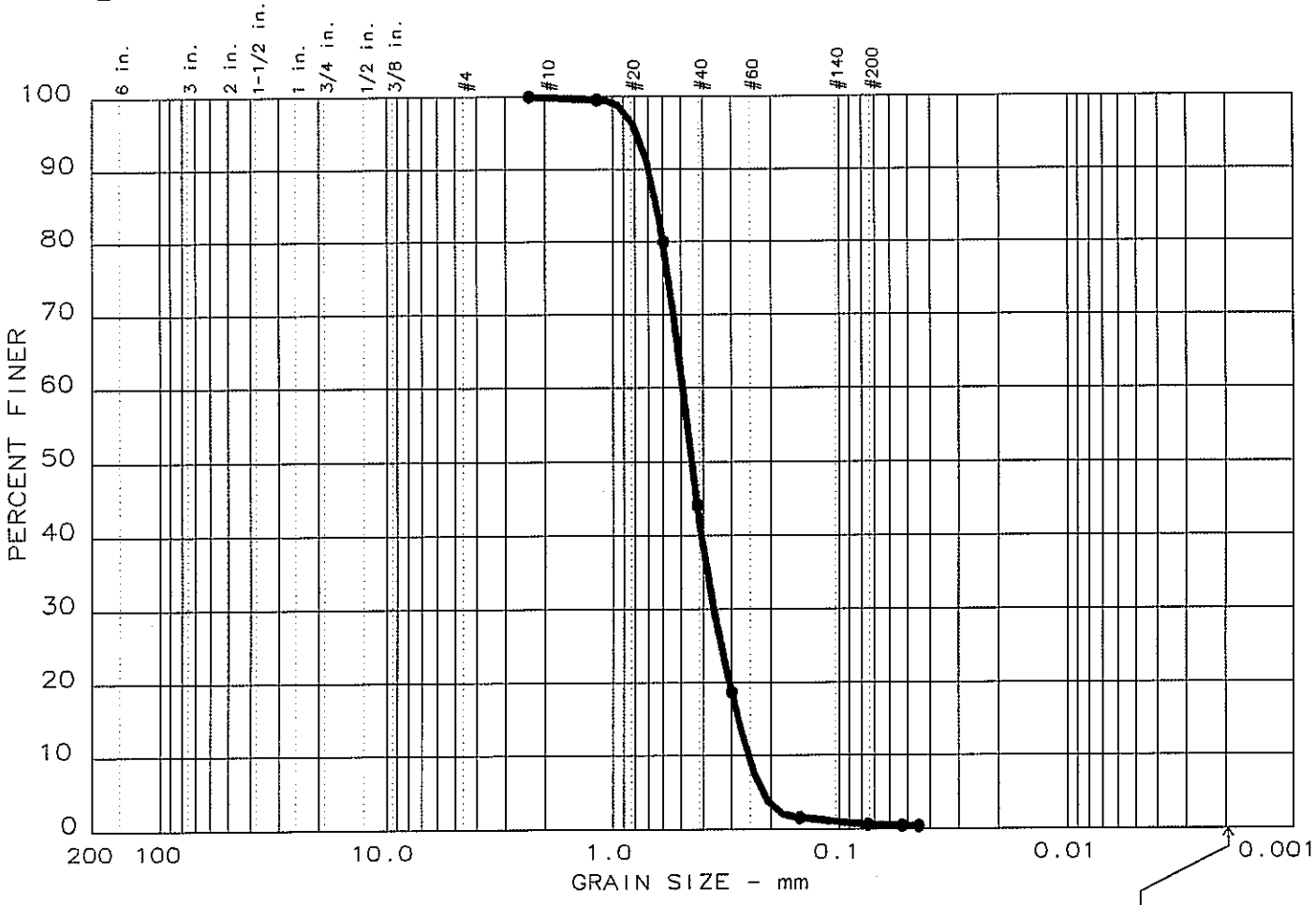
Remarks:

Prepared for:

Burnside Environmental

Figure No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	0.0	99.4	0.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.64	0.49	0.45	0.359	0.2799	0.2523	1.03	2.0

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND		

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
● Location: Test Pit 4

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

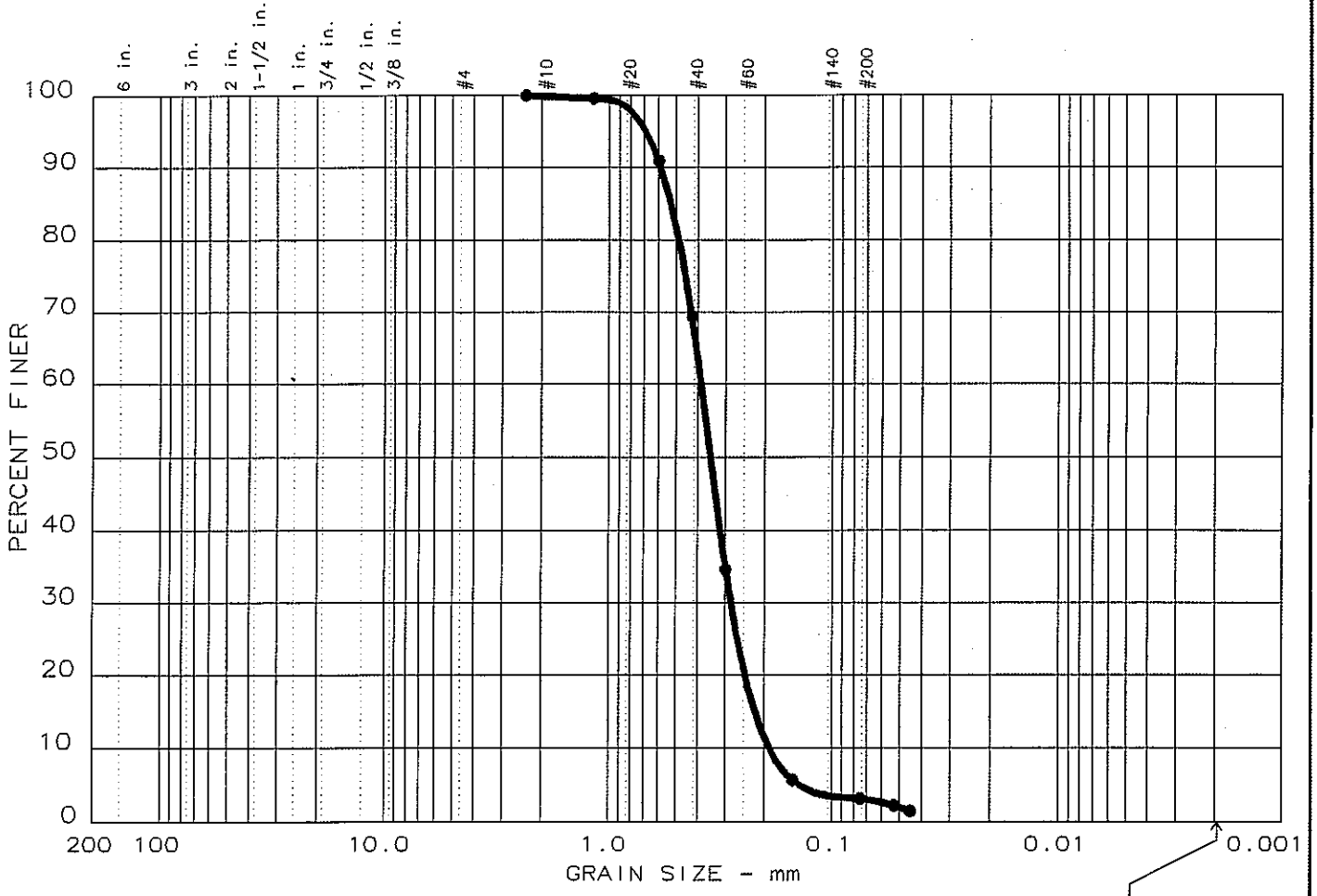
Remarks:

Prepared for:

Burnside Environmental

Figure No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	0.0	96.9	3.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.53	0.39	0.35	0.284	0.2203	0.1897	1.10	2.0

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, trace silt		

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
● Location: Test Pit 5

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

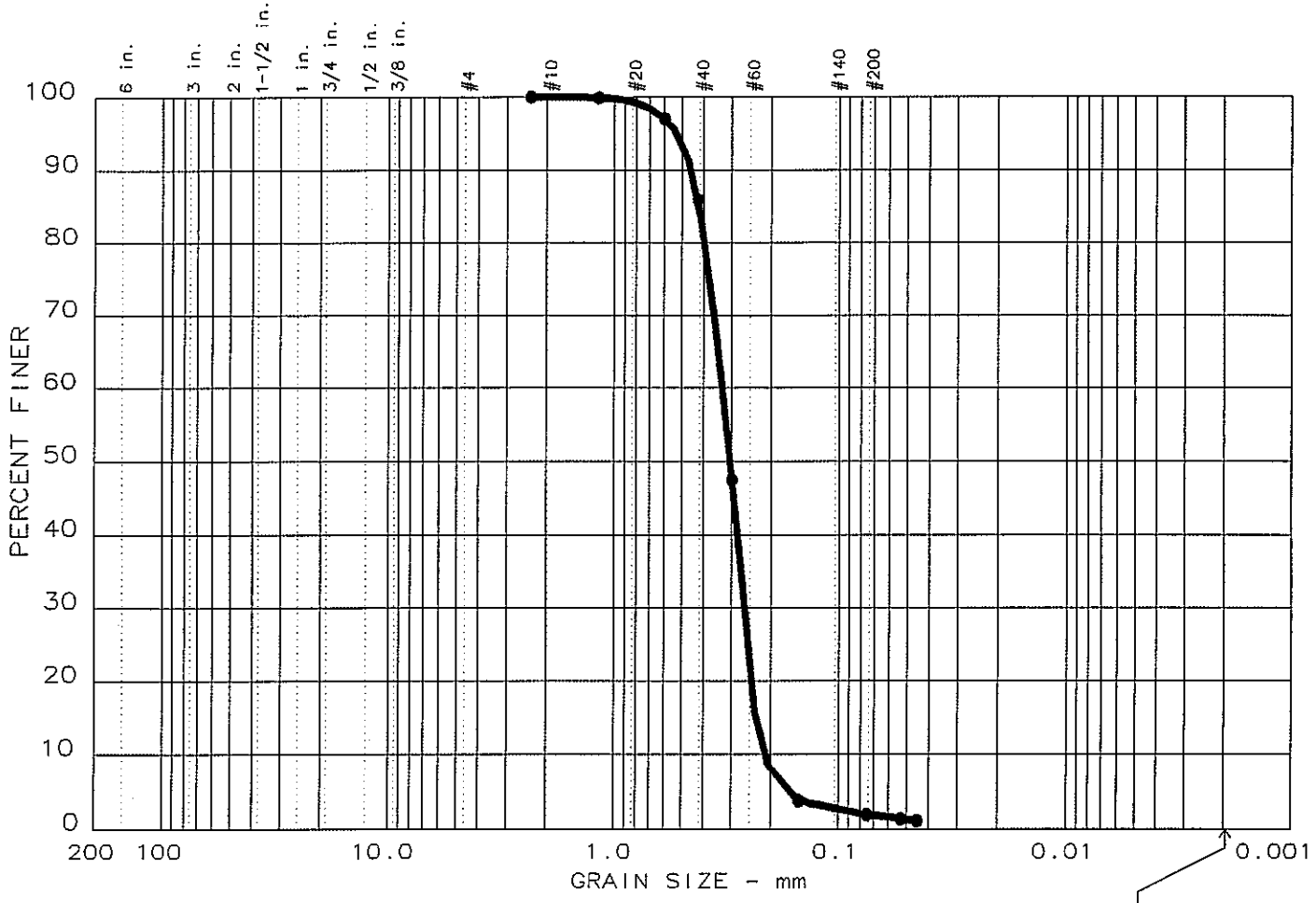
Remarks:

Prepared for:

Burnside Environmental

Figure No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	0.0	98.1	1.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.42	0.33	0.31	0.262	0.2342	0.2236	0.93	1.5

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, trace silt		

Project No.: 05-090
Project: Burnside Project # FE0 09754 Kugluktuk
● Location: Test Pit 7

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

Remarks:

Prepared for:

Burnside Environmental

Figure No. 9

Appendix E
Detailed Design Calculations

DETAILED DESIGN CALCULATIONS OF NEW SEWAGE LAGOON

SEWAGE NEW LAGOON DIMENSIONS

d = depth of the lagoon	=	4	m
SS = slope of the sides of the lagoon	=	3	
ES = slope of the ends of the lagoon	=	3	
L = Length of the top of the lagoon	=	223	m
W = Width of the top of the lagoon	=	223	m
F = Freeboard Allowance	=	1	m
EXS = Esternal Slope	=	2	:1

Calculations

V = Total Volume New Lagoon	=	178276	m^3

Assume

2 m Berm top width around perimeter

BERM DETAILS	=	32	[metres^2]/m
Length Berm	=	7136	m^3
Width Berm	=	7136	m^3
Total Berm	=	28544	m^3

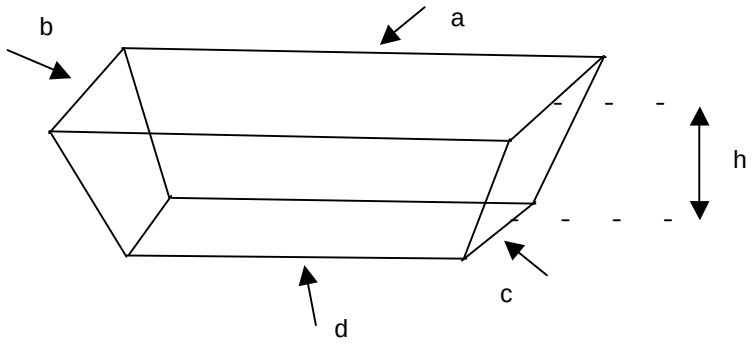
USABLE LAGOON CAPACITY DIMENSIONS

Usable Depth =	=	3	m
Top Length, L	=	217	m
Top Width, L	=	217	m
Bottom Length, BL	=	199	m
Bottom Width, BW	=	199	m

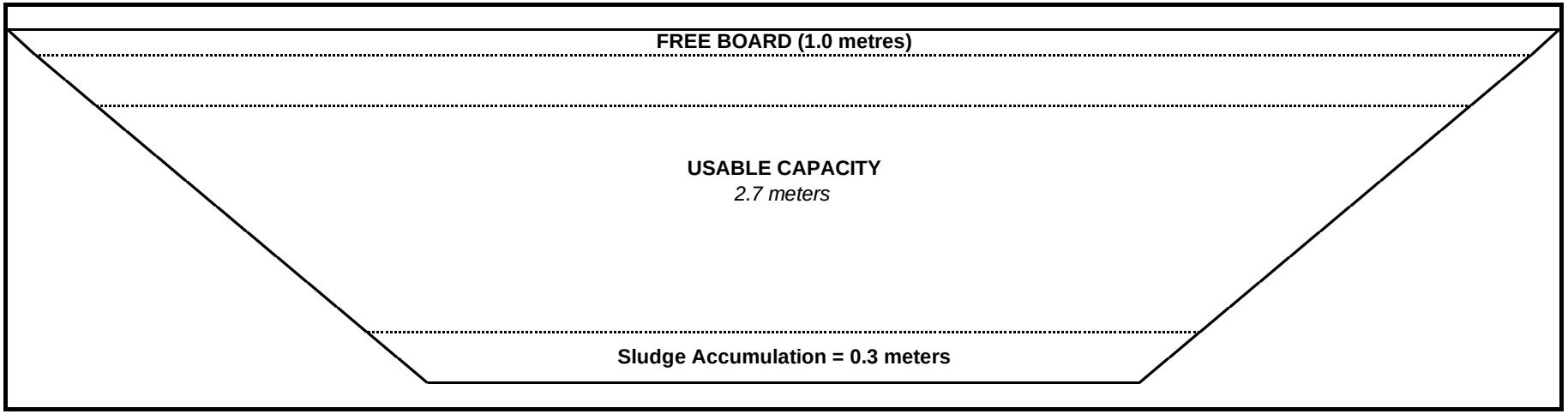
Calculations

V = Total USABLE Volume New Lagoon	=	**129873**	**m^3**

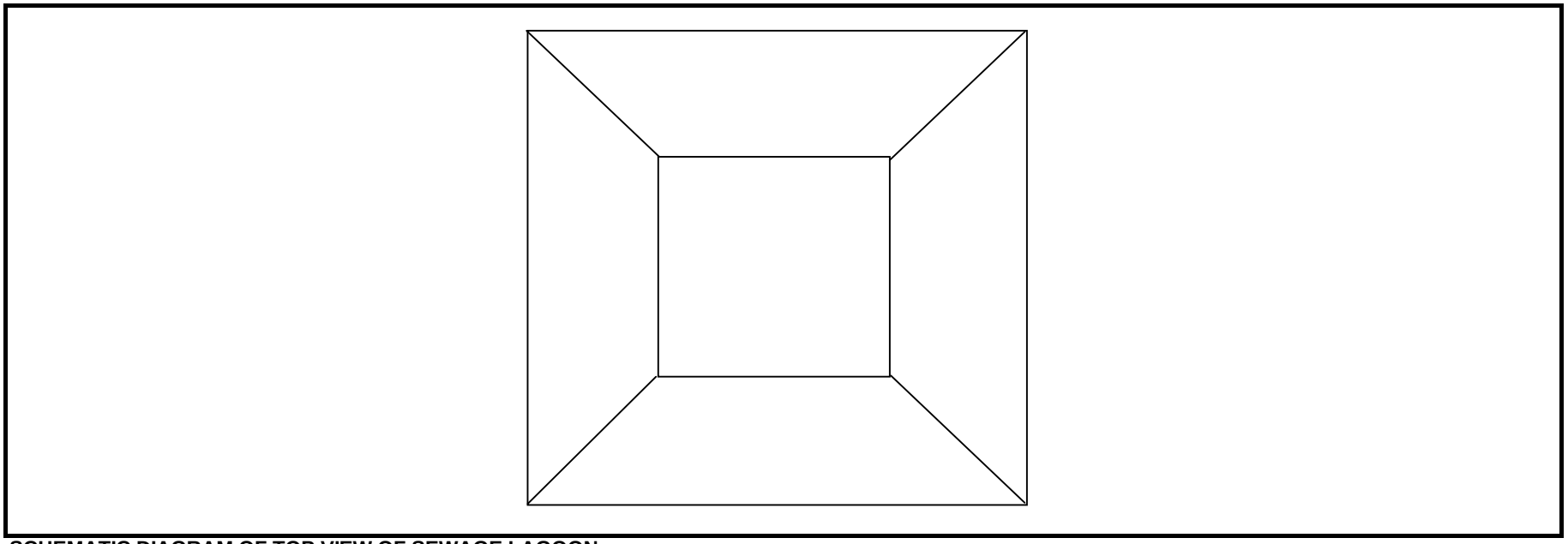
Volume = $^1/_3$h(ab + cd + (ab)(cd))



SCHEMATIC DIAGRAMS OF SEWAGE LAGOON



SCHEMATIC DIAGRAM OF CROSS-SECTIONAL VIEW OF SEWAGE LAGOON



SCHEMATIC DIAGRAM OF TOP VIEW OF SEWAGE LAGOON

J:\2006\F\NUNA\09754\Detailed Design Report\Appendix E\[Detailed Design Calculations.xls]Diagram

Appendix F
Wetland Treatment Predictive Model

Appendix F
Alberta Department of the Environment
Wetland Treatment Predictive Model

Assumptions

- Total year 20 discharge (including sewage and precipitation falling into the lagoon) - 128,073 m^3

- Expected sewage lagoon effluent quality prior to wetland treatment in year 2026, assuming 25 percent carbon removal efficiency:

BOD	222 mg/l
TSS	237 mg/l
T-PO_4	11 mg/l
TKN	59 mg/l
Fecal Coliforms	4.7E07 CFU/100ml

- Nunavut guideline requirements for final effluent quality at discharge from the sewage treatment system

	Current Guidelines	**Anticipated Guidelines**
BOD mg/l	120	45
TSS mg/l	180	45
T-PO_4 mg/l	-	1
TKN	-	10
Fecal Coliforms CFU/100 ml	1,000,000	2,000

- Based on Kugluktuk climate data (Appendix A) the average temperature of the period June through September is 6.9ºC. For conservative calculations purposes 5ºC will be used in the predictive model

- Average daily discharge to the wetland during the 120 day biologically active period (June through September) is 1,067 m^3/day

- The wetland predictive model was designed for 20ºC. To account for an average temperature of 5ºC the Area Rate Constant has been charged as follows:

Parameter Area Rate Constant

	@ 20ºC	**@ 10ºC**	**@ 5ºC**
BOD	1,000	500	250
TSS	34	17	8.5
T-PO_4	12	6	3
TKN	22	11	5.5
Fecal Coliforms	77	38.5	19.25

Surface Flow Wetland Treatment - Preliminary Feasibility Calculations

Based upon:
- Predicted effluent volume in year 20
- Predicted effluent chemistry in year 20
- Anticipated future guideline requirements.

Predictive Model

$$\text{Required Area (ha)} = \frac{0.0365Q}{k} * \ln((Ci - C^*) / (Ce - C^*))$$

Design Flow (m^3/day) **Q= 1067**

	TSS	BOD	T-PO_4	TKN	FC
Design Flow (Q)	**1067.00**	**1067.00**			
Wastewater Characterization (Ci)	237.00	222.00	11.00	59.00	4.70E+07
Target Effluent Quality (Ce)	45.00	45.00	1.00	10.00	2.00E+02
Wetland Background Input (C*)	**22.73**	**15.27**	0.05	2.00	100.00
Area Constant at 5°C (k)	250.00	8.50	3.00	5.50	19.25
Required Treatment Area (ha)	**0.35**	**8.88**	**31.74**	**13.90**	**26.42**

for TSS, C* **22.73**
for BOD, C* **15.27**

Predictive model from a "Guidelines for the Approval and Design of Natural and Constructed Treatment Wetlands for Water Quality Improvement", Alberta Department of the Environment, Program Development Branch, Environmental Services Division, March 2000.

Appendix G
Operation and Maintenance Plans

Appendix G1

Sewage Lagoon

Sewage Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Kugluktuk, Nunavut

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175, 25 Third Avenue Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

June 2006

File No: N-O 09755

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Figures

Appendices

1.0 Introduction

The Hamlet of Kugluktuk (formerly known as Coppermine), is situated on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River, at latitude 67°49'N, longitude 115°06'W, as shown on Figure 1.

The community has a population of approximately 1,362, with an approximate 1.5 percent projected growth rate. Community infrastructure includes:

- A water treatment plant, which draws water from the Coppermine River and stores it for treatment
- Trucked water to holding tanks in each building
- A sewage lagoon which receives trucked sewage collected from holding tanks in each building
- Sewage treatment via an exfiltration lagoon to a wetland discharging north to the ocean
- A solid waste disposal facility, which includes a bulky metals disposal area, a contaminated soil pile, a waste oil and liquid waste storage area, and a battery and other materials storage area
- Several rock and sand quarries
- Diesel powered generators
- Two wind generators (one partially dismantled and the other currently off-line)
- Barge landing area.

The Hamlet of Kugluktuk is predominately residential with a few small commercial establishments including a hotel, several construction and contracting businesses, grocery store, and a variety of other small businesses. Hunting and fishing in the traditional manner is still a prime occupation for many of the inhabitants. Community buildings include a high school, an elementary school, arena, swimming pool, Hamlet office, public works yard, GN offices, and a police station.

With regard to the weather, Kugluktuk is affected by Arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The mean annual air temperature is -12°C. Monthly averages range from -31°C in February to 10°C in July. Kugluktuk receives about 249 mm of precipitation per year, of which 134 mm falls as rain between June and September. Prevailing winds are from the east in summer and from the southwest in winter. The mean wind speed is approximately 15 km/hr. Climate details are included in Appendix A.

The Detailed Design Report (Nuna Burnside, 2006) for the Improvements to the Wastewater and Solid Waste Facilities determined the projected population, associated waste requirements and sewage generation rates using information from the Nunavut

Bureau of Statistics. The tables with the detailed calculations are available for inspection in Appendix B.

1.1 Purpose

The Hamlet of Kugluktuk operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB3KUG0308, dated July 15, 2003 (Appendix C). Part G, Section 1 requires that an Operation and Maintenance (O&M) Plan be submitted for the facilities in accordance with all applicable regulations and following applicable guidelines. This document is created based on the improvements proposed for the sewage treatment system, which an amendment and renewal to the NWB license is being requested.

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

2.0 Background Information on Hamlet Operations

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

The Sewage Treatment Facility operated by the Hamlet of Kugluktuk is located approximately 5 km from the Hamlet. Sewage is collected daily by truck from all the houses and occupied buildings with holding tanks, and discharged to the sewage lagoon located to the west-southwest of the community. The lagoon is located westwards heading out of the Hamlet along Coronation Drive. The Hamlet currently utilizes a facultative sewage lagoon originally designed to hold sewage for 365 days, with an annual discharge in mid-August. The existing unlined earthen lagoon was constructed in 2003 by the Hamlet staff during a heavy equipment operator course. (Figure 3). The current single-cell lagoon area is approximately 60 m x 40m with a depth of 2 m. The total volume is estimated to be 4,648 m^3. Sewage effluent from the lagoon discharges overland through a large wetland treatment area, to the Final Discharge Point into the Coronation Gulf, which is located approximately 2 km from the Initial Discharge Point of the sewage lagoon. The retaining berm of the lagoon is very permeable which allows rapid exfiltration of the sewage, so much so that the levels in the lagoon are not significantly above the natural surface water level in the drainage stream of the wetland area.

3.0 Operation and Maintenance of the Sewage Treatment Facility

Satellite imagery of the Sewage Treatment Facility operated by the Hamlet of Kugluktuk, which is described above, is provided in Figure 2 (Figure 6/Schematic Design Report). This Figure illustrates both the drainage pathway of the treatment wetlands and the proximity to adjacent water bodies that finally discharges to Coronation Gulf. The boundaries of the treatment wetland area are also illustrated in this figure.

In the event of emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1: Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Kugluktuk – SAO	Kugluktuk	(867) 982-6500	(867) 982-3060
Government of Nunavut (Regional Engineer)	Cambridge Bay	(867) 983-4125	(867) 983-4123
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Kugluktuk	(867) 982-2222	(867) 982-3407
RCMP Detachment	Kugluktuk	(867) 982-1111	(867) 982-3390
Community Health Center	Kugluktuk	(867) 982-4531	(867) 982-3115

3.1 Sewage Collection Procedures

The following sewage collection operational procedures shall be carried out by the staff of the Hamlet of Kugluktuk on a daily basis dependent upon weather conditions:

- Household and commercial sewage holding tanks will be pumped out using a vacuum truck and hauled to the Sewage Lagoon Storage Facility
- Sewage from the vacuum truck will be discharged to the Sewage Lagoon Storage Facility, via a flume designed to prevent erosion of the lagoon wall

- Daily waste volumes deposited to the Sewage Lagoon Storage Facility (and trip counts) shall be recorded on the recording form attached in Appendix D

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

3.2 Lagoon Operation Procedures

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

- Household and commercial sewage deposited to the Sewage Lagoon Storage Facility shall be decanted to the Wetland Treatment Facility via the outlet discharge piping over a 60-day period

- Decant operations shall occur between June 15th and October 1st, dependant on weather conditions

- The Hamlet of Kugluktuk shall advise an Inspector and the Nunavut Water Board at least 10 days prior to starting the decant operations of the wastewater lagoon

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

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

- Upon completion of decanting operations, the decant structure valve shall be closed and checked that flow has ceased, the lagoon berms inspected, and any required maintenance (as described below) performed.

3.3 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the staff of the Hamlet of Kugluktuk during periodic and seasonal maintenance operations at the Sewage Treatment Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and surface grading in the summer, and any defects to be repaired as necessary

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

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

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

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

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

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

- Desludging of the lagoons shall occur every 5 to 10 years or as required based on the determination of the sludge thickness.

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

3.4 Facility Monitoring Procedures

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

- Biological Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Conductivity
- Oil and Grease (OGG) (Visual)
- Magnesium (Mg)
- Sodium (Na)
- Chloride (C1)
- Total Hardness
- Faecal Coliforms (FC)
- pH
- Nitrate-Nitrite (NO_3-NO_2)
- Total Phenols (Total-P)
- Calcium (Ca)
- Potassium (K)
- Sulphate (SO_4)
- Total Alkalinity

- Ammonia Nitrogen (NH_3-N)
- Total Cadmium (Cd)
- Total Cobalt (Co)
- Total Chromium (Cr)
- Total Copper (Cu)
- Total Aluminum (Al)
- Total Mercury (Hg)
- Total Zinc (Zn)
- Total Iron (Fe)
- Total Manganese (Mn)
- Total Nickel (Ni)
- Total Lead (Pb)
- Total Arsenic (As)
- Total Organic Carbon (TOC)

Additional analytical parameters, which are identified in the NWB water license, or by an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* shall also have samples collected and analyzed.

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

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

3.5 Annual Reporting Procedures

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

4.0 References

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

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

Nuna Burnside Engineering and Environmental Ltd. January 2005. *Schematic Design for the Improvements to the Sewage Lagoon and Solid Waste Facility for the Hamlet of Kugluktuk.* Cambridge Bay, Nunavut.

Nunavut Water Board. 15 July 2003. *Hamlet of Kugluktuk Water License NWB3KUG0308*. Gjoa Haven, Nunavut.

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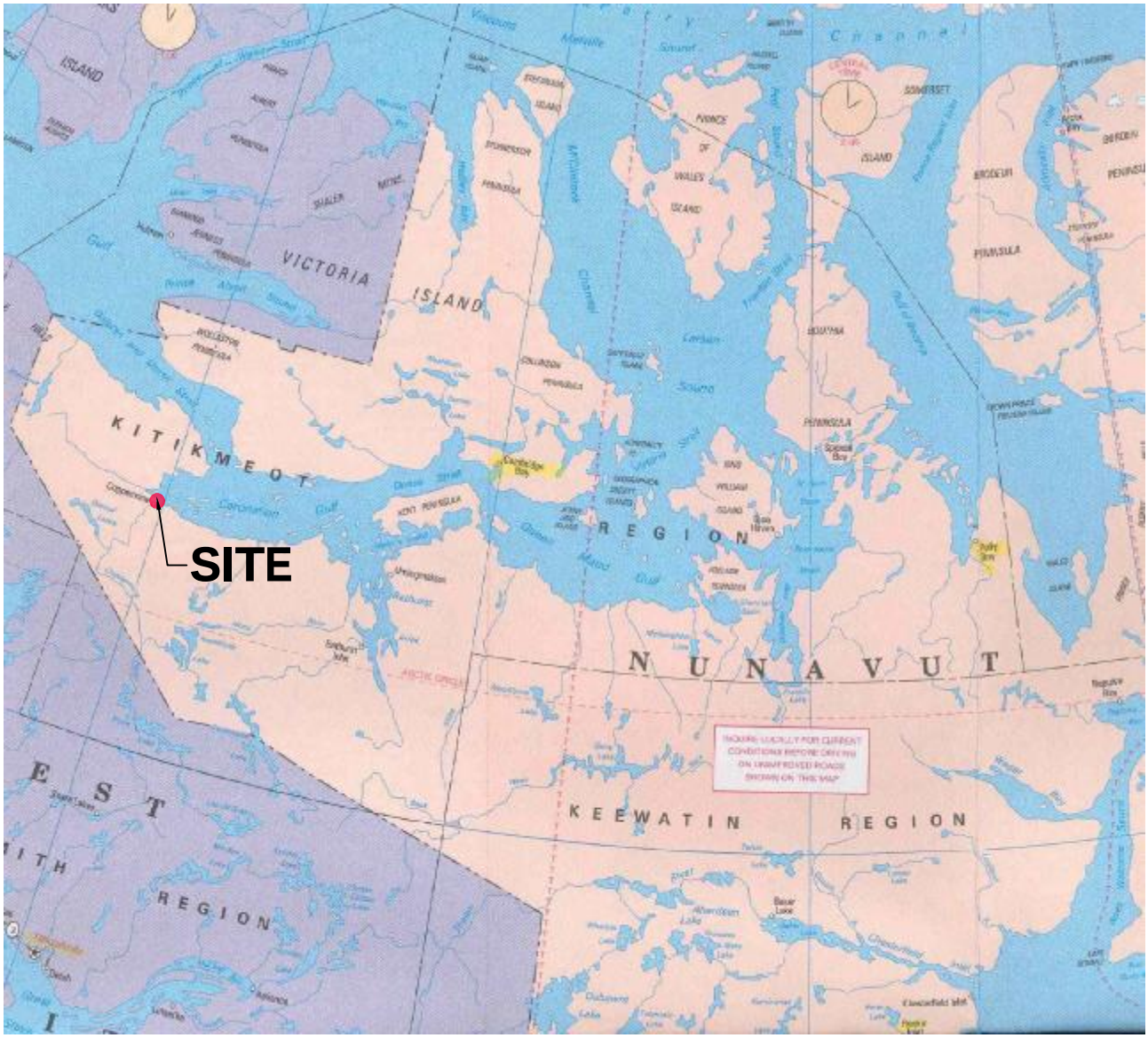
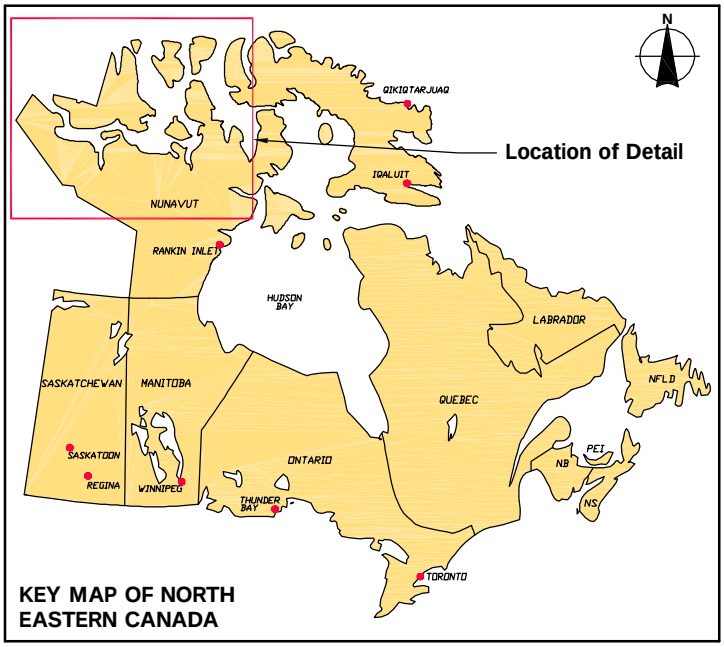
Figures



Map Reference:
Map of Canada
Published by the CAA



KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION

THE HAMLET OF KUGLUKTUK, NUNAVUT

SEWAGE TREATMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

October 2005
Project Number: N-O 09755.0

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

FEO09754 O&M STF SL.DWG

FIGURE 2

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

SATELLITE IMAGERY OF ENTIRE COMMUNITY AND INFRASTRUCTURE

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
October 2005
Project Number: N-O 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

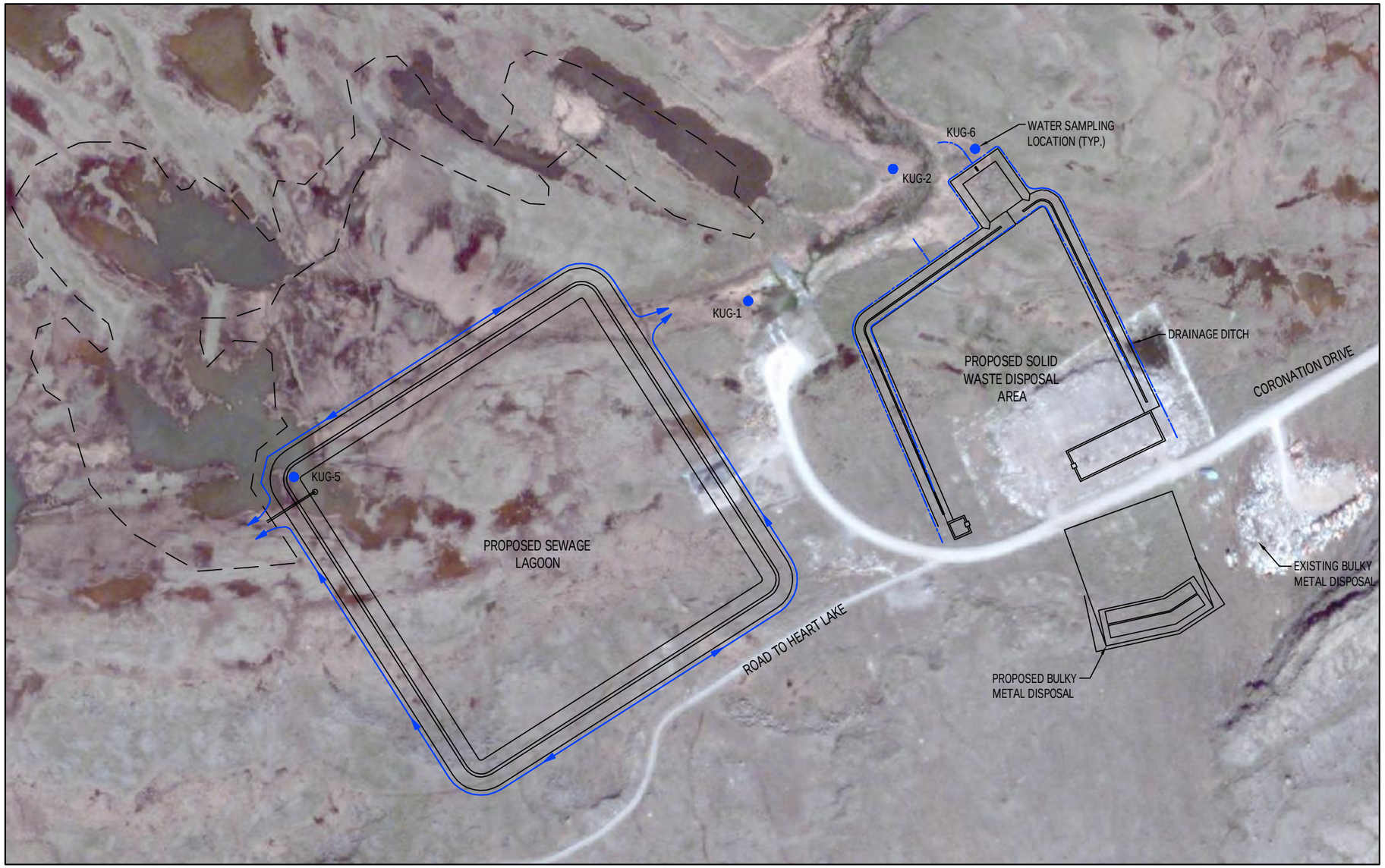


FIGURE 3

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

REGIONAL VIEW OF SEWAGE LAGOON AND SOLID WASTE DISPOSAL FACILITY (LANDFILL)

Legend

PROPOSED SURFACE WATER SAMPLING LOCATION

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 20 40 60 80 100 120 140 160 180 200 220 240
Meters

1:3000
June 2006
Project Number: N-0 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

Appendix A
Climate Data

The *Climate Data* for the *Sample Monitoring Program Quality Assurance / Quality Control Plan* is the same as that presented in APPENDIX B of the *Detailed Design Report.*

Appendix B
Projected Water Requirements and Sewage Generation Rates

Table 4: Projected Sewage and Sludge Generation Rate for the Hamlet of Kugluktuk

Planning Year	Calendar Year	Total Population	Projected Sewage generation (lpcd)	Projected Volume (litres/day)	Projected Volume (litres/year)	Projected Sludge Volume (m^3/annum)	Cumulative Sludge Volume (m^3)	BOD (mg/l)	TSS (mg/l)	T-PO_4 (mg/l)	TKN (mg/l)	Faecal Coliforms (C.F.U./100ml)
0	2006	1585	136.5	216,281	78,942,629	28.9	28.9	329.8	351.8	16.9	87.9	6.96E+07
	2007	1618	137.2	222,012	81,034,472	29.5	58.4	328.0	349.8	16.8	87.5	6.92E+07
	2008	1653	138.0	228,145	83,273,074	30.2	88.6	326.0	347.8	16.7	86.9	6.88E+07
	2009	1686	138.8	233,980	85,402,593	30.8	119.4	324.3	345.9	16.6	86.5	6.85E+07
	2010	1720	139.6	240,043	87,615,768	31.4	150.8	322.4	343.9	16.5	86.0	6.81E+07
5	2011	1760	140.5	247,245	90,244,352	32.1	182.9	320.3	341.7	16.4	85.4	6.76E+07
	2012	1793	141.2	253,242	92,433,157	32.7	215.6	318.6	339.8	16.3	85.0	6.73E+07
	2013	1827	142.0	259,472	94,707,414	33.3	248.9	316.9	338.0	16.2	84.5	6.69E+07
	2014	1859	142.8	265,385	96,865,621	33.9	282.9	315.2	336.2	16.1	84.1	6.65E+07
	2015	1893	143.5	271,719	99,177,554	34.5	317.4	313.5	334.4	16.0	83.6	6.62E+07
10	2016	1928	144.3	278,295	101,577,760	35.2	352.6	311.8	332.5	15.9	83.1	6.58E+07
	2017	1965	145.2	285,308	104,137,484	35.9	388.5	309.9	330.6	15.8	82.6	6.54E+07
	2018	2000	146.0	292,000	106,580,000	36.5	425.0	308.2	328.8	15.8	82.2	6.51E+07
	2019	2041	146.9	299,911	109,467,392	37.2	462.2	306.2	326.7	15.7	81.7	6.47E+07
	2020	2076	147.7	306,725	111,954,570	37.9	500.1	304.6	324.9	15.6	81.2	6.43E+07
15	2021	2107	148.5	312,835	114,184,737	38.5	538.6	303.1	323.3	15.5	80.8	6.40E+07
	2022	2139	149.2	319,082	116,465,007	39.0	577.6	301.6	321.7	15.4	80.4	6.37E+07
	2023	2171	149.9	325,470	118,796,633	39.6	617.2	300.1	320.2	15.3	80.0	6.34E+07
	2024	2203	150.7	332,002	121,180,905	40.2	657.4	298.7	318.6	15.3	79.6	6.30E+07
	2025	2236	151.4	338,683	123,619,146	40.8	698.2	297.2	317.0	15.2	79.2	6.27E+07
20	2026	2270	152.2	345,514	126,112,716	41.4	739.7	295.6	315.4	15.1	78.8	6.24E+07
	2027	2304	153.0	352,501	128,663,012	42.0	781.7	294.1	313.7	15.0	78.4	6.21E+07
	2028	2339	153.8	359,648	131,271,469	42.7	824.4	292.6	312.1	15.0	78.0	6.18E+07
	2029	2374	154.6	366,958	133,939,561	43.3	867.7	291.1	310.5	14.9	77.6	6.15E+07
	2030	2409	155.4	374,435	136,668,802	44.0	911.7	289.6	308.9	14.8	77.2	6.11E+07
25	2031	2445	156.2	382,084	139,460,748	44.6	956.3	288.0	307.2	14.7	76.8	6.08E+07

Appendix C

Nunavut Water Board License

P.O. BOX 119
GJOA HAVEN, NU X0B 1J0
TEL: (867) 360-6338
FAX: (867) 360-6369

kNK5 wmoEp5 vtmpq
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3KUG0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated July 15, 2003, made by:

Hamlet of Kugluktuk

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

DECISION

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

Licence Number NWB3KUG0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-35)

SIGNED this 20th day of November 2003 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

TABLE OF CONTENTS

I. BACKGROUND

Kugluktuk is located immediately west of the mouth of the Coppermine River on Coronation Gulf at 67°50'N, 115°15'W, 595 air km north of Yellowknife. The Hamlet extends inland to cover a rocky knoll. The town site is underlain by Precambrian sedimentary and volcanic rock. Dolomite and shale, interspersed with volcanic rock, form steep outcrops in the vicinity of the settlement. The buildings along the shore are perched on consolidated beach deposits. Directly behind this ridge is a low, marshy area. There are numerous exposed bedrock surfaces in the community. Surficial deposits in the area include talus and deltaic deposits. The angular talus, derived primarily from the mechanical breakdown of dolerite, ranges in size from silt to boulders but is commonly found as course sand or fine gravel. Kugluktuk is underlain by permafrost. The thickness of the active layer ranges from less than 0.5 m to over 1 m in the sandy waterfront area. Permafrost features such as polygonal ground and thaw-related instability affect the raised delta surfaces and strongly influence their drainage characteristics. Grasses, sedges, heather, mosses, and lichens grow in limited soils. Willow and alder thickets are common in wetland depressions. Kugluktuk receives an average of 10.3 cm of rainfall and 100.7 cm of snowfall per year. Mean annual precipitation totals 20.2 cm. July mean high and low temperatures are 13.8° C and 5.6° C. The January mean high and low temperatures are -26.4° C and -33.8° C. The winds are generally south-west and annually average 16.6 km/h.

II. PROCEDURAL HISTORY

On July 15, 2003, an application for the renewal of water license N3L4-1526, was filed by Ferguson Simek Clark Environmental Consultants (Yellowknife) on behalf of the Hamlet of Kugluktuk. The previous water licence was issued by the Northwest Territories Water Board on 1 July 1998 and valid until June 30, 2003. In consideration of the application for renewal the Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement,* on July 23, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

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

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the compliance record of the Applicant. Specifically, the August 9, 2001 DIAND Inspection Report indicated that:

1. The Licensee has failed to produce Annual Reports from 1996-2001;
2. Water supply field pH , turbidity, and iron concentration exceeded the levels recommended in the *Guidelines for Canadian Drinking Water Quality*;
3. Sewage treatment system effluent concentrations of ammonia and phenol exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*;
4. Sewage treatment effluent contained noteworthy concentrations of faecal coliforms (1,470,000 CFU/100ml);
5. Solid waste disposal site effluent concentrations of iron and zinc exceeded the levels; and
6. The sewage treatment system effluent evidenced a significant toxicity, as determined by a MicroTox EC_{50} assessment.

Additionally, the NWB brings to the attention of the Licensee their failure to provide the Board with the as-built plans and drawings for the modifications to the Sewage Disposal Facilities, as required by Part D, Item 3 of Water License N7L4-1526. The Board requests that these as-built plans and drawings be forwarded by the Licensee within ninety (90) days following issuance of this license.

In review of the application, DIAND, has recommended a licence term of five (5) years. The NWB concurs that a term of five (5) years is appropriate, and will allow enough time for the Hamlet to establish a consistent compliance record with the terms and conditions of its licence. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

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

The NWB has also imposed on the Licensee the requirement to produce an Operations and Maintenance Manual for their sewage and solid waste operations. The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is

capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II).

Water Use

The Municipality currently receives water from Coppermine River. Water is treated using membrane filtration, which is accomplished in a twin train Harmsco filtration system, and stored in a 320 m^3 tank. The water receives a chlorine treatment prior to trucked-service distribution. Water consumption is projected to reach 53,475 m^3 *per annum* in 2003 and 60,533 m^3 *per annum* by 2008.

No serious concerns were raised by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Issues related to the quality of water produced by the present water treatment system were identified, but are currently being addressed by the Applicant and the Department of Community Government and Transportation, Government of Nunavut. DIAND has provided specific recommendations regarding volume usage limits, as well as recommending that the Applicant to be required to maintain a monitoring station at the water intake area KUG-1 in order to monitor the volume of water used. The Board concurs with these recommendations, and has set the terms and conditions in the water licence, which govern, water usage accordingly. The Board also recommends that the Hamlet and the Department of Community Government and Transportation take whatever steps are necessary to address the water quality issues identified in the August 9, 2001 DIAND Inspection Report.

Deposit of Waste

Sewage

The Hamlet of Kugluktuk utilizes a Sewage Disposal Facility approximately 5.0 km west of the Municipality. A gravel berm provides limited retention of sewage prior to discharge to an undefined wetland where it receives additional treatment prior to discharge to the marine environment. Specific comments relevant to sewage disposal operations in the Hamlet were provided by DIAND, and Environment Canada. Both DIAND and Environment Canada requested that the Applicant provide information to the NWB on how the Municipality plans to address the operational and environmental issues evidenced in the August 9, 2001 DIAND Inspection Report. Additionally, Environment Canada recommended that a minimum of 1 m of freeboard should be maintained at all retention structures, and that All Terrain Vehicle (ATV) traffic be restricted in the wetland area so as to prevent soil erosion and damage to vegetation from compromising the effectiveness of the wetland treatment of the sewage.

DIAND and Environment Canada also recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. Additionally, DIAND provided recommendations concerning effluent discharge criteria, which are consistent with the *Guidelines for the Discharge of*

Treated Municipal Wastewater in the Northwest Territories (Northwest Territories Water Board; 1992), as well as specific recommendations concerning the Monitoring Program.

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

Solid Waste

The Hamlet's solid waste management site is located approximately 4.5 km from the community. Waste is segregated, with a generic landfill area, a bulky wastes area, and a sealift container for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered on a yearly basis.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND and Environment Canada. Both DIAND and Environment Canada recommended that preventative measures be implemented to prevent standing water noted at the toe of the solid waste site from escaping the facility. Environment Canada also recommended that the Municipality undertake a waste composition study, which will assist the Municipality to plan for the long term waste disposal needs of the community. The Board concurs that the Hamlet should give serious consideration to this recommendation, and recommends that discussions be commenced with the Department of Community Government and Transportation to determine potential assistance which may be available to the Hamlet to undertake such a study.

DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans for their solid waste operations. DIAND and Environment Canada further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. DIAND and Environment Canada recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. Additionally, both Environment Canada and DIAND recommended the installation of appropriate fencing at the bulky waste and hazardous waste disposal sites, so as to improve security on the sites. The Board concurs that the Hamlet should give serious consideration to this recommendation, and in the interim take whatever steps are practicable to implement this recommendation.

LICENCE NWB3KUG0308

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF KUGLUKTUK

(Licensee)

of **KUGLUKTUK, NUNAVUT, X0E 0E0**

(Mailing Address)

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

Licence Number **NWB3KUG0308**

Water Management Area **NUNAVUT 05**

Location **KUGLUKTUK, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **64,000 CUBIC METRES ANNUALLY**

Date of Licence **NOVEMBER 20, 2003**

Expiry Date of Licence **NOVEMBER 30, 2008**

Dated this 20th of November 2003 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Kugluktuk, Nunavut (67°50'N, 115°15'W);

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

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

2. Definitions

In this Licence: **NWB3KUG0308**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"Licensee" means the holder of this Licence;

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

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

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

"Sewage" means all toilet wastes and greywater;

"Sewage Disposal Facilities" comprises the area and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

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

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

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Coppermine River, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2.

PART B: GENERAL CONDITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(i) Chief Administrative Officer:

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

(ii) Inspector Contact:

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

(iii) Analyst Contact:

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

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

PART C: CONDITIONS APPLYING TO WATER USE

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

2. The annual quantity of water used for all purposes shall not exceed 64,000 cubic metres.

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

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

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

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

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

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

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

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

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

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

7. The Licensee shall implement measures to ensure waste from the Solid Waste Disposal Facility does not enter water.

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

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

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

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

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

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

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

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

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

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

    iv. the Board has not rejected the proposed modifications.

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

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

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before March 31, 2004 submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996). This Plan shall specifically address the waste disposal and operational issues related to the Sewage Disposal Facility and the Solid Disposal Facility, which were identified in the August 9, 2001 DIAND Inspection Report.

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

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

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

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

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

    i. take whatever steps are immediately practicable to protect human life, health and the environment;
    ii. without delay seek guidance from the Departments of Community Government and Transportation and Sustainable Development with regards to mitigation and remedial actions required to address the discharge;

ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

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

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

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

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

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

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Monitoring Station	Description
KUG-1	Raw water supply at Coppermine River prior to treatment
KUG-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
KUG-3	Raw Sewage at truck offload point
KUG-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

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

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

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

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

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

6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence.

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

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

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

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

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

Appendix D
Example Operation Log

Hamlet of Kugluktuk

Water Distribution Operations Log Sheet

Month: _____ **Truck #: _____**

Date	Number of Trips to the Water Reservoir	Quantity of Water Delivered (Liters)	Driver Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
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Appendix E
Environmental Emergency Contingency Plan

Environmental Emergency Contingency Plan
Hamlet of Kugluktuk

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175, 25 Third Avenue Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

June 2006

File No: N-O 09755

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Figures

Appendices

Preamble

This Environmental Emergency Contingency Plan relating to the collection, transportation, storage, and treatment operations of sewage and solid waste for the Hamlet of Kugluktuk, Nunavut, is effective from November 20, 2003 to November 30, 2008. This plan applies to all operations and spill events relating to sewage, solid waste and hydrocarbons including gasoline, oil, and lubricants in the Hamlet of Kugluktuk, Nunavut (formerly known as Coppermine).

The following formal distribution will be made after this document receives approval:

- Hamlet of Kugluktuk:
  - Mayor and Council
  - Senior Administrative Officer (SAO)
  - Hamlet Operations Staff
  - Fire Department
  - Community Health Centre
  - RCMP Detachment.

- Nunavut Water Board.

Additional copies and updates of this plan may be obtained by writing to:

Hamlet of Kugluktuk
Senior Administrative Officer
Kugluktuk, Nunavut, X0E 0E0

1.0 Introduction

1.1 Purpose of Plan

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

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

1.2 Objectives

The objectives of this Emergency Spill Contingency Plan are to:

- Provide a plan including procedures so that the Hamlet and their Spill Response Team can rapidly respond to a spill situation and minimize injury to individuals and environmental damage
- Comply with all existing regulations
- Cooperate with other groups and agencies
- Be prepared and able to provide an integrated team approach with all involved departments and agencies
- Keep staff, government officials, and Hamlet residents informed.

1.3 Hamlet of Kugluktuk Environmental Policy

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

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

- Nunavut Waters and Nunavut Surface Rights Tribunal Act.

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

2.0 Site Description

2.1 General Site Description

This *Environmental Emergency Contingency Plan* is to be implemented within the Municipal boundaries of the Hamlet of Kugluktuk, Nunavut.

The Hamlet of Kugluktuk is situated on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River, at latitude 67°49'N, longitude 115°06'W. The Hamlet is predominately residential with a few small commercial establishments including a hotel, several construction contracting businesses, a grocery store, and a variety of other small businesses. Hunting and fishing in the traditional manner is still a prime occupation for many of the inhabitants. Community buildings include a high school, elementary school, arena, swimming pool, Hamlet office, public works yard, GN offices, and police station. The community has a population of approximately 1,585. A site location map is included on Figure 1.

2.2 Sewage Collection, Water Supply, Treatment and Distribution, and Storage

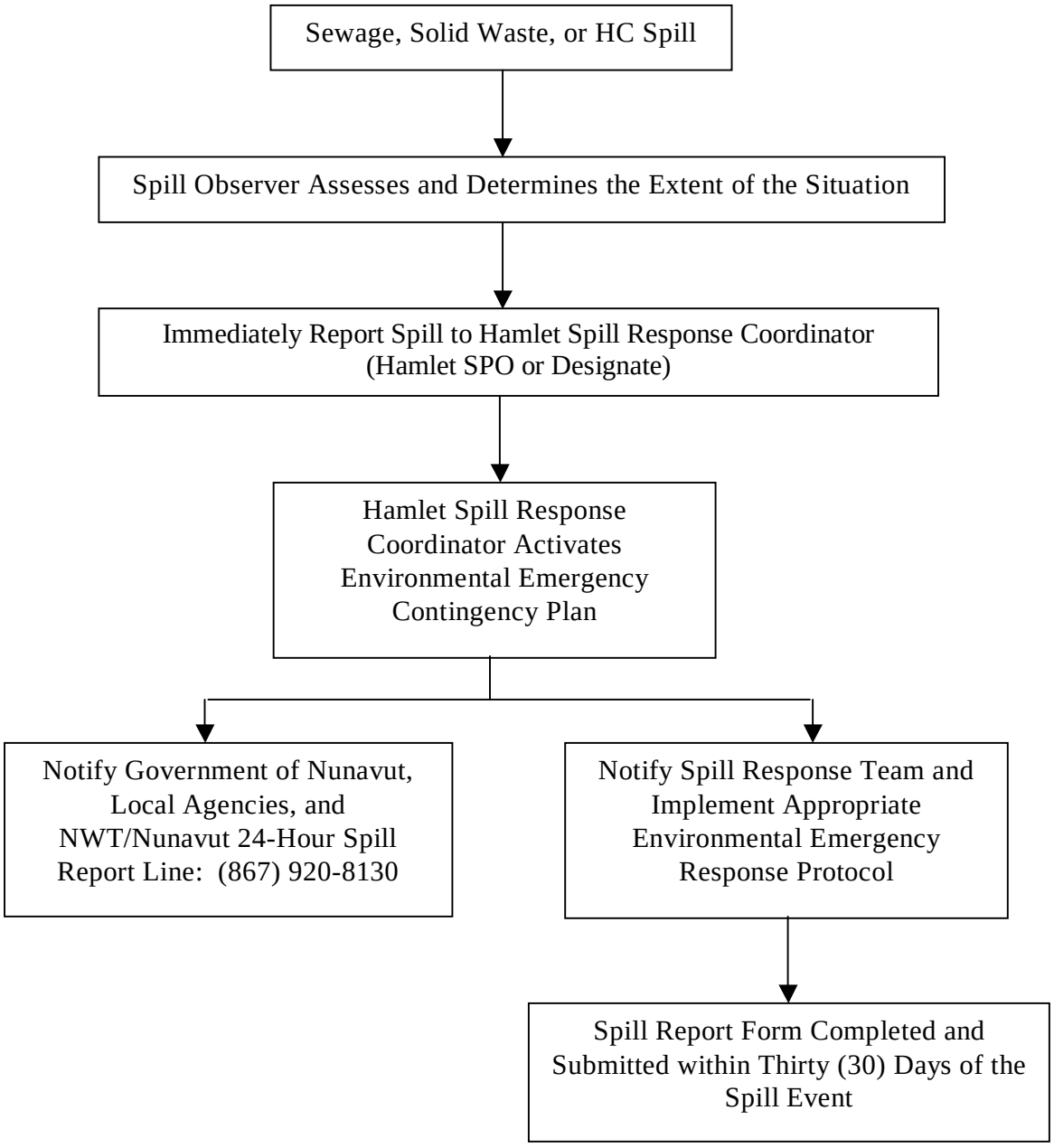
The Hamlet provides trucked water service for the community. Water is drawn from the Coppermine River and treated by membrane filtration and chlorination. Treated water is distributed by tanker truck to storage tanks in each building.

Sewage is collected by vacuum truck, and transported to a Sewage Treatment Facility (Figure 3) operated by the Hamlet of Kugluktuk located approximately 4 km west-southwest from the Hamlet on Coronation Drive. Sewage is discharged into a lagoon, which provides primary treatment before discharging to an engineered wetland where treatment is completed.

The Hamlet of Kugluktuk provides regular solid waste pickup for the Community's residents, businesses, and institutions. Solid waste is trucked to the Hamlet's Solid Waste Disposal facility (Figure 3), which is located adjacent to the sewage treatment facility on Coronation Drive, approximately 4 km west-southwest from the Hamlet. The Solid Waste Disposal Facility includes a landfill cell for municipal solid waste, a landfarm for contaminated soils, a storage area for hazardous and liquid wastes, and a long-term storage area for bulky metals. Municipal solid waste is burned daily prior to spreading and compaction by a loader.

3.0 Spill Response Organization

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



Emergency Response Flow Chart

3.1 Spill Response Team

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

- Spill Response Coordinator (Hamlet SAO or Designate)
- Hamlet Works Personnel.

The responsibilities of the Spill Response Coordinator are as follows:

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

3.2 Contact Information

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

4.0 Spill Reporting Procedure

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

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

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

4.1 NWT/Nunavut Spill Report Line

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

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

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

5.0 Action Plans

5.1 Initial Action

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

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

5.2 Environmental Health Protection and Mitigation Measures

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

5.2.1 General Procedures

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

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

- Conduct required clean-up operations
- Assess and appropriately treat any areas disturbed by clean-up activities with laboratory testing
- Ensure the site has been completely restored and cease operations, only when all work is finalized and laboratory testing confirmed.

Procedures for containing spills of specific contaminants are provided in the following sections.

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

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

5.3.1 HC Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill after all vapors have dissipated
- Remove the spill by using absorbent pads or excavating the soil, gravel or snow
- Remove spill splashed on vegetation using particulate absorbent material.

5.3.2 HC Spill On Water

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

5.3.3 HC Spill on Ice and Snow

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

5.3.4 HC-Contaminated Material Storage and Transfer

Soil and gravel contaminated by HC should be treated at the on-site landfarm in accordance with normal operating procedures. If necessary, contaminated soil and gravel may be stored temporarily until space becomes available in the landfarm, provided that appropriate measures are taken to prevent the leaching of contaminants into the underlying soil. Larger quantities of soil could be placed on a tarp, and covered if necessary. Small quantities could be stored in labeled drums in the hazardous waste storage area.

As space permits, small quantities of water, ice, snow, vegetation and cleanup supplies contaminated by HC may be stored in labeled drums in the hazardous waste storage facility in accordance with normal operating procedures. If the quantity of contaminated material makes storage in drums unfeasible, the Hamlet shall contact the appropriate regulatory agencies before removing any materials.

5.4 Mitigative Measures: Sewage

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

5.4.1 Sewage Spill on Soil, Gravel, Rock, or Vegetation

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

5.4.2 Sewage Spill into Water

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

5.4.3 Sewage Spill on Ice and Snow

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

5.4.4 Sewage Storage and Transfer

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

5.5 Mitigative Measures: Solid Waste

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

- Physically remove the spilled solid waste from the area, and deposit in the approved Hamlet Solid Waste Disposal Facility.

5.5.2 Solid Waste Spill into Water

- Use containment boom to capture soil for recovery
- Physically remove the spilled solid waste from the water, and deposit in the approved Hamlet Solid Waste Disposal Facility

- Capture any sheen from the water using absorbent pads or skimmer, and deposit any used absorbent pads to the approved Hamlet Solid Waste Disposal facility.

5.5.3 Solid Waste Spill on Ice and Snow

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

5.5.4 Disposal

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

5.6 Spill Recovery Assessment

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

6.0 Spill Response Resource Inventory

6.1 Additional Personnel Available

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

6.2 Spill Response Equipment Inventory

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

Composition of Spill Kit

	Quantity
• 360 litre polyethylene over pack drum	1
• oil sorbent booms (5” X 10’)	6
• oil sorbent sheets (16.5” X 20” X 3/8”)	100
• drain cover (36” X 36” X 1/16”)	1
• Caution tape (3” X 500’)	1
• 1 lb plugging compound	1
• Nitrile gloves (pair)	4
• Safety goggles (pair)	4
• Tyvek coveralls (pair)	4
• instruction booklet	1
• printed disposable bags (24” X 48”)	10

Sorbent capacity of each spill kit is 240 litres.

The spill response kits should be stored in the on-site lockers provided for this purpose. Some equipment may be stored in other areas throughout the community while being used to complete other tasks.

7.0 Training

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

Spill Response Team training should include the following aspects:

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

8.0 Annual Review of this Environmental Emergency Contingency Plan

As part of the preparation of the Annual Report to the Nunavut Water Board for the Water License, the Hamlet should review and update the information contained within this plan. The purpose of the update is to ensure all changes to regulations are incorporated into this plan, along with the use of any new technology or method advances, to prevent or stop a spill and to mitigate and/or remediate a spill. This ensures that the plan adapts as the Hamlet grows, to ensure the community is properly prepared in the event of an incident.

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

9.0 References

Nunavut Water Board, September 2000. *Hamlet of Kugluktuk Water License NWB3Q1K0106.* Goja Haven, Nunavut.

Nunavut Water Board, November 2004. *Guidelines for Spill Contingency Planning*. Goja Haven, Nunavut.

Northwest Territories, Date Unknown. *Contingency Planning and Spill Reporting in the NWT: A Guide to the New Regulations, Yellowknife, Northwest Territories.*

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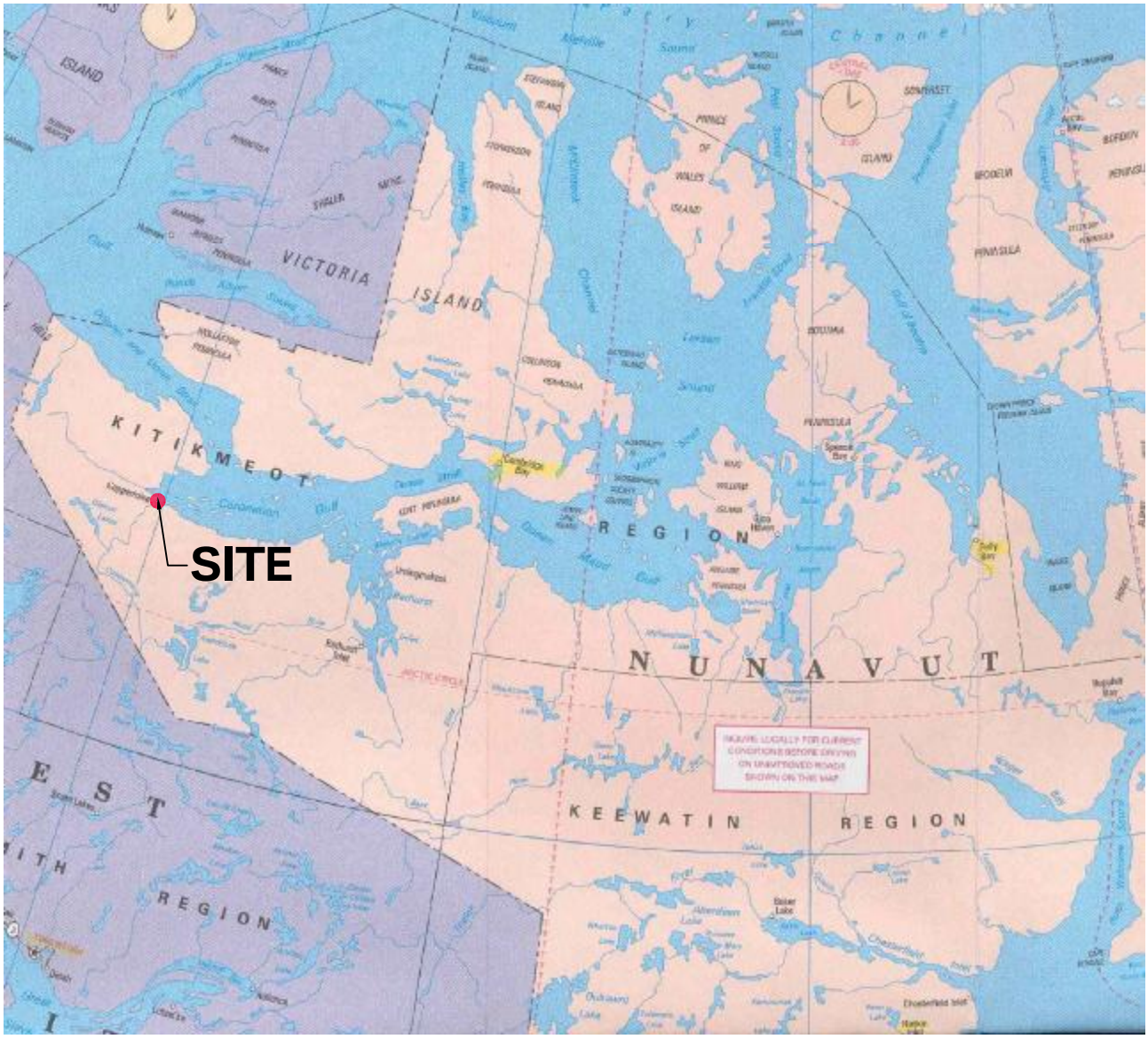
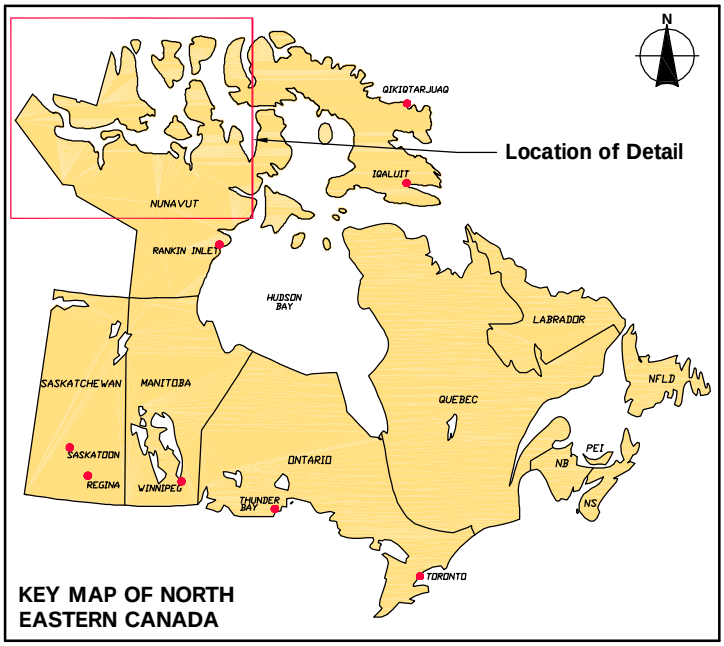
Figures



Map Reference:
Map of Canada
Published by the CAA



KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF KUGLUKTUK, NUNAVUT

ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

June 2006
Project Number: N-O 09755.0
Prepared by: C. Reynolds
Verified by: J. Walls

BURNSIDE

FEO09754 DD SL.DWG

FIGURE 2

HAMLET OF KUGLUKTUK
ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

SATELLITE IMAGERY OF ENTIRE COMMUNITY AND INFRASTRUCTURE

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
June 2006
Project Number: N-O 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

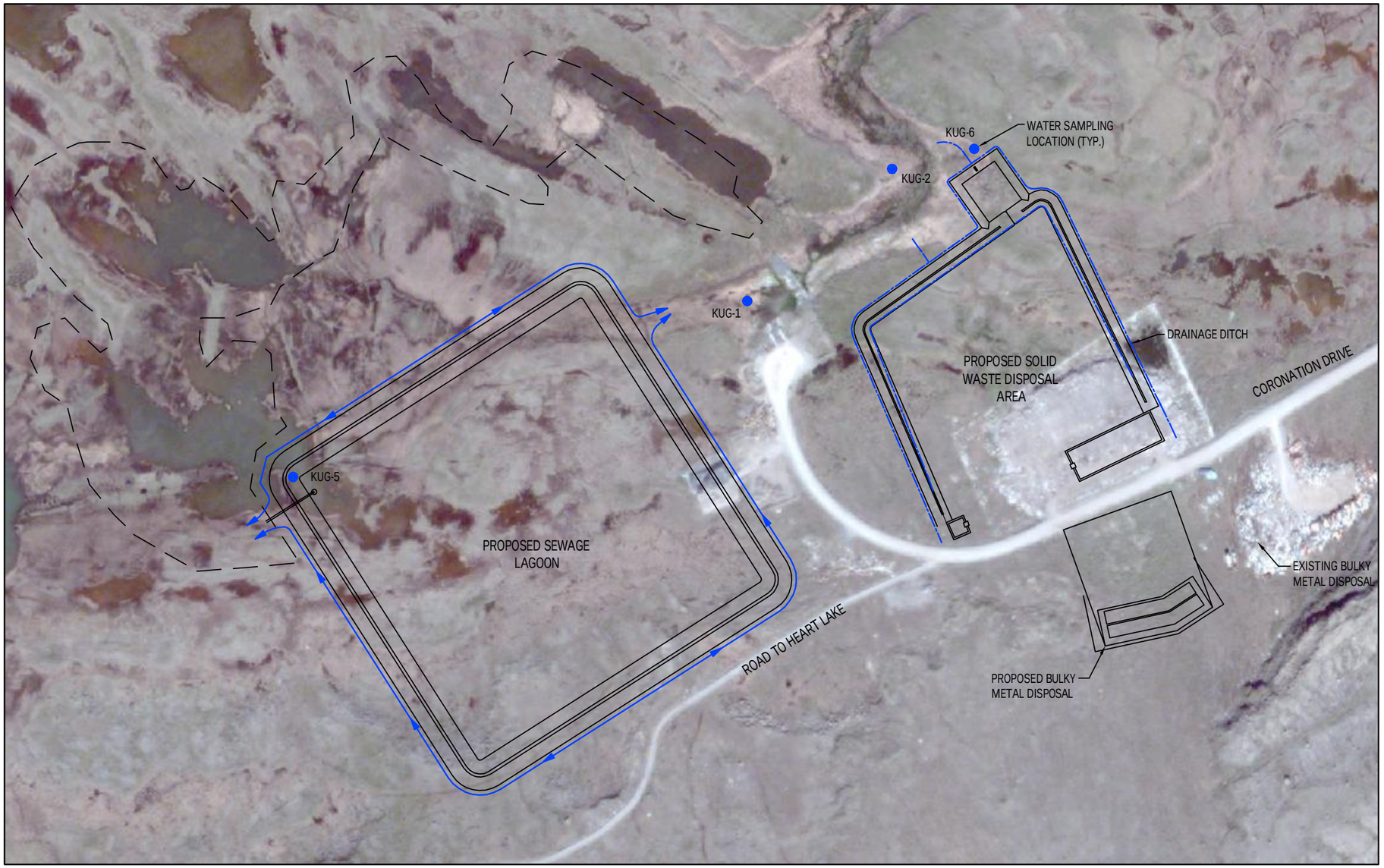


FIGURE 3

HAMLET OF KUGLUKTUK
ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

SEWAGE AND SOLID WASTE DISPOSAL FACILITIES

Legend

● **PROPOSED SURFACE WATER SAMPLING LOCATION**

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 20 40 60 80 100 120 140 160 180 200 220 240
Meters

1:3000
June 2006
Project Number: N-0 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

Appendix A
Contact Information

APPENDIX A

Contact Information

Contact	Location	Telephone Number	Fax Number
Hamlet of Kugluktuk SAO	Kugluktuk	(867) 982-6500	(867) 982-3060
24-Hour NWT/Nunavut Spill Report Line	Yellowknife	(867) 920-8130	(867) 873-6924
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Government of Nunavut - Regional Engineer	Cambridge Bay	(867) 983-4125	(867) 983-4123
Environment Canada - Inspector	Iqaluit	(867) 975-4644	(867) 979-4594
Fire Department	Kugluktuk	(867) 982-2222	(867) 982-3407
RCMP Detachment	Kugluktuk	(867) 982-1111	(867) 982-3390
Community Health Centre	Kugluktuk	(867) 982-4531	(867) 982-3115

Appendix B

NWT Spill Report

NUNAVUT SPILL REPORT (Oil, Gas, Hazardous Chemicals or other Materials)

ᓄᓇᕗᑦ ᑯᐃᓴᓄᑦ ᐅᓂᒃᑳᖅ (ᐅᖃᓗᐊᓂᐃᑦ, ᓴᓇᓪᓕᖅ, ᐊᑦᑕᕐᓇᖅᑐᑦ, ᐃᓕᓴᕐᓂᐃᑦ ᐅᑉᐹᓪᓕᖅ ᐊᓗᓚᖅᑐᑦ)

24-Hour Report Line 24-ᓄᑦ ᐃᒃᖃᓄᑦ ᐅᓂᒃᑲᐃᐅᔪᓐᓇᖅᑐᖅ ᐅᖃᓕᑦ

Phone/ᐅᖃᓕᐅᑦ **(867) 920-8130**

Fax/ᓱᒃᑐᒃᓴᑦ **(867) 873-6924**

A Report Date and Time ᐅᑉᓗᖅ ᓯᖓᖏᓚᑦᓗᓂ ᖃᓄᐃᓕᐊᖅᑎᑦᓗᒍ ᐅᓂᒃᑲᐅᑎᒋᐊᕐᓂᖅ	**B** Date and Time of Spill(if known) ᐅᑉᓗᖓ ᑯᐃᑎᑦᓗᒍ ᖃᓄᐃᓕᐊᖅᑎᑦᓗᒍᓗᒍ (ᖃᐅᔨᒪᓕᐅᕐᕕᑦ)	**C** ☐ Original Report ᓯᓚᑦᓂᖅᓯᒥ ᐅᓂᒃᑲᐅᓯᐅᔪᖅ ☐ Update No. _____ ᓂᒃᑲᐅᓯᐅᒃᖃᓂᖅᓯᖓ ᓇᓴᐅᑦ	Spill Number ᑯᐃᓚᑦ ᓇᓴᐅᑦ

D Location and Map Coordinates (if known) and Direction (if moving) ᓇᓂ ᑯᐃᓛᓇ ᐊᓇᓐᓚᐅᑦ ᓇᓴᐅᓪᓗᑎᑦ (ᖃᐅᔨᒪᓕᐅᕐᕕᑦ) ᐊᒻᒪᓗ ᓇᒧᓐᖓᐅᓪᓚᕐᓂᐊᓪᓚᖓᑦ (ᐃᖅᑲᖏᕐᕕᑦ)

E Party Responsible for Spill (Full Name and Address) ᑭᒃᑯᑦ ᑯᐃᑎᑦᑎᐊᓪᓚᑦ (ᐃᑎᑦ ᐊᒻᒪᓗ ᑐᕌᑎᖓ)

F Product(s) Spilled and Estimated Quantities(provide metric volumes/weights if possible) ᑭᓱᑦ ᑭᓱᓪᓗᓐᓂᑦ ᑯᐃᓚᑦ ᖃᓄᑎᓗ ᐊᖏᔪᖃᖅᓯᑦ (ᐊᖏᔪᖓ ᐅᑭᖏᑦᔪᖏᓪᓗᓐᓂᑦ ᐊᓯᓐᓇᖏᑦᑐᑦ)

G Cause of Spill ᑭᓱ ᑯᐃᐸᓯᑕᐅᓚᑦ

H Is Spill Terminated? ᑯᐃᔪᖅ ᓄᖅᖃᑕᐅᓚᑦ? ☐ Yes/ᐃ ☐ No/ᐊᒃᑲ	**I** If Spill is Continuing, Give Estimated Rate ᓯᓚ ᑯᐃᐸᑦ ᖃᓄᑎᑎ ᓯᑲᑲᑎᑎᖃᖅᑲᓐᓂᖅ	**J** Is Further Spillage Possible? ᑯᐃᐸᒃᖃᓗᐃᓪᓕᐅᑭᖃᖅᑐᑦ? ☐ Yes/ᐃ ☐ No/ᐊᒃᑲ	**K** Extent of Contaminated Area (in square metres if possible) ᖃᓄᖅ ᐊᖏᑎᑎᓚᓐ ᑯᐃᓴᐃᐅᔪᖅ (ᐅᐸᑐᖅᓯᒪᓗᒍ ᐊᐅᖏᓐᓇᖏᑦᑐᑦ)

L Factors Affecting Spill or Recovery(weather conditions, terrain, snow cover, etc.) ᑭᓱᑦ ᐱᐅᓯᑕᐅᓚᑦ ᑯᐃᐊᒍᑦ ᐅᑦᓓ ᐊᑲᑭᑕᐅᓕᓯᑎᓪᓗᒍ (ᓯᓚ ᖃᓄᐃᓕᓐᓂᓕᖅᓂᑦ, ᓄᓇ ᖃᓄᐃᓕᓐᓂᓕᖅᓂᑦ ᐊᐅᓵᐅᓯᒪᓕᖅᓂᑦ, ᐊᓯᖏᓪᓕᐅᕐᓂᖅᓂᑦ) .	**M** Containment (natural depression, dykes, etc.) ᐅᖃᓗᐊᓂᖃᖅᐸᑦ ᑭᓕᐊᓱᑦ ᐃᓯᖏᓐᓂᓯᓯᒪᔪᖅ (ᓄᓇᒥ ᐃᓯᖏᓐᓇᐃᑦ, ᐊᓯᖏᓐᓇᓕᐅᕐᓂᖅᓂᑦ)

N Action, if any, taken or Proposed to Contain, Recover, Clean Up or Dispose of Product(s) and Contaminated Materials
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Appendix F
Monitoring Program Quality Assurance/ Quality Control Plan

Quality Assurance/Quality Control Plan for Hamlet Sewage Lagoon and Solid Waste Management Facilities Monitoring Program Hamlet of Kugluktuk

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175, 25 Third Avenue Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

June 2006

File No: N-O 09755

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Figures

Appendices

1.0 Introduction

The Hamlet of Kugluktuk (formerly known as Coppermine), is situated on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River, at latitude 67°49'N, longitude 115°06'W, as shown on Figure 1. The Hamlet is predominately residential with a few small commercial establishments including a hotel, several construction contracting businesses, a grocery store, and a variety of other small businesses. Hunting and fishing in the traditional manner is still a prime occupation for many of the inhabitants. Community buildings include a high school, elementary school, arena, swimming pool, Hamlet office, public works yard, GN offices, and police station. The community has a population of approximately 1,585, with an approximate projected growth rate of 1.5 percent.

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. The water, wastewater, and solid waste systems include the following facilities and services:

- A water treatment plant, which draws water from the Coppermine River and treats it by membrane filtration and chlorination
- Trucked water to holding tanks in each building
- A sewage lagoon which receives trucked sewage collected from holding tanks in each building
- Sewage treatment via an exfiltration lagoon to a wetland discharging north to the ocean
- A solid waste disposal facility, which includes a bulky metals disposal area, a contaminated soil pile, a waste oil and liquid waste storage area, and a storage area for batteries and other hazardous materials.

Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) has been retained by the Department of Community and Government Services, Government of Nunavut, to undertake the detailed design of improvements to the sewage lagoon and solid waste facilities, and to prepare reports required by Nunavut Water Board License NWB3KUG0308.

1.1 Purpose

The sewage lagoon and solid waste disposal facilities operate under Nunavut Water Board License NWB3KUG0308 (the license) issued on November 20, 2003. A copy of the license, which expires November 30, 2008, is included in Appendix A. The license requires the Hamlet to conduct a monitoring program, which includes regular water quality sampling and reporting. As required by the license, this Quality

Assurance/Quality Control Plan (QA/QC Plan) has been prepared to achieve the following objectives:

- To ensure that all samples taken in the field will follow procedures and controls in order to maintain a high quality, so that the results obtained represent both the physical and chemical nature of the samples being taken

- To ensure best management practices (BMP) are used throughout the sampling program

- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and controls to be used by Hamlet operations staff when conducting environmental sampling under the monitoring program.

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

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Kugluktuk. Contact information for the Hamlet is provided in Appendix B.

1.2 Quality Assurance and Quality Control

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

- Personnel involved in water sampling and analysis are well trained

- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean

- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized BMP

- Laboratory and field instruments are calibrated according to manufacturers recommendations or recognized as good operating practice
- Supplies used in sampling and analysis are of consistent high quality and are not expired
- Quality Control (QC) procedures are developed and implemented based on good operating practices to assess quality of analytical data and provide warning of unacceptable errors
- Remedial action is promptly implemented when deficiencies are identified
- Results of the monitoring program are reported in the Annual report as required in the water license. The Annual Report must be submitted by March 31 of the year following the calendar year for which the report has been submitted.

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

1.3 Lab Accreditation

All analyses shall be conducted in laboratories that are accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) or an alternative approved by the NWB. The Contact information for the DIAND Analyst for Nunavut is provided in Appendix B.

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

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

The Hamlet shall notify the NWB in writing of the laboratory to be used to perform the analysis prior to collecting any samples under the monitoring program.

2.0 Field Sampling

2.1 Sample Collection

Effluent and surface water sampling by the Hamlet of Kugluktuk is conducted to provide information for the Hamlet for effective environmental management and to monitor regulatory compliance.

2.1.1 Sampling Location and Frequency

The monitoring program created by the water license includes specific requirements regarding sampling locations, sampling frequency, parameters to be analyzed, and effluent quality. At the time that the water license was issued, the sewage lagoon was intended to be the sole method of sewage treatment, and effluent samples collected at the point of discharge from the lagoon were required to meet prescribed water quality criteria. In December 2005, Nuna Burnside submitted a revised conceptual design for the sewage lagoon and solid waste management facilities at Kugluktuk. Under the revised conceptual design, the sewage lagoon is only the first step in the treatment process. The sampling locations specified by the license have been modified slightly to reflect the revised design, as described below.

The revised design includes a larger, lined sewage lagoon that will provide improved retention of solids by increasing sewage retention time. However, the sewage lagoon is no longer the final step in the treatment process. Sewage discharged from the lagoon will flow into an engineered wetland where treatment will be completed. The wetland will consist of a network of small berms, ditches, and shallow ponds designed to maximize retention time and promote attenuation by natural processes. The monitoring program created by the water license includes four sampling locations labeled KUG-1 to KUG-4. The revised monitoring program includes one additional sampling location, labeled KUG-5, located at the discharge point of the engineered wetland, and one point labeled KUG-6 at the discharge from the landfill. Because KUG-5 is the final discharge point of the sewage treatment facilities, samples collected at this location will be required to meet the effluent quality standards prescribed by the water license. Samples collected at KUG-4, which is located at the discharge point of the lagoon, will no longer be required to meet the standard. However, water quality monitoring will continue at KUG-4 to assess the effectiveness of the primary treatment provided by the lagoon. The locations of KUG-2 to KUG-6 are shown on Figure 3. Note that KUG-1 is located at the raw water supply intake at the Coppermine River.

The sampling schedule and list of monitoring parameters specified by the water license will remain unchanged. KUG-5 and KUG-6 will be sampled according to the same schedule and list of parameters as KUG-2 and KUG-4. The proposed Monitoring Program is summarized in Table 1.

Table 1: Surveillance Network Program for Water License NWB3KUG0308

Station	Description	Frequency	Analysis Requirements
KUG-1	Raw Water Supply Intake at the Coppermine River		Nuna Burnside has been retained for the detailed design of the sewerage and solid waste facilities only. Monitoring requirements for the raw water supply system are provided elsewhere. Station KUG-1 is included here for completeness.
KUG-2	Effluent Discharge from Final Discharge Point of The Solid Waste Disposal facility	Monthly from May to August, Inclusive	• BOD • Faecal Coliforms • pH • Conductivity • Total Suspended Solids • Ammonia Nitrogen • Nitrate-Nitrite • Oil and Grease (visual) • Total Phenols • Sulphate • Sodium • Potassium Magnesium • Calcium • Total Arsenic • Total Cadmium • Total Copper • Total Chromium • Total Iron • Total Lead • Total Mercury • Total Nickel • Total Zinc • Chloride • Total Hardness.
KUG-3	Raw Sewage from Pump Out Truck	Ongoing	The Hamlet will measure and record the volume of all raw sewage offloaded at the facility. Monthly and annual totals will be reported in Annual Report.
KUG-4	Discharge from the Sewage Lagoon	Monthly from May to August, Inclusive	Same as KUG-2.
KUG-5	Discharge from Engineered Wetland	Monthly from May to August, Inclusive	Same as KUG-2.
KUG-6	Solid Waste Disposal Facility – Drainage Ditch Discharge	Monthly from May to August, Inclusive	Same as KUG-2.

The sampling stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector. Each sampling location must have its Global Positioning System (GPS) coordinates determined. This task should be completed prior to the first

sampling to be completed under this QA/QC Plan. Samples shall be taken at the same location on each sampling occasion, unless the Inspector has approved a new location.

Additional sampling and analysis may be requested by an Inspector.

2.1.2 Sample Planning

To understand what sample containers, sampling techniques, and preservation methods are required, Hamlet personnel first need to understand what parameters will be analyzed in the laboratory. Table 2 is a summary of parameters required in the License, which are grouped according to their different sampling requirements:

Table 2: Parameters Examined in NWB Water Licenses

Group	Description	Parameter
I	Microbiological	Biological Oxygen Demand (BOD) Fecal Coliform (FC)
II	General Water Chemistry	pH Conductivity Total Alkalinity Total Suspended Solids (TSS) Ammonia Nitrogen (NH_3-N) Nitrate-Nitrite (NO_3-NO_2) Oil and Grease (OGG) (Visual) Sulphate (SO_4) Sodium (Na) Total Organic Carbon (TOC) Potassium (K) Magnesium (Mg) Calcium (Ca) *Total Hardness* *Chloride (Cl)*
	Total Metals (except Mercury):	*Total Nickel (Ni)* *Total Aluminum (Al)* Total Arsenic (As) Total Cadmium (Cd) Total Copper (Cu) *Total Cobalt (Co)* Total Chromium (Cr) Total Iron (Fe) Total Lead (Pb) Total Manganese (Mg) Total Zinc (Zn)
III		Total Mercury (Hg)
IV		Total Phenols (Total-P)

Note: parameters in italics are not included in license, but should be sampled for completeness.

It is strongly recommended that the Hamlet seek advice for the sizes and types of buffers required for analysis of the parameters required. Furthermore, it is recommended that the laboratory pre-fill the sample collection bottles with the proper preservative to minimize error in the field.

All of the samples taken will be grab samples. Samples will normally be taken from natural lakes, streams, treatment ponds, or process streams. Where possible, samples shall be taken from just below the surface to avoid floating debris, which may contaminate the sample.

Freshwater Streams, Surface Drainage, and Wetlands

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

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

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

Lakes or Ponds

Surface sampling shall be collected using the same procedures as streams. Sample bottles shall be plunged to approximately 150 mm (6 inches) below the water surface.

Although not currently required under the Monitoring Program, information on water quality at various depths in lakes or ponds may be required. If an Inspector requests that this sampling be carried out, specific procedures shall be implemented in accordance with accepted sampling and good engineering practice.

Process Streams

When sampling a process stream (i.e. valve or pipe discharge) the sampler shall collect a grab sample or a set of composite samples collected over an extended period of time. In

the case of sampling from a valve, valves shall be open and running for a least one-minute before taking the sample to ensure that a representative sample of the process stream is taken.

2.1.3 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers for each analysis are shown in Table 2. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers to the Hamlet specific for the sampling program requested by the Hamlet. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The Hamlet shall **contact the laboratory at least one month prior to the sampling event** in order to ensure that containers are available for sampling. Refer to Section 1.3 for laboratory contact information.

2.1.4 Field Sampling Log

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

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

2.1.5 Field Measurements

No field measurements are required as part of the Hamlet sampling program, however, it is strongly recommended that the following parameters be sampled immediately on site using appropriate portable field equipment:

- pH
- Temperature
- Dissolved oxygen
- Total alkalinity
- Turbidity
- Chlorine residuals.

It is important that separate equipment be used to sample between potable water and non-potable water (i.e. surface water). Furthermore, all instruments, glassware, etc. should be

cleaned between each sample following manufacturer's recommended guidelines and/or BMPs.

2.1.6 Sampling Procedures

The sampling procedures described in Table 3 shall be used to collect water samples appropriate to the sampling location.

General Procedures for Sample Collection

1. Protocols

General procedures for sample collection are outlined below. Different laboratories have slightly different bottle requirements and sample handling protocols. Sampling technicians must receive site specific training and laboratory procedures must take precedence over other protocols.

2. Sample Locations and Sampling Frequency

The location and frequency of each sampling option has been carefully selected, and is part of site design and layout, as well as the Water Board License. Sampling will follow there requirements. Diversions must be recorded and submitted to the Water Board for approval.

3. Preparation

Approximately one month prior to the sampling event the laboratory will be notified and the required bottles, blanks, and materials assembled. Plans for rapid return of the samples prepared.

4. Field Collection

At each sampling station the specified samples will be collected and field data recorded.

5. Handling Storage and Transportation

Approximate personal protective equipment (gloves, safety glasses, etc.) will be used when handling samples. Samples will be stored a 4ºC and protected from freezing until delivered to the laboratory. Chain of custody for sampling, storage, and delivery must be maintained. Laboratory sample sheets will be filled in as per laboratory protocols.

6. Delivery to Laboratory

Samples will be delivered to the laboratory in the laboratory dictated method and within the hold times specified. Preplanning for rapid transport and delivery will usually be required.

2.1.7 Sample Identification

All samples collected are to be labeled according to standard identification procedures (Name of sampler, time and date of sampling, sample identifier, sampling method and type of sample). **Sample labels shall be water-resistant, and prepared prior to going into the field**. An example of a typical Label is provided in Figure 3.

The individual samples will be labeled with the following information:

- Sample ID #
- Samples name
- Date and time of collection
- Parameter to be analyzed
- Preservatives
- Project number identifier
- Bottle number 1 of ___.

2.1.8 Sample Preservation

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

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

For the Hamlet of Kugluktuk, Table 4 provides the appropriate preservation methods for the parameters to be assessed.

Table 3: Sample Preservation

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

Note: 1000 mL = 1 Liter

2.1.9 Sample Transportation

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

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

3.0 Quality Control

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

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

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

3.1 Replicate or Duplicate Samples

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

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

4.0 Laboratory Analysis/Reporting

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

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

5.0 Glossary

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

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

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

6.0 References

Nunavut Water Board. *Water License NWB3KUG0308*. Gjoa Haven, Nunavut.

Nunavut Water Board, September 2000, *Guidelines for the Discharge of Domestic Wastewater in Nunavut*.

Wilson, Neal. 1995. *Soil Water and Ground Water Sampling*. CRC Press: New York, USA.

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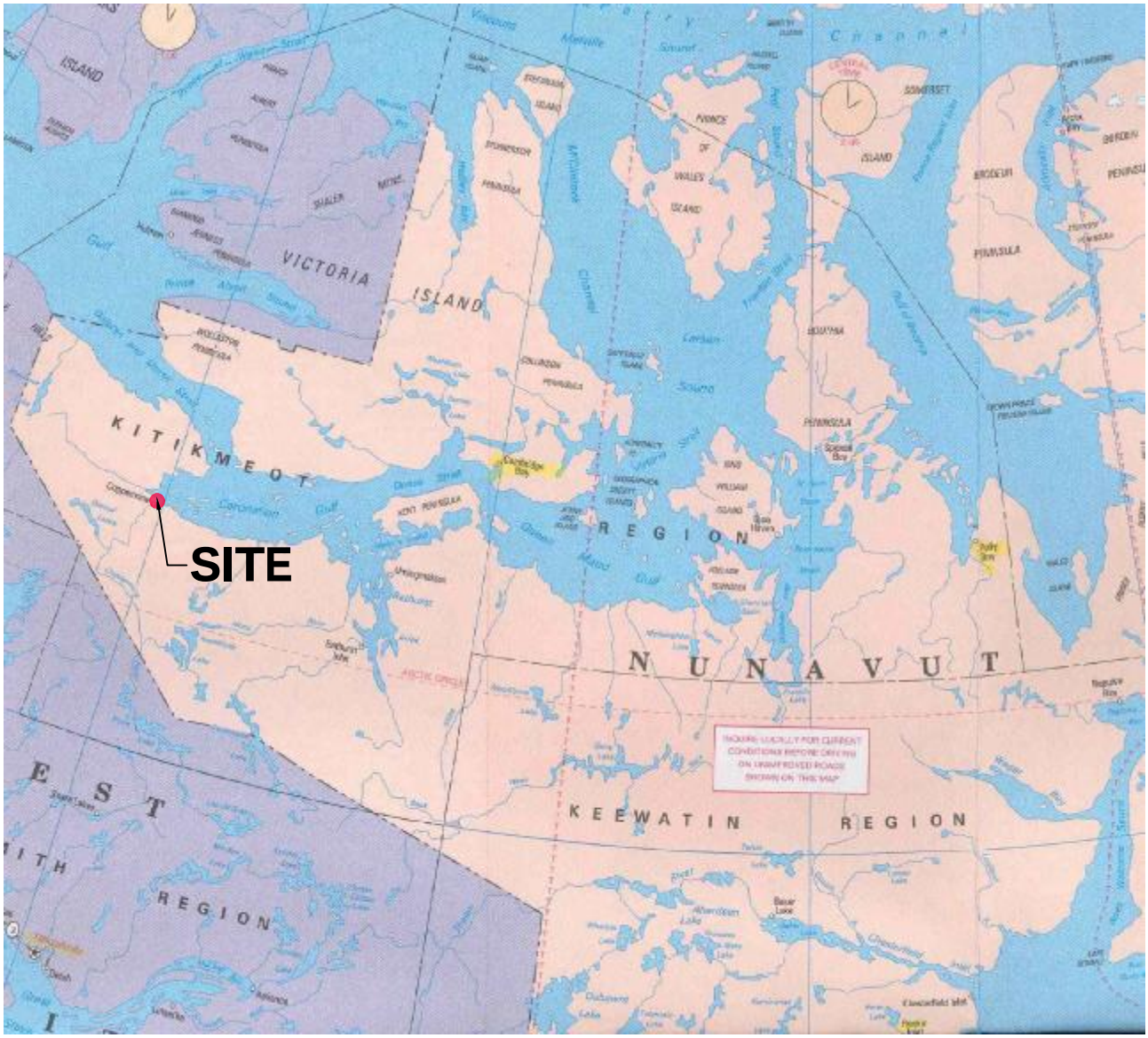
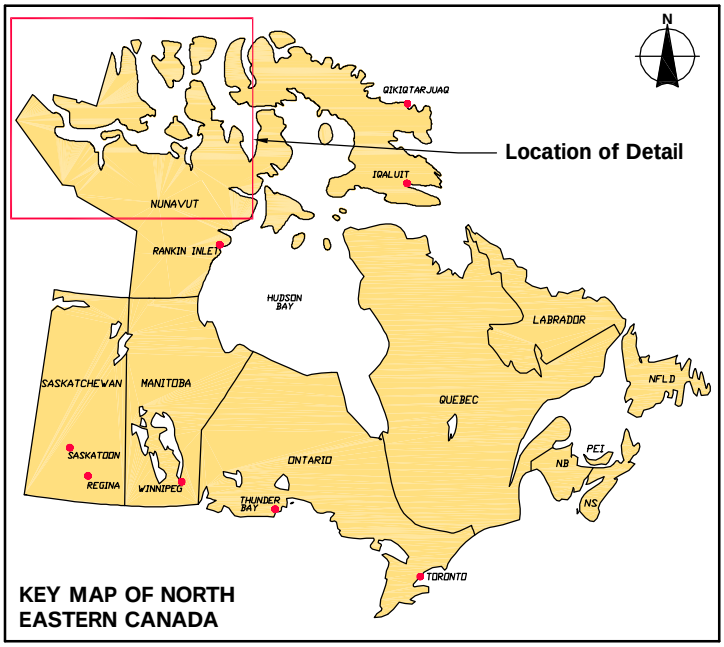
Figures



Map Reference:
Map of Canada
Published by the CAA



KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF KUGLUKTUK, NUNAVUT

QUALITY ASSURANCE/ QUALITY CONTROL PLAN

October 2005
Project Number: N-O 09755.0

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

FEO09754 QAQC SL.DWG

FIGURE 2

HAMLET OF KUGLUKTUK
QUALITY ASSURANCE/ QUALITY CONTROL PLAN

SITE PLAN

Image Source: © Copyright 2002 DigitalGlobe Inc., All Rights Reserved.

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
October 2005
Project Number: N-O 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

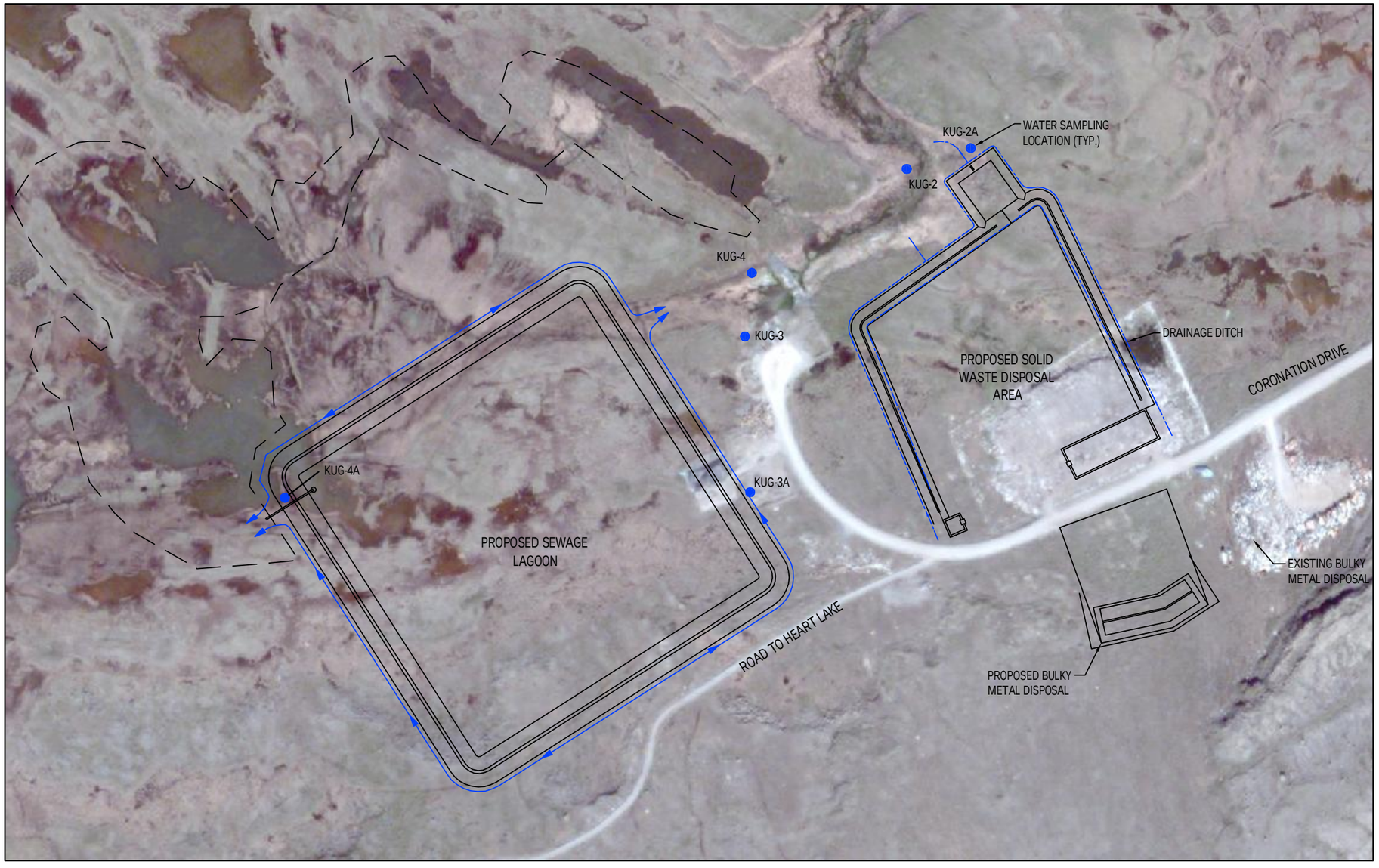
Verified by: J. Walls

BURNSIDE

FIGURE 3

HAMLET OF KUGLUKTUK
QUALITY ASSURANCE / QUALITY CONTROL PLAN

LANDFILL AND LAGOON AREA



Legend

- **PROPOSED SURFACE WATER SAMPLING LOCATION**

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000
June 2006
Project Number: N-0 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

NUNA BURNSIDE

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Appendix A

Water Board License

P.O. BOX 119
GJOA HAVEN, NU X0B 1J0
TEL: (867) 360-6338
FAX: (867) 360-6369

kNK5 wmoEp5 vtmpq
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3KUG0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated July 15, 2003, made by:

Hamlet of Kugluktuk

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

DECISION

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

Licence Number NWB3KUG0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-35)

SIGNED this 20th day of November 2003 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

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I. BACKGROUND

Kugluktuk is located immediately west of the mouth of the Coppermine River on Coronation Gulf at 67°50'N, 115°15'W, 595 air km north of Yellowknife. The Hamlet extends inland to cover a rocky knoll. The town site is underlain by Precambrian sedimentary and volcanic rock. Dolomite and shale, interspersed with volcanic rock, form steep outcrops in the vicinity of the settlement. The buildings along the shore are perched on consolidated beach deposits. Directly behind this ridge is a low, marshy area. There are numerous exposed bedrock surfaces in the community. Surficial deposits in the area include talus and deltaic deposits. The angular talus, derived primarily from the mechanical breakdown of dolerite, ranges in size from silt to boulders but is commonly found as course sand or fine gravel. Kugluktuk is underlain by permafrost. The thickness of the active layer ranges from less than 0.5 m to over 1 m in the sandy waterfront area. Permafrost features such as polygonal ground and thaw-related instability affect the raised delta surfaces and strongly influence their drainage characteristics. Grasses, sedges, heather, mosses, and lichens grow in limited soils. Willow and alder thickets are common in wetland depressions. Kugluktuk receives an average of 10.3 cm of rainfall and 100.7 cm of snowfall per year. Mean annual precipitation totals 20.2 cm. July mean high and low temperatures are 13.8° C and 5.6° C. The January mean high and low temperatures are -26.4° C and -33.8° C. The winds are generally south-west and annually average 16.6 km/h.

II. PROCEDURAL HISTORY

On July 15, 2003, an application for the renewal of water license N3L4-1526, was filed by Ferguson Simek Clark Environmental Consultants (Yellowknife) on behalf of the Hamlet of Kugluktuk. The previous water licence was issued by the Northwest Territories Water Board on 1 July 1998 and valid until June 30, 2003. In consideration of the application for renewal the Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement,* on July 23, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

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

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the compliance record of the Applicant. Specifically, the August 9, 2001 DIAND Inspection Report indicated that:

1. The Licensee has failed to produce Annual Reports from 1996-2001;
2. Water supply field pH , turbidity, and iron concentration exceeded the levels recommended in the *Guidelines for Canadian Drinking Water Quality*;
3. Sewage treatment system effluent concentrations of ammonia and phenol exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*;
4. Sewage treatment effluent contained noteworthy concentrations of faecal coliforms (1,470,000 CFU/100ml);
5. Solid waste disposal site effluent concentrations of iron and zinc exceeded the levels; and
6. The sewage treatment system effluent evidenced a significant toxicity, as determined by a MicroTox EC_{50} assessment.

Additionally, the NWB brings to the attention of the Licensee their failure to provide the Board with the as-built plans and drawings for the modifications to the Sewage Disposal Facilities, as required by Part D, Item 3 of Water License N7L4-1526. The Board requests that these as-built plans and drawings be forwarded by the Licensee within ninety (90) days following issuance of this license.

In review of the application, DIAND, has recommended a licence term of five (5) years. The NWB concurs that a term of five (5) years is appropriate, and will allow enough time for the Hamlet to establish a consistent compliance record with the terms and conditions of its licence. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

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

The NWB has also imposed on the Licensee the requirement to produce an Operations and Maintenance Manual for their sewage and solid waste operations. The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is

capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II).

Water Use

The Municipality currently receives water from Coppermine River. Water is treated using membrane filtration, which is accomplished in a twin train Harmsco filtration system, and stored in a 320 m^3 tank. The water receives a chlorine treatment prior to trucked-service distribution. Water consumption is projected to reach 53,475 m^3 *per annum* in 2003 and 60,533 m^3 *per annum* by 2008.

No serious concerns were raised by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Issues related to the quality of water produced by the present water treatment system were identified, but are currently being addressed by the Applicant and the Department of Community Government and Transportation, Government of Nunavut. DIAND has provided specific recommendations regarding volume usage limits, as well as recommending that the Applicant to be required to maintain a monitoring station at the water intake area KUG-1 in order to monitor the volume of water used. The Board concurs with these recommendations, and has set the terms and conditions in the water licence, which govern, water usage accordingly. The Board also recommends that the Hamlet and the Department of Community Government and Transportation take whatever steps are necessary to address the water quality issues identified in the August 9, 2001 DIAND Inspection Report.

Deposit of Waste

Sewage

The Hamlet of Kugluktuk utilizes a Sewage Disposal Facility approximately 5.0 km west of the Municipality. A gravel berm provides limited retention of sewage prior to discharge to an undefined wetland where it receives additional treatment prior to discharge to the marine environment. Specific comments relevant to sewage disposal operations in the Hamlet were provided by DIAND, and Environment Canada. Both DIAND and Environment Canada requested that the Applicant provide information to the NWB on how the Municipality plans to address the operational and environmental issues evidenced in the August 9, 2001 DIAND Inspection Report. Additionally, Environment Canada recommended that a minimum of 1 m of freeboard should be maintained at all retention structures, and that All Terrain Vehicle (ATV) traffic be restricted in the wetland area so as to prevent soil erosion and damage to vegetation from compromising the effectiveness of the wetland treatment of the sewage.

DIAND and Environment Canada also recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. Additionally, DIAND provided recommendations concerning effluent discharge criteria, which are consistent with the *Guidelines for the Discharge of*

Treated Municipal Wastewater in the Northwest Territories (Northwest Territories Water Board; 1992), as well as specific recommendations concerning the Monitoring Program.

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

Solid Waste

The Hamlet's solid waste management site is located approximately 4.5 km from the community. Waste is segregated, with a generic landfill area, a bulky wastes area, and a sealift container for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered on a yearly basis.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND and Environment Canada. Both DIAND and Environment Canada recommended that preventative measures be implemented to prevent standing water noted at the toe of the solid waste site from escaping the facility. Environment Canada also recommended that the Municipality undertake a waste composition study, which will assist the Municipality to plan for the long term waste disposal needs of the community. The Board concurs that the Hamlet should give serious consideration to this recommendation, and recommends that discussions be commenced with the Department of Community Government and Transportation to determine potential assistance which may be available to the Hamlet to undertake such a study.

DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans for their solid waste operations. DIAND and Environment Canada further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. DIAND and Environment Canada recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. Additionally, both Environment Canada and DIAND recommended the installation of appropriate fencing at the bulky waste and hazardous waste disposal sites, so as to improve security on the sites. The Board concurs that the Hamlet should give serious consideration to this recommendation, and in the interim take whatever steps are practicable to implement this recommendation.

LICENCE NWB3KUG0308

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF KUGLUKTUK

(Licensee)

of **KUGLUKTUK, NUNAVUT, X0E 0E0**

(Mailing Address)

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

Licence Number **NWB3KUG0308**

Water Management Area **NUNAVUT 05**

Location **KUGLUKTUK, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **64,000 CUBIC METRES ANNUALLY**

Date of Licence **NOVEMBER 20, 2003**

Expiry Date of Licence **NOVEMBER 30, 2008**

Dated this 20th of November 2003 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Kugluktuk, Nunavut (67°50'N, 115°15'W);

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

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

2. Definitions

In this Licence: **NWB3KUG0308**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"Licensee" means the holder of this Licence;

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

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

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

"Sewage" means all toilet wastes and greywater;

"Sewage Disposal Facilities" comprises the area and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

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

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

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Coppermine River, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2.

PART B: GENERAL CONDITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(i) Chief Administrative Officer:

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

(ii) Inspector Contact:

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

(iii) Analyst Contact:

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

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

PART C: CONDITIONS APPLYING TO WATER USE

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

2. The annual quantity of water used for all purposes shall not exceed 64,000 cubic metres.

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

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

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

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

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

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

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

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

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

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

7. The Licensee shall implement measures to ensure waste from the Solid Waste Disposal Facility does not enter water.

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

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

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

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

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

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

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

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

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

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

    iv. the Board has not rejected the proposed modifications.

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

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

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before March 31, 2004 submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996). This Plan shall specifically address the waste disposal and operational issues related to the Sewage Disposal Facility and the Solid Disposal Facility, which were identified in the August 9, 2001 DIAND Inspection Report.

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

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

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

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

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

    i. take whatever steps are immediately practicable to protect human life, health and the environment;
    ii. without delay seek guidance from the Departments of Community Government and Transportation and Sustainable Development with regards to mitigation and remedial actions required to address the discharge;

ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

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

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

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

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

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

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Monitoring Station	Description
KUG-1	Raw water supply at Coppermine River prior to treatment
KUG-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
KUG-3	Raw Sewage at truck offload point
KUG-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

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

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

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

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

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

6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence.

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

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

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

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

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

Appendix B
Contact List

APPENDIX B

Contact Information

Contact	Location	Telephone Number	Fax Number
Hamlet of Kugluktuk SAO	Kugluktuk	(867) 982-6500	(867) 982-3060
24-Hour NWT/Nunavut Spill Report Line	Yellowknife	(867) 920-8130	(867) 873-6924
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Government of Nunavut - Regional Engineer	Cambridge Bay	(867) 983-4125	(867) 983-4123
Environment Canada - Inspector	Iqaluit	(867) 975-4644	(867) 979-4594
Fire Department	Kugluktuk	(867) 982-2222	(867) 982-3407
RCMP Detachment	Kugluktuk	(867) 982-1111	(867) 982-3390
Community Health Centre	Kugluktuk	(867) 982-4531	(867) 982-3115

Appendix G2

Solid Waste Management Facility

Solid Waste Management Facility
Operation and Maintenance (O&M) Plan
Hamlet of Kugluktuk

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175, 25 Third Avenue Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

June 2006

File No: N-O 09755

Solid Waste Management Facility
Operation and Maintenance (O&M) Plan
Hamlet of Kugluktuk

June 2006

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Appendices

1.0 Introduction

This Operation and Maintenance Plan has been prepared to assist the Community of Kugluktuk in the operation of their Solid Waste Disposal Facility. It provides a description of the regular operating procedures as well as monitoring requirements.

The Hamlet of Kugluktuk Solid Waste Disposal Facility consists of the following components:

- Landfill (also referred to as the Municipal Solid Waste Disposal Area)
- The Bulky Materials Disposal Area
- The Landfarming Area
- The Hazardous Waste Storage Area.

The facility has been in use for approximately 15 years, and currently operates under Water Board License NWB3KUGO308 issued November 20, 2003. The license expires November 30, 2008. A copy is included in Appendix A.

1.1 Background

The Hamlet of Kugluktuk (formerly known as Coppermine), is situated on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River, at latitude 67°49'N, longitude 115°06'W, as shown on Figure 1.

The community has a population of approximately 1,585, with an approximate 1.5 percent projected growth rate. Community infrastructure includes:

- A water treatment plant, which draws water from the Coppermine River and stores it for treatment
- Trucked water to holding tanks in each building
- A sewage lagoon which receives trucked sewage collected from holding tanks in each building
- Sewage treatment via an exfiltration lagoon to a wetland discharging north to the ocean
- A Solid Waste Disposal Facility, which includes a Municipal Solid Waste Disposal Area, a Bulky Materials Disposal Area, a Hazardous Waste Storage Area and a landfarm (currently being developed)
- Several rock and sand quarries
- Diesel powered generators
- Two wind generators (one partially dismantled and the other currently off-line)
- Barge landing area.

Key features of the community are shown on Figure 2. The landfill and sewage lagoon locations are shown on Figure 3.

The Hamlet is predominately residential with a few small commercial establishments including a hotel, several construction contracting businesses, grocery store, and a variety of other small businesses. Hunting and fishing in the traditional manner is still a prime occupation for many of the inhabitants. Community buildings include a high school, an elementary school, arena, swimming pool, Hamlet office, public works yard, GN offices, and police station.

1.1.1 Climate

Kugluktuk is affected by Arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The mean annual air temperature is -12°C. Monthly averages range from -31°C in February to 10°C in July. Kugluktuk receives about 249 mm of precipitation per year, of which 134 mm falls as rain between June and September. Prevailing winds are from the east in summer and from the southwest in winter. The mean wind speed is approximately 15 km/hr. Climate details are included in Appendix B.

1.1.2 Geology and Morphology

The terrain surrounding Kugluktuk consists of coastal lowlands of sand and clay plains dotted with shallow lakes.

The ground surface consists of bedrock and glacial deposits. Boulder and cobbles cover some areas. Much of the surface is covered with turf consisting of various grasses, sedges, and moss underlain by a thin (10 cm to 30 cm) layer of topsoil and/or peat.

The land area around Kugluktuk is underlain by permafrost estimated at several hundred metres thick. There is no permafrost under major water bodies such as Coronation Gulf. A deep zone of non-permafrost probably exists as a talik beneath the Coppermine River. The depth of the active layer over most of the land area is dependent on vegetation cover, soil type, and moisture conditions. Test pitting in the vicinity of the sewage lagoon and landfill found the top of the permafrost in early October to be approximately 0.9 m below surface.

The bedrock in the area consists of Proterozoic fine grained sedimentary and meta-sedimentary (shale) of the Rae Group. These have been intruded by the Coronation Sills, which are composed primarily of granular gabbro.

A northeast trending ridge of bedrock dominates the topography from Heart Lake to the mouth of the Coppermine River. Both gabbro and shale have been quarried locally for construction materials.

The area is dominated by the effects of isostatic rebound following the last glaciation, and deposits related to the discharge of the Coppermine River. East of Kugluktuk (between the sewage lagoon and the ocean) is an area of raised beach ridges comprised of well sorted medium grained sand. More varied fine to coarse sediments are found in the Hamlet and along the west side of the Coppermine River. Sand is quarried at a pit located near the west end of the runway. Another area used for extraction of sandy construction material is located near the east end of the runway.

2.0 Operation and Maintenance

2.1 Material Arrival

Material will arrive at the facility mainly by a side-loading garbage truck owned by the Hamlet or by private residential drop-off.

After Hamlet resources collect waste, the collection vehicles will progress to the landfill, where wastes will be tipped into the burn pit. After being tipped (or during collection), staff will perform an inspection of the waste to ensure that it does not contain visible hazardous or bulky waste. If such waste is noted, it will be segregated in the appropriate locations of the approved Hazardous Waste Segregation Facility or the Bulky Materials Disposal Area.

Members of the community may drop off materials directly at the facility (mainly bulky materials) or hazardous wastes. The public should be encouraged to place materials in the appropriate location; generally bulky materials within the Bulky Material Disposal Area, and hazardous waste outside of the Hazardous Waste Storage Area.

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

2.2 Landfill

The landfill, showing the site upgrades, is included as Figure 3. The operational procedures for the landfill are presented below:

2.2.1 Operation

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

- Burn only in the established burn area
- If possible, materials should not to be tipped directly onto burning or smoldering waste; it is preferable to not ignite the waste until it has all been collected for the day
- Ensure that the weather is acceptable for burning. The following guidelines are recommended:

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

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

Prior to waste handling, the equipment operator will confirm that the waste is no longer hot or burning. As required, using a dozer or a loader, the ash and unburnt general municipal wastes will be pushed away from the burn pit and along the active face, observing the following operating principles:

- All waste shall be removed from the tipping and burn areas

- The waste shall be pushed and spread along the tipping face at approximately a 3:1 grade (shallower grades result in the need for too much cover, steeper grades are typically not stable)

- As required, (but minimally once per year) cover material shall be spread over waste. Use contaminated soil stockpiled adjacent to the site for regular soil cover, until this source has been exhausted (likely in about 3 years) or can no longer be used because of permafrost. Then cover material shall be obtained from any locally available source.

Figures 3 to 7 illustrate the progress for landfill development.

2.2.2 Maintenance

Operations staff will perform weekly site inspection and maintenance. During these inspections, weekly site inspection forms (Appendix C) will be completed. These forms are designed to note the standard items requiring inspection and maintenance at the site, as well as other relevant information, such as weather. They are also used to document the response to any incidents that affect site operations such as accidents, injuries, fires, flooding, or chemical spills.

- The tipping area and necessary roadways shall be maintained by snow clearing in the winter and grading in the summer, and repaired as necessary
- Ditches and drainage channels shall be inspected for erosion, and repaired as necessary
- Site warning signage, which identifies the boundaries of the Solid Waste Disposal Facility (which includes the landfill, Hazardous Waste Storage Area, the Bulky Materials Disposal Area and the landfarm) shall be inspected, and repaired or replaced as necessary

- Any airborne litter outside of the litter-control fences (which are located on top of the berms at the Facility) shall be removed, and deposited in the landfill
- Litter that has accumulated against the fences shall be removed and placed into the landfill
- After rain events and following the spring thaw, the site shall be inspected for leachate breakout. Cover the face if possible and ensure that leachate is being contained within the water retention area
- The berms and final cover at the Solid Waste Disposal Facility shall be inspected for erosion and settlement
- The fences at the Solid Waste Disposal Facility shall be inspected for damage, and repaired as necessary.

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

Staff will place hazardous materials, such as oil or solvents into drums located in the waste storage area. Materials should be left in the original container and placed into the drums, sorted according to what is in the containers (i.e., waste oils stored with oils, solvents with solvents, cleaners with cleaners). Drums will remained sealed within the compound.

2.3 Bulky Materials Disposal Area

2.3.1 Regular Operation

Staff should inspect the bulky materials disposal area on a regular basis to check for new materials. Fluids (oil, antifreeze) should be drained from vehicles, and if possible, batteries should be removed and transferred to the Hazardous Waste Storage Area. Bulky materials should then be tagged to indicate that they have been inspected and cleaned.

Bulky materials should be moved to the appropriate location to maximize segregation of the materials. These groupings can be developed by the operation staff based on needs and materials, but are anticipated to consist of tires, appliances, bicycles, ATV's, snowmobiles and miscellaneous debris.

2.3.2 Regular Maintenance

Although reuse of the material is possible, there are materials that will have no potential future life. It is recommended that periodically, (i.e., every 5 to 10 years) all bulky materials be removed out and buried in a dedicated burial pit, developed to the west of the existing Bulky Materials Disposal Area. A detail of the Bulky Materials Burial Area is included as Figure 8.

2.4 Hazardous Waste Storage Area

2.4.1 Operations

During regular operations work on the facility, any hazardous materials placed on site should be transferred to the storage area. Batteries must be stored upright. Oils, lubricants and antifreeze may be bulked together in common drums, preferably remaining in their original packaging. Unknown substances should remain in their package and placed into drums.

2.4.2 Maintenance

The area should be inspected on a regular basis for signs of spillage or leaks. Degraded containers (i.e., rusted drums) should be replaced as required.

When materials within the facility have accumulated to quantities that constitute a load, the Hamlet should arrange for them to be removed from site by a licensed hauler and who will dispose of them in a licensed facility.

If rainwater accumulates within the area, it shall be pumped out and transferred to the Sewage Treatment Lagoons.

2.5 Landfarming Area

2.5.1 Operations

At least once per month between May and August, soils within the landfarm will be tilled. Commencing at the east end of the landfarm, placed soil will be excavated and turned over using a backhoe, such that soils are loose, even and aerated. The backhoe must not drive over aerated soils until the next tilling event.

If soils are dry and access water is present in the water retention area, water will be added to soils to keep them moist.

A minimum of four samples will be taken from the landfarm in early August, and tested for petroleum hydrocarbons (F1 to F4). When the CCME criteria shown below have been met (or appropriate parameters depending on the material placed in the landfarm), soils shall be considered sufficiently remediated and used for cover on the landfill.

Clean-up Criteria for Contaminated Soil at Landfarm

	Criteria (mg/kg)	Sample Results	Sample Results	Sample Results	Sample Results
Petroleum Hydrocarbon Fraction-1 (F1)	310				
Petroleum Hydrocarbon Fraction-2 (F2)	760				
Petroleum Hydrocarbon Fraction-3 (F3)	1700				
Petroleum Hydrocarbon Fraction-4 (F4)	3300				

Additional materials may be placed in the landfarm, if available.

3.0 Facility Monitoring Procedures

As outlined in the NWB water license, regular monitoring of runoff from the Solid Waste Disposal Facility is required. The Monitoring Program is to include effluent samples collected from the water collection pond during the months on June to September, inclusive.

The monitoring program is outlined in detail in Appendix D (QA/QC) and explained briefly below.

Effluent samples collected shall be analyzed for the following parameters:

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

In addition, any additional analytical parameters which are identified in the NWB water license, or by an Inspector (as defined in the ***Nunavut Waters and Nunavut Surface Rights Tribunal Act)*** shall be included.

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

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

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

3.1 Annual Report

An annual report shall be prepared for the site and submitted to the Water Board. The report shall include:

- An overall description of the activities that occurred at the facility throughout the year, including both regular waste acceptance and annual shaping
- An estimate of the quantity of material received at the site
- A description of any maintenance or improvements that were completed at the site throughout the year
- A list of any complaints and actions taken to address them
- Analytical testing results.

4.0 Contingency Measures

Contingency plans are designed so that site operators are prepared in the event of an accident or occurrence. The contingency measures described below are generic in nature since they must address a wide variety of issues.

4.1 Injuries

In the event of an injury to workers or members of the public:

- Apply first aid
- Seek medical assistance, if necessary
- Report the injury to the supervisor
- Document the incident and all response measures on the Weekly Site Inspection Form and Supplementary Site Inspection Form (Appendix A).

4.2 Spills

Activities to be completed in the event of a spill are explained in detail in Appendix E (Environmental Emergency Contingency Plan).

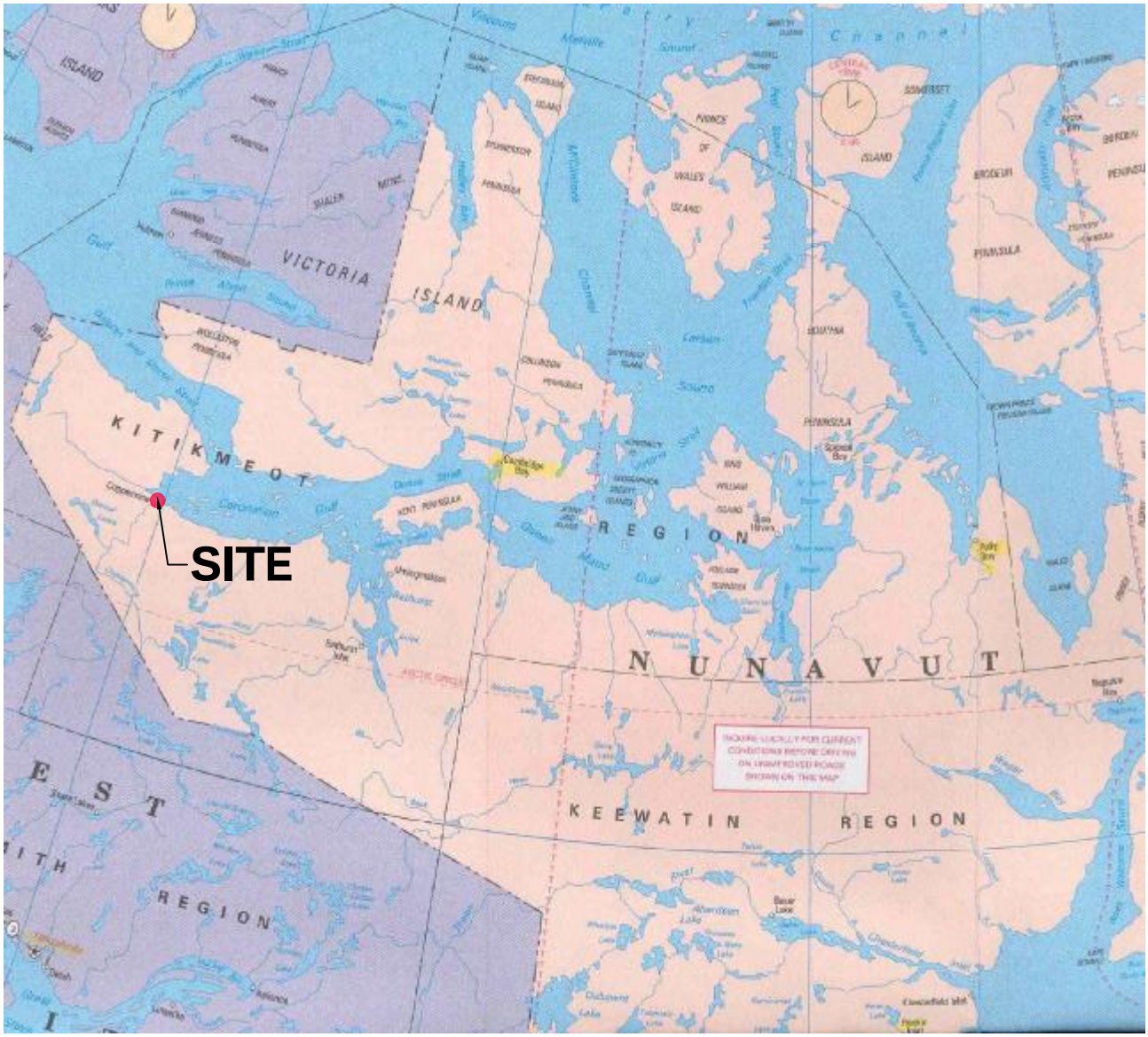
4.3 Fires

In the event of a fire, assess the situation. Do not attempt to fight a fire if it cannot be done safely. Standard fire fighting equipment available in the Hazardous Waste Storage Trailer can manage most small fires. Alternatively, cover soils can be thrown onto the fire either by hand, or by using available equipment (i.e., bulldozer). Obtain help as necessary. Document the incident and all response measures on the Weekly Site Inspection Form and Supplementary Site Inspection Form (Appendix A).

4.4 Erosion

Erosion may become a problem if runoff rates exceed expectations or cover soils and vegetation is not well established for any reason. The preferred contingency measure for this is to repair the area of erosion with available materials and cover with blast rock.

Figures



Map Reference:
Map of Canada
Published by the CAA

KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION

THE HAMLET OF KUGLUKTUK, NUNAVUT

SOLID WASTE MANAGEMENT FACILITY
OPERATION AND MAINTENANCE (O&M) PLAN

October 2005
Project Number: N-O 09755.0

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

FEO09754 O&M SOLID WASTE SL.DWG

FIGURE 2

HAMLET OF KUGLUKTUK
SOLID WASTE MANAGEMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

KEY FEATURES OF COMMUNITY

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
October 2005
Project Number: N-O 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

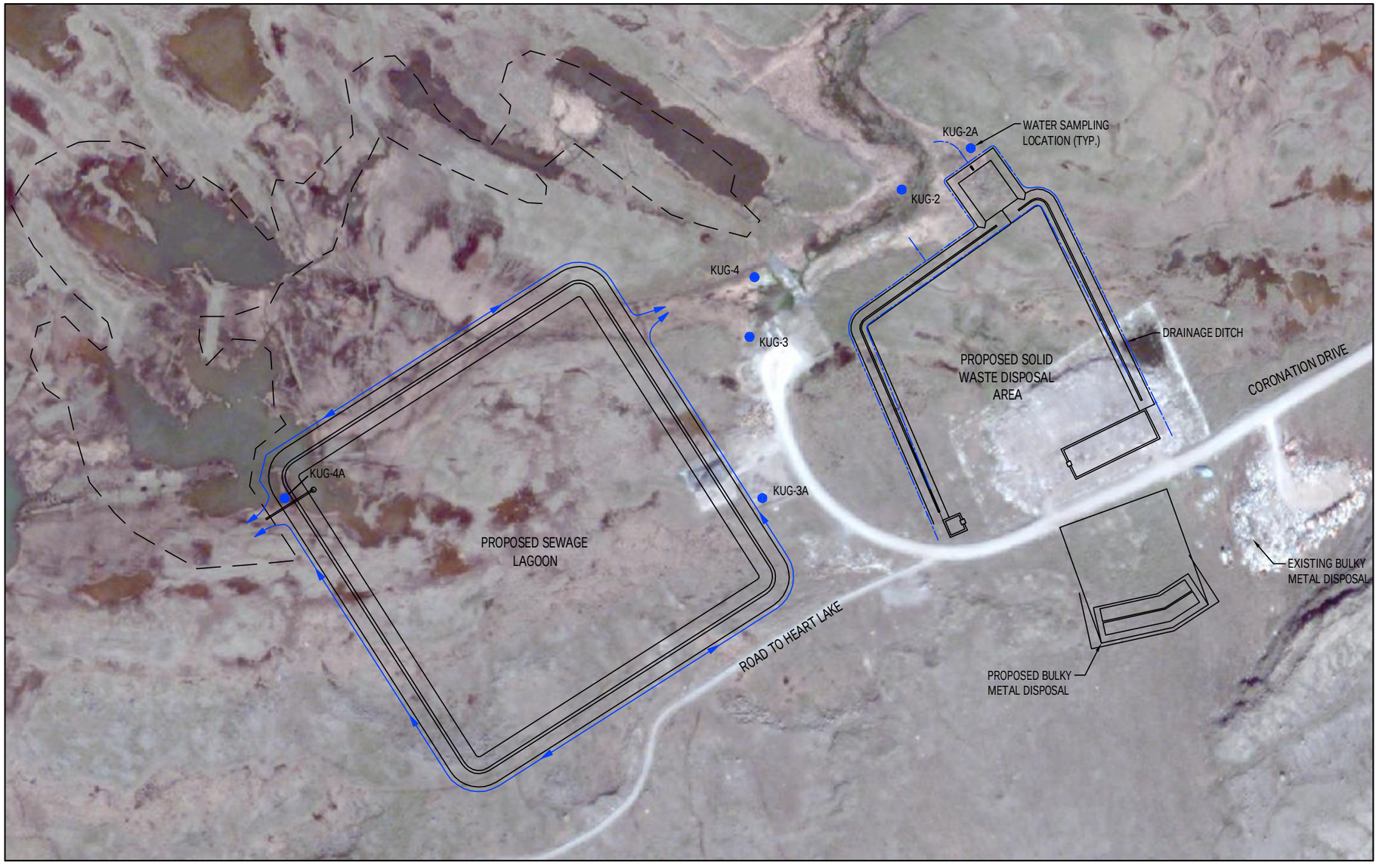


FIGURE 3

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

REGIONAL VIEW OF SEWAGE LAGOON AND SOLID WASTE DISPOSAL FACILITY (LANDFILL)

Legend

PROPOSED SURFACE WATER SAMPLING LOCATION

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 20 40 60 80 100 120 140 160 180 200 220 240
Meters

1:3000
June 2006
Project Number: N-0 09755.0

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

K:\DWG\EEO_JOB\EEO_09754\Kugluktuk_EE009754.0\Operation_&_Maintenance_Plan_–_Sewage_Treatment_Facility\EE009754_O&M_LANDFILL_AREA.dwg

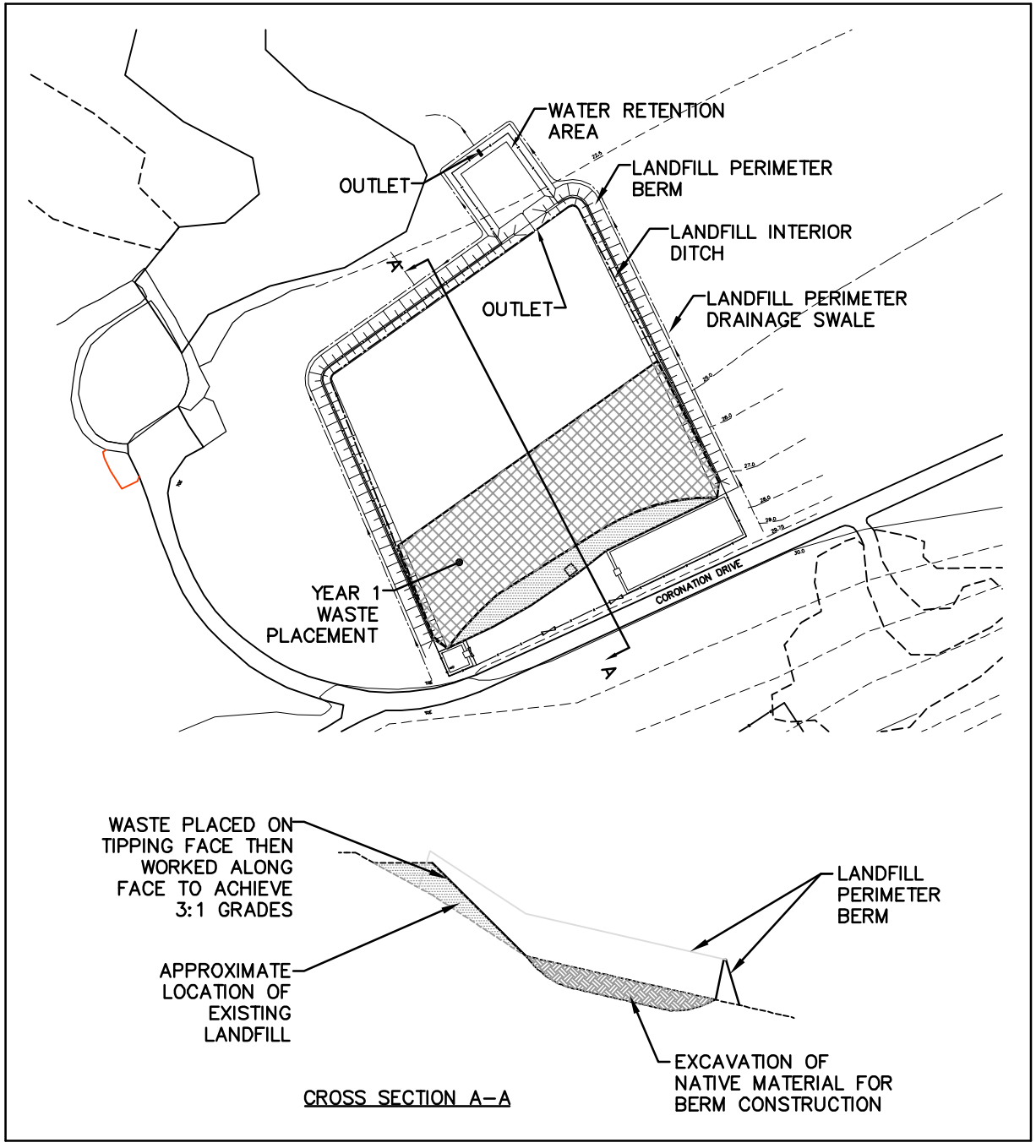


FIGURE 4

HAMLET OF KUGLUKTUK

SOLID WASTE MANAGEMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 1

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Metres

1:3000

JUNE 2006

Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG

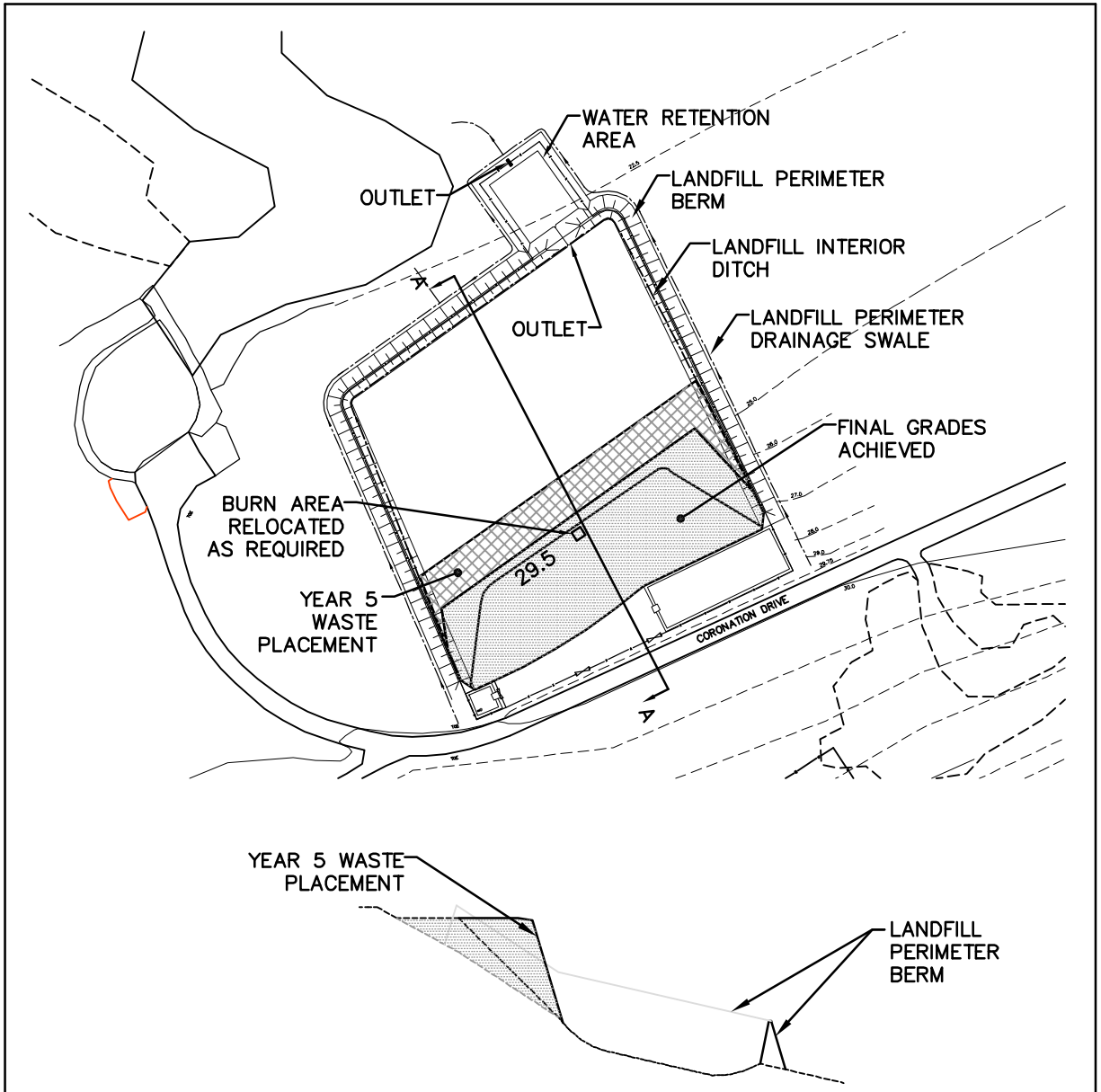


FIGURE 5

HAMLET OF KUGLUKTUK
SOLID WASTE MANAGEMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 5

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Metres

1:3000
JUNE 2006
Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG

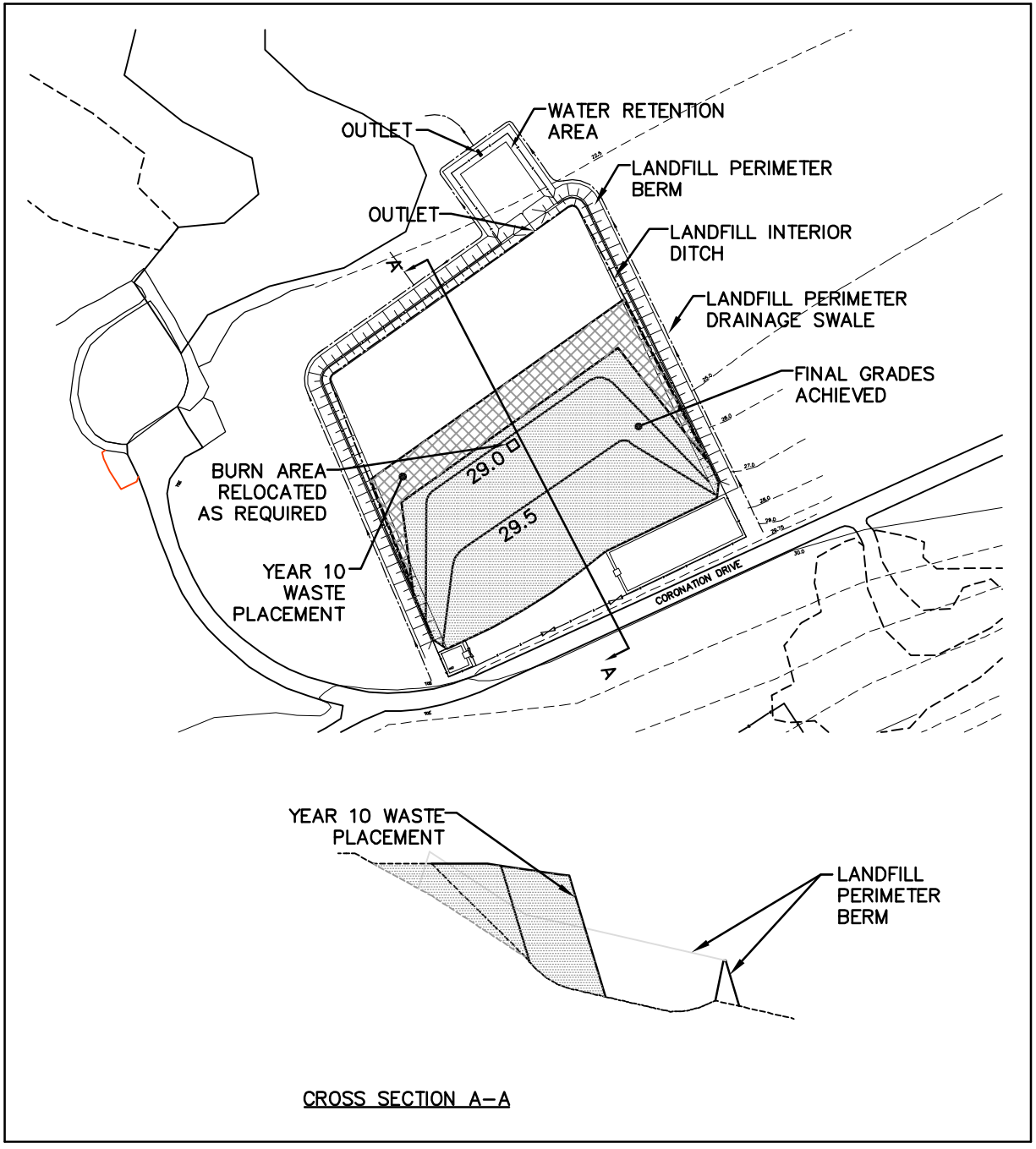


FIGURE 6

HAMLET OF KUGLUKTUK

SOLID WASTE MANAGEMENT FACILITY
OPERATION AND MAINTENANCE
(O&M) PLAN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 10

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000
JUNE 2006
Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG

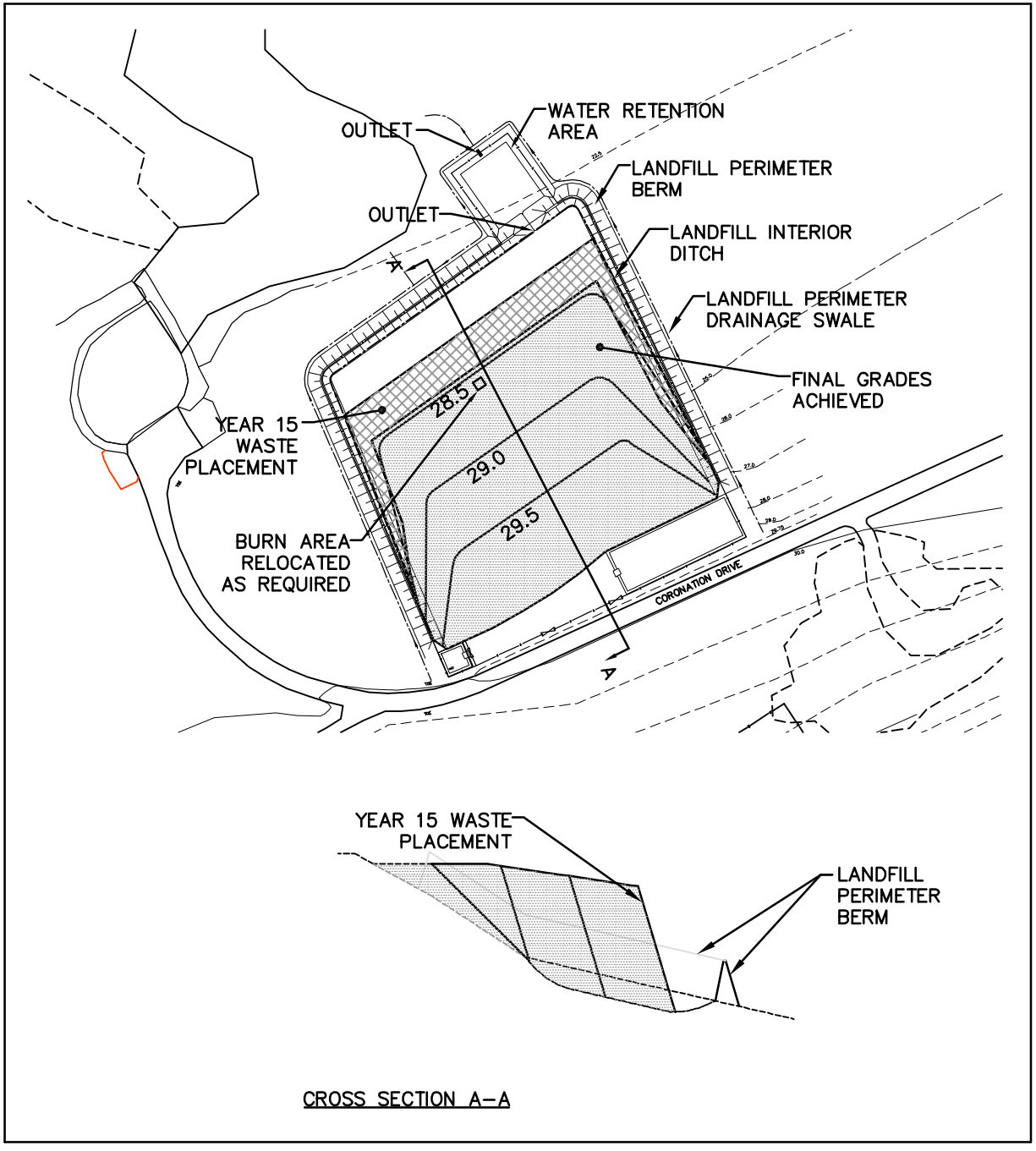


FIGURE 7

HAMLET OF KUGLUKTUK

SOLID WASTE MANAGEMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 15

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000

JUNE 2006

Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG

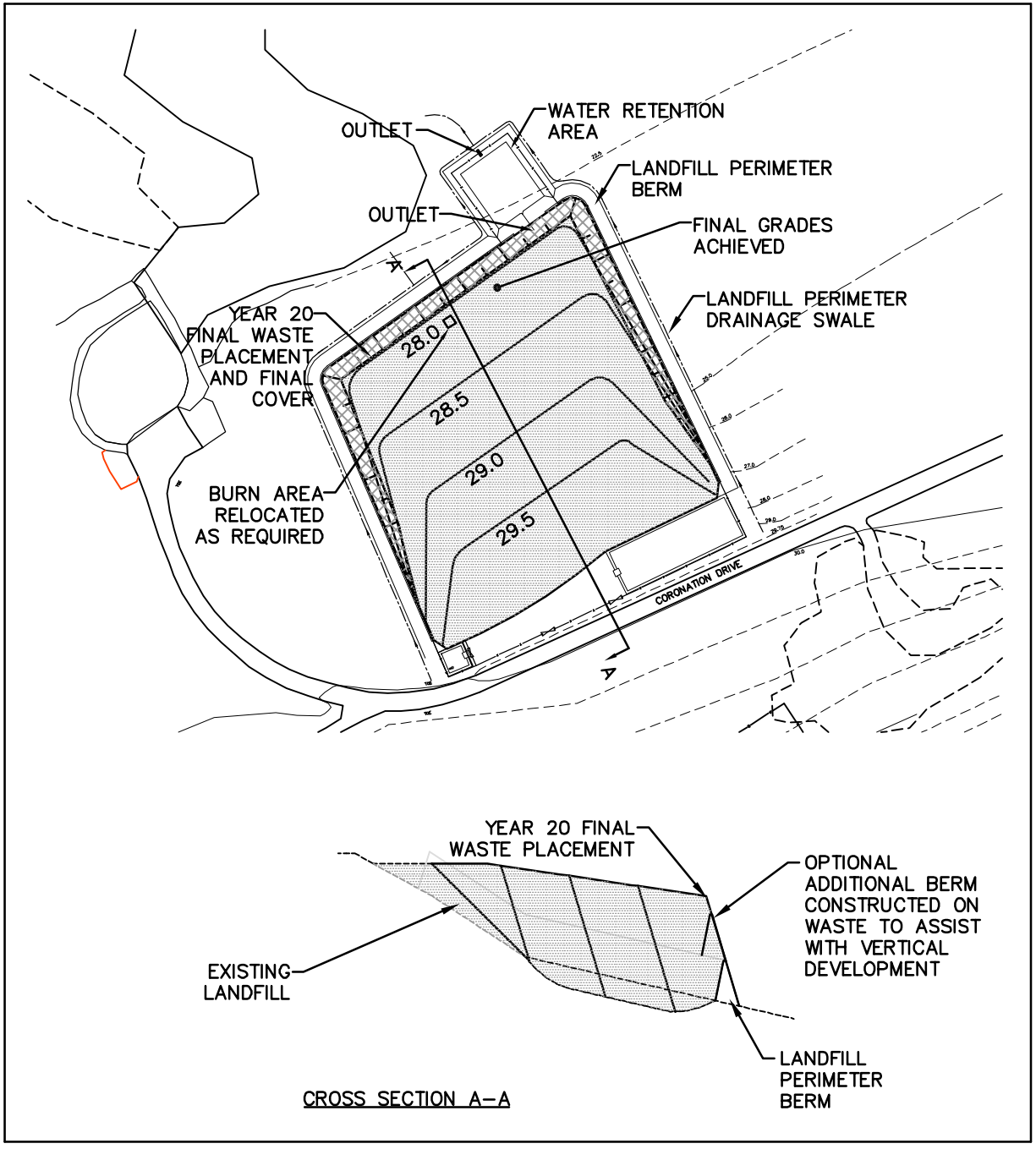


FIGURE 8

HAMLET OF KUGLUKTUK

SOLID WASTE MANAGEMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

SOLID WASTE DISPOSAL FACILITY LANDFILL DEVELOPMENT YEAR 20

Legend

WASTE PLACEMENT

N

0 20 40 60 80 100 120 140 160 180 200 220 240

Meters

1:3000

JUNE 2006

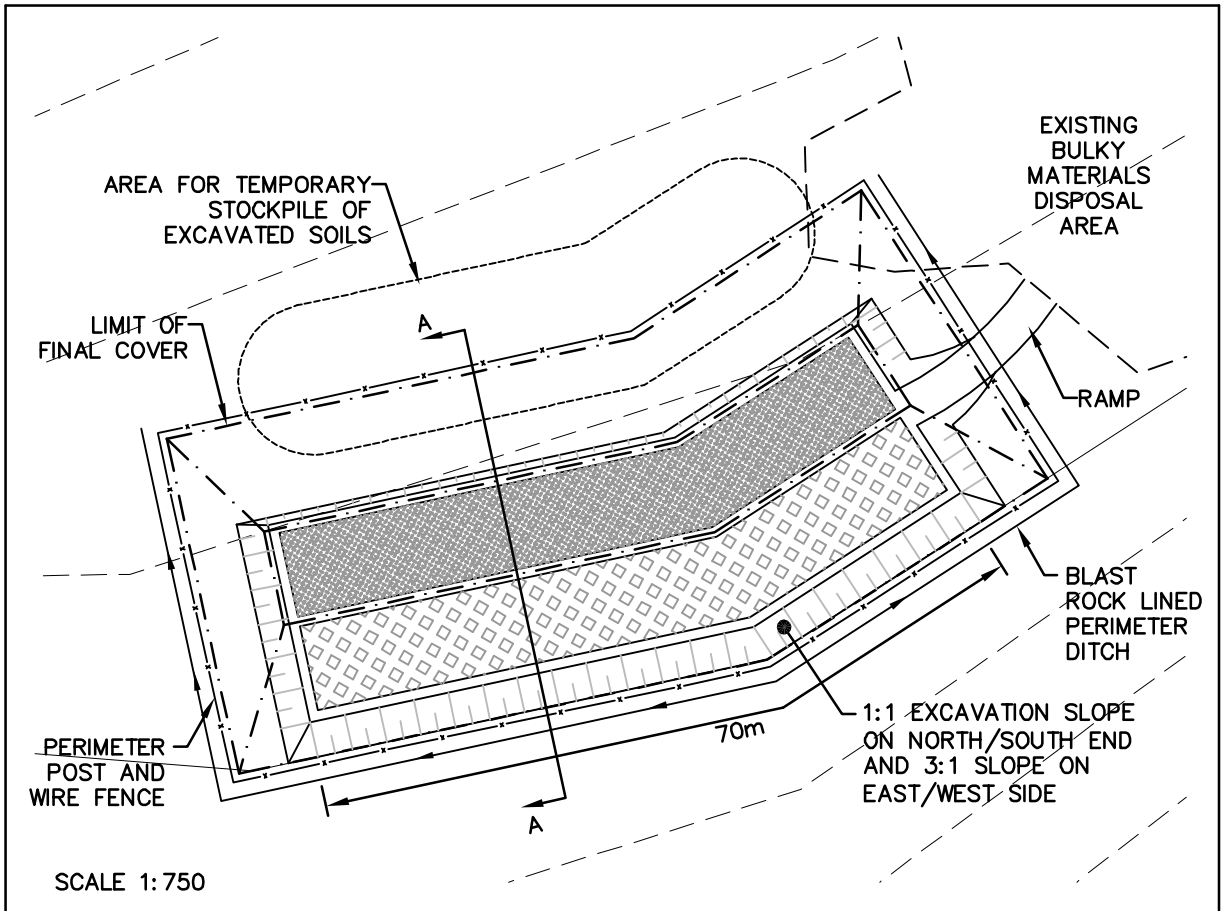
Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG



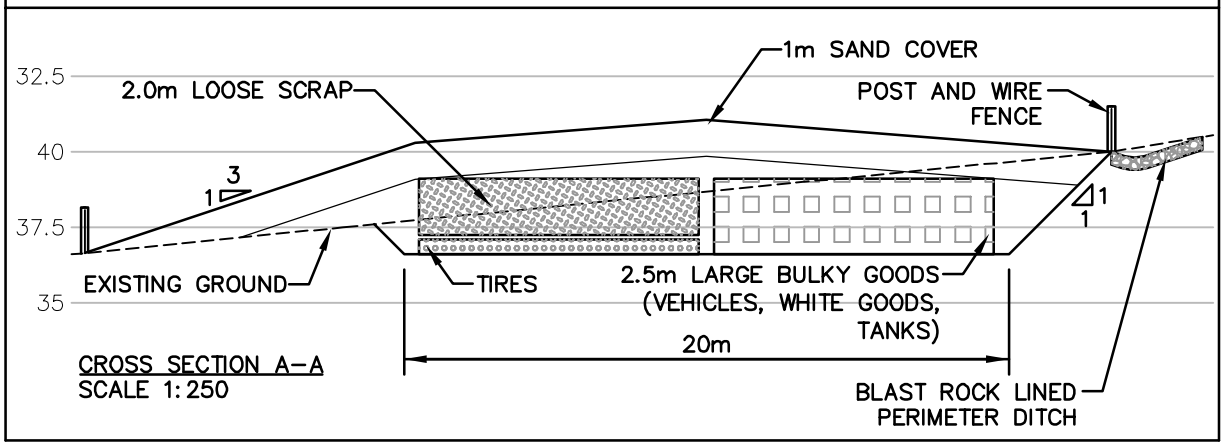


FIGURE 9

HAMLET OF KUGLUKTUK

SOLID WASTE MANAGEMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN

BULKY MATERIALS DISPOSAL PIT

N

0 10 20 30 40 50 60

Metres

1:750

JUNE 2006

Project Number: N-O 9755

Prepared by: T. Thompson

Verified by: K. Hunter

BURNSIDE

XREF: N-O9755-BASE.DWG

Appendix A

Water Board License

P.O. BOX 119
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FAX: (867) 360-6369

kNK5 wmoEp5 vtmpq
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3KUG0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated July 15, 2003, made by:

Hamlet of Kugluktuk

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

DECISION

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

Licence Number NWB3KUG0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-35)

SIGNED this 20th day of November 2003 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

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I. BACKGROUND

Kugluktuk is located immediately west of the mouth of the Coppermine River on Coronation Gulf at 67°50'N, 115°15'W, 595 air km north of Yellowknife. The Hamlet extends inland to cover a rocky knoll. The town site is underlain by Precambrian sedimentary and volcanic rock. Dolomite and shale, interspersed with volcanic rock, form steep outcrops in the vicinity of the settlement. The buildings along the shore are perched on consolidated beach deposits. Directly behind this ridge is a low, marshy area. There are numerous exposed bedrock surfaces in the community. Surficial deposits in the area include talus and deltaic deposits. The angular talus, derived primarily from the mechanical breakdown of dolerite, ranges in size from silt to boulders but is commonly found as course sand or fine gravel. Kugluktuk is underlain by permafrost. The thickness of the active layer ranges from less than 0.5 m to over 1 m in the sandy waterfront area. Permafrost features such as polygonal ground and thaw-related instability affect the raised delta surfaces and strongly influence their drainage characteristics. Grasses, sedges, heather, mosses, and lichens grow in limited soils. Willow and alder thickets are common in wetland depressions. Kugluktuk receives an average of 10.3 cm of rainfall and 100.7 cm of snowfall per year. Mean annual precipitation totals 20.2 cm. July mean high and low temperatures are 13.8° C and 5.6° C. The January mean high and low temperatures are -26.4° C and -33.8° C. The winds are generally south-west and annually average 16.6 km/h.

II. PROCEDURAL HISTORY

On July 15, 2003, an application for the renewal of water license N3L4-1526, was filed by Ferguson Simek Clark Environmental Consultants (Yellowknife) on behalf of the Hamlet of Kugluktuk. The previous water licence was issued by the Northwest Territories Water Board on 1 July 1998 and valid until June 30, 2003. In consideration of the application for renewal the Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement,* on July 23, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

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

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the compliance record of the Applicant. Specifically, the August 9, 2001 DIAND Inspection Report indicated that:

1. The Licensee has failed to produce Annual Reports from 1996-2001;
2. Water supply field pH , turbidity, and iron concentration exceeded the levels recommended in the *Guidelines for Canadian Drinking Water Quality*;
3. Sewage treatment system effluent concentrations of ammonia and phenol exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*;
4. Sewage treatment effluent contained noteworthy concentrations of faecal coliforms (1,470,000 CFU/100ml);
5. Solid waste disposal site effluent concentrations of iron and zinc exceeded the levels; and
6. The sewage treatment system effluent evidenced a significant toxicity, as determined by a MicroTox EC_{50} assessment.

Additionally, the NWB brings to the attention of the Licensee their failure to provide the Board with the as-built plans and drawings for the modifications to the Sewage Disposal Facilities, as required by Part D, Item 3 of Water License N7L4-1526. The Board requests that these as-built plans and drawings be forwarded by the Licensee within ninety (90) days following issuance of this license.

In review of the application, DIAND, has recommended a licence term of five (5) years. The NWB concurs that a term of five (5) years is appropriate, and will allow enough time for the Hamlet to establish a consistent compliance record with the terms and conditions of its licence. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

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

The NWB has also imposed on the Licensee the requirement to produce an Operations and Maintenance Manual for their sewage and solid waste operations. The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is

capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II).

Water Use

The Municipality currently receives water from Coppermine River. Water is treated using membrane filtration, which is accomplished in a twin train Harmsco filtration system, and stored in a 320 m^3 tank. The water receives a chlorine treatment prior to trucked-service distribution. Water consumption is projected to reach 53,475 m^3 *per annum* in 2003 and 60,533 m^3 *per annum* by 2008.

No serious concerns were raised by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Issues related to the quality of water produced by the present water treatment system were identified, but are currently being addressed by the Applicant and the Department of Community Government and Transportation, Government of Nunavut. DIAND has provided specific recommendations regarding volume usage limits, as well as recommending that the Applicant to be required to maintain a monitoring station at the water intake area KUG-1 in order to monitor the volume of water used. The Board concurs with these recommendations, and has set the terms and conditions in the water licence, which govern, water usage accordingly. The Board also recommends that the Hamlet and the Department of Community Government and Transportation take whatever steps are necessary to address the water quality issues identified in the August 9, 2001 DIAND Inspection Report.

Deposit of Waste

Sewage

The Hamlet of Kugluktuk utilizes a Sewage Disposal Facility approximately 5.0 km west of the Municipality. A gravel berm provides limited retention of sewage prior to discharge to an undefined wetland where it receives additional treatment prior to discharge to the marine environment. Specific comments relevant to sewage disposal operations in the Hamlet were provided by DIAND, and Environment Canada. Both DIAND and Environment Canada requested that the Applicant provide information to the NWB on how the Municipality plans to address the operational and environmental issues evidenced in the August 9, 2001 DIAND Inspection Report. Additionally, Environment Canada recommended that a minimum of 1 m of freeboard should be maintained at all retention structures, and that All Terrain Vehicle (ATV) traffic be restricted in the wetland area so as to prevent soil erosion and damage to vegetation from compromising the effectiveness of the wetland treatment of the sewage.

DIAND and Environment Canada also recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. Additionally, DIAND provided recommendations concerning effluent discharge criteria, which are consistent with the *Guidelines for the Discharge of*

Treated Municipal Wastewater in the Northwest Territories (Northwest Territories Water Board; 1992), as well as specific recommendations concerning the Monitoring Program.

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

Solid Waste

The Hamlet's solid waste management site is located approximately 4.5 km from the community. Waste is segregated, with a generic landfill area, a bulky wastes area, and a sealift container for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered on a yearly basis.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND and Environment Canada. Both DIAND and Environment Canada recommended that preventative measures be implemented to prevent standing water noted at the toe of the solid waste site from escaping the facility. Environment Canada also recommended that the Municipality undertake a waste composition study, which will assist the Municipality to plan for the long term waste disposal needs of the community. The Board concurs that the Hamlet should give serious consideration to this recommendation, and recommends that discussions be commenced with the Department of Community Government and Transportation to determine potential assistance which may be available to the Hamlet to undertake such a study.

DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans for their solid waste operations. DIAND and Environment Canada further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. DIAND and Environment Canada recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. Additionally, both Environment Canada and DIAND recommended the installation of appropriate fencing at the bulky waste and hazardous waste disposal sites, so as to improve security on the sites. The Board concurs that the Hamlet should give serious consideration to this recommendation, and in the interim take whatever steps are practicable to implement this recommendation.

LICENCE NWB3KUG0308

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF KUGLUKTUK

(Licensee)

of **KUGLUKTUK, NUNAVUT, X0E 0E0**

(Mailing Address)

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

Licence Number **NWB3KUG0308**

Water Management Area **NUNAVUT 05**

Location **KUGLUKTUK, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **64,000 CUBIC METRES ANNUALLY**

Date of Licence **NOVEMBER 20, 2003**

Expiry Date of Licence **NOVEMBER 30, 2008**

Dated this 20th of November 2003 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Kugluktuk, Nunavut (67°50'N, 115°15'W);

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

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

2. Definitions

In this Licence: **NWB3KUG0308**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"Licensee" means the holder of this Licence;

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

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

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

"Sewage" means all toilet wastes and greywater;

"Sewage Disposal Facilities" comprises the area and decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

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

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

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Coppermine River, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2.

PART B: GENERAL CONDITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(i) Chief Administrative Officer:

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

(ii) Inspector Contact:

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

(iii) Analyst Contact:

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

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

PART C: CONDITIONS APPLYING TO WATER USE

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

2. The annual quantity of water used for all purposes shall not exceed 64,000 cubic metres.

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

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

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

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

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

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

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

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

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

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

7. The Licensee shall implement measures to ensure waste from the Solid Waste Disposal Facility does not enter water.

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

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

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

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

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

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

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

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

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

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

    iv. the Board has not rejected the proposed modifications.

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

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

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before March 31, 2004 submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996). This Plan shall specifically address the waste disposal and operational issues related to the Sewage Disposal Facility and the Solid Disposal Facility, which were identified in the August 9, 2001 DIAND Inspection Report.

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

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

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

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

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

    i. take whatever steps are immediately practicable to protect human life, health and the environment;
    ii. without delay seek guidance from the Departments of Community Government and Transportation and Sustainable Development with regards to mitigation and remedial actions required to address the discharge;

ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

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

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

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

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

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

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Monitoring Station	Description
KUG-1	Raw water supply at Coppermine River prior to treatment
KUG-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
KUG-3	Raw Sewage at truck offload point
KUG-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

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

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

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

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

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

6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence.

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

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

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

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

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

Appendix B
Climate Data

The *Climate Data* for the *Sewage Treatment Facility O&M Plan* is the same as that presented in APPENDIX B of the *Detailed Design Report.*

Appendix C
Site Forms

Hamlet of Kugluktuk
Weekly Landfill Inspection Form

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

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

Hamlet of Kugluktuk
Waste Placement Form

Date	Quantity Present upon arrival (m^3)	Quantity Delivered (m^3)	Number of Trips	Additional Activities (i.e., burning, tipping over edge, maintenance)	Initials

Appendix D

QA/QC Plan

The *Sample Monitoring Program/Quality Assurance and Quality Control Plan* is the same as that presented in APPENDIX F of the *Sewage Lagoon Operation & Maintenance Plan* found in APPENDIX H1 of the *Detailed Design Report.*

Appendix E
Environmental Emergency Contingency Plan

The *Environmental Emergency Contingency Plan* is the same as that presented in APPENDIX E of the *Sewage Lagoon Operation & Maintenance Plan* found in APPENDIX H1 of the *Detailed Design Report.*

Appendix H
Format For Annual Report

NWB Annual Report **Year being reported:** Select

License No: **Issued Date:**
Expiry Date:

Project Name:

Licensee:

Mailing Address:

Name of Company filing Annual Report (if different from Name of Licensee please clarify relationship between the two entities, if applicable):

General Background Information on the Project (*optional):

Licence Requirements: the licensee must provide the following information in accodance with

Select Select

A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; drill waste management; solid and hazardous waste management.

Water Source(s):
Water Quantity:
- Quantity Allowable Domestic (cu.m)
- Actual Quantity Used Domestic (cu.m)
- Quantity Allowable Drilling (cu.m)
- Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal
- ☐ Solid Waste Disposal
- ☐ Sewage
- ☐ Drill Waste
- ☐ Greywater
- ☐ Hazardous
- ☐ Other:

Additional Details:

A list of unauthorized discharges and a summary of follow-up actions taken.

Spill No.: (as reported to the Spill Hot-line)
Date of Spill:
Date of Notification to an Inspector:
Additional Details: (impacts to water, mitigation measures, short/long term monitoring, etc)

Revisions to the Spill Contingency Plan

Select

Additional Details:

Revisions to the Abandonment and Restoration Plan

Select

Additional Details:

Progressive Reclamation Work Undertaken

Additional Details (i.e., work completed and future works proposed)

Results of the Monitoring Program including:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where sources of water are utilized;

Select

Additional Details:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where wastes associated with the licence are deposited;

Select

Additional Details:

Results of any additional sampling and/or analysis that was requested by an Inspector

Select

Additional Details: (date of request, analysis of results, data attached, etc)

Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported.

Select

Additional Details: (Attached or provided below)

Any responses or follow-up actions on inspection/compliance reports

Select

Additional Details: (Dates of Report, Follow-up by the Licensee)

Any additional comments or information for the Board to consider

Date Submitted:		
Submitted/Prepared by:		
Contact Information:	**Tel:**	
	Fax:	
	email:	

Appendix I
Cost Estimate Tables

Improvements to the Sewage Lagoon and Solid Waste

SCHEDULE D - SOLID WASTE

ITEM NO.	DESCRIPTION	CLASS B COST
	Mobilization 2006 (30%)	$59,400
	STAGE 1 ACTIVITIES	$198,000
	Mobilization 2007 (30%)	$815,025
	MUNICIPAL SOLID WASTE DISPOSAL SITE	$390,000
	SEWAGE LAGOON	$1,933,250
	BULKY MATERIALS DISPOSAL AREA	$232,000
	HAZARDOUS WASTE DEPOT	$53,700
	LANDFARM	$107,800
	Contingency (15%)	$568,376
	SUBTOTAL:	**$4,357,551**

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST
	STAGE 1 ACTIVITIES				
1	Manifest and Dispose of Waste Batteries	200	units	$50	$10,000
2	Mobilize a portable incinerator	1	units	$20,000	$20,000
3	Incinerate waste oil	100000	litres	$2	$150,000
4	Removal of top portion of contaminated soil stockpile	360	m3	$50	$18,000
				SUBTOTAL:	**$198,000**

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST
	SEWAGE LAGOON - KUGLUKTUK				
1	Fencing (1.8 m frost fence with poles) on berm (Supply and install)	886	m(l)	$80.00	$ 70,880
2	Gates along fences for access to culverts (3m wide - Supply and install0	2	LS	$2,000.00	$ 4,000
3	Granular 'A' for Truck Pad/Road - installed	150	m3	$125.00	$ 18,750
4	Granular 'B' for Truck Pad/Road - installed	150	m3	$100.00	$ 15,000
5	Discharge Flume - Supply and Fit	1	LS	$15,000.00	$ 15,000
6	Effluent Discharge - Supply & Fit Valve	1	LS	$6,400.00	$ 6,400
	- Supply and Fit Piping	200	m	$25.00	$ 5,000
7	Supply and place signage	1	LS	$5,000.00	$ 5,000
8	Exfiltration Berm	120	m	$20.00	$ 2,400
9	Site Construction - Bulldozer/Truck/cut/fill/contours	25,000	m3	$20.00	$ 500,000
	- Surface of berm	12,111	m3	$20.00	$ 242,220
	- Road re-routing, transport of rock.	10,000	m3	$25.00	$ 250,000
10	40 mm HDPE Artic liner for lagoon sides ONLY (Supply and install)	19,965	m2	$40.00	$ 798,600
				SUBTOTAL:	**$ 1,933,250**

Improvements to the Sewage Lagoon and Solid Waste

SCHEDULE D - SOLID WASTE

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST
	MUNICIPAL SOLID WASTE DISPOSAL SITE				
1	Construct landfill perimeter berm using native soils around outside of landfill	6600	m(l)	$50	$330,000
2	Supply and place fence on berms	320	m(l)	$100	$32,000
3	Install ditches	550	m(l)	$40	$22,000
4	Supply and place signage	3	Ea	$2,000	$6,000
				SUBTOTAL:	**$390,000**

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST
	BULKY MATERIALS DISPOSAL AREA				
1	Excavation of burial pit	2400	m3	$30	$72,000
2	Relocation of bulky materials	4200	m3	$20	$84,000
3	Cover burial Pit	2400	m3	$20	$48,000
4	Post and wire fence	200	m(l)	$100	$20,000
5	Gate	1	each	$2,000	$2,000
6	Signage	3	Ea	$2,000	$6,000
				SUBTOTAL:	**$232,000**

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST
	HAZARDOUS WASTE DEPOT				
1	Berm construction and surface preparation	34	m(l)	$40	$1,360
2	Fencing (1.8 m frost fence with poles) on berm	68	m(l)	$100	$6,800
3	40 mil HDPE Arctic Liner installed	156	m^2	$200	$31,200
4	Sand base over liner	78	Ea	$30	$2,340
5	Spill Kit (Locker)	1	units	$10,000	$10,000
6	Swing gates	1	LS	$2,000	$2,000
				SUBTOTAL:	**$53,700**

Improvements to the Sewage Lagoon and Solid Waste

SCHEDULE D - SOLID WASTE

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST
	LANDFARM				
3	Berm construction (1m high with 3:1 slopes) and surface preparation	80	m(l)	$50	$4,000
4	Fencing (1.8 m frost fence with poles) on berm	160	m(l)	$100	$16,000
1	40 mil HDPE Arctic Liner installed	1320	m^2	$50	$66,000
2	Sand base over liner	660	Ea	$30	$19,800
5	Swing gates (1.8 m high fence to provide 3 m wide opening)	1	LS	$2,000	$2,000
				SUBTOTAL:	**$107,800**

Appendix J

CEAA Environmental Screening Report

Appendix J1

Sewage Lagoon

Indian and Northern Affairs Canada

Environmental Screening Report

C A N A D I A N E N V I R O N M E N T A L A S S E S S M E N T A C T

This form, when completed in full, constitutes an environmental screening report intended to meet the requirements of s. 16 of the *Canadian Environmental Assessment Act* (CEAA). It contains the following sections:

The table on Page 2 will be completed by INAC staff. The proponent should complete the sections that follow, starting with "1. PROJECT IDENTIFICATION" on page 3.

Project Reference	
Section 5 Triggers	Please identify the reason(s) for INAC involvement: • *CEAA* s. 5.1(a) proponent • *CEAA* s. 5.1(b) funding • *CEAA* s. 5.1(c) granting an interest in land • *CEAA* s. 5.1(d)** regulatory function ---------- **If a 5.1 (d) trigger, please specify the trigger, as per *Law List Regulations*: • *Indian Act* subsection 18(2) • *Indian Act* subsection 28(2) • *Indian Act* paragraph 58(4)(b) • *Indian Act* subsection 35(1) • *Indian Act* subsection 39(1) • *Indian Mining Regulations* subsection 5(2) • *Indian Mining Regulations* subsection 6(1) • *Indian Reserve Waste Disposal Regulations* section 5 • *Indian Timber Regulations* subsection 5(1) • *Indian Timber Regulations* section 9 • *Indian Timber Regulations* subsection 22(1)
FEAC[1] ("LEAD RA")	
Other RAs	
Expert FAs	
Project also subject to a provincial EA: YES/NO - (if YES, provide details)	
CEAR[2] Reference #	
Env. Officer	
Reviewing Officer	
RCM & Directorate	

[1] FEAC - Federal Environmental Assessment Coordinator
[2] CEAR - Canadian Environmental Assessment Registry

1) PROJECT IDENTIFICATION

Location:	Hamlet of Kugluktuk, Nunavut
Project Title:	Improvements to Wastewater Lagoon
Project proponent(s):	Government of Nunavut, Community and Government Services

2) LOCATION

Detailed Location: *If project is not on reserve, specify latitude and longitude coordinates, and nearest town, highway, lake, etc.*	The Hamlet of Kugluktuk (formerly Coppermine) is located on Coronation Gulf at the mouth of the Coppermine river. The Hamlet is situated on a rocky area on the west side of the Coppermine River at Latitude 67°49'N, longitude 115°06'W. The sewage lagoon will located approximately 4 kilometres southwest of the main community. (It will remain at its current location.)

YES	**All or part of the project is <u>OFF</u> Reserve Land (YES/NO)**

Definition of Project Area *The geographical extent of the project, and those areas affected during construction and operation. For example:* *- key transportation routes for equipment and materials* *- staging & refueling areas* *- main activity/construction site, traffic routes, etc.*	Most of the work will take place in the immediate vicinity of the existing wastewater treatment facility. The current wastewater treatment facility will be upgraded with updated operational and maintenance procedures. The access route will remain the same as it is currently. It is assumed that refueling will take place at the existing fuel depot, in the main community.

Adjacent Land: *Land use and description to the North, East, South, and West of project*	N: The areas to the north include vacant and undeveloped tundra. Coronation Gulf is 1.5 kilometres to the north. There is a sand quarry near the Coronation Gulf shoreline. The main community is located more than 4 kilometres to the northeast.
	E: The existing landfill site is 200 m to the east, the bulky metals disposal area is 400 m east and there is a rock quarry 500 m to the east. The access road servicing all of these facilities runs southwest northeast 200 m to the east. Vacant undisturbed tundra is located further east.
	S: The access road continues southwest towards Heart Lake 800 metres to the southwest. Vacant, undisturbed tundra occupies the remaining areas to the south.
	W: Vacant undisturbed tundra.

3) PROJECT JUSTIFICATION

Need for the Project: *Rationale: e.g. what problem is the project going to solve or what opportunity is the project going to provide?*	The community now operates a single wastewater lagoon with effluent discharge to an intermittent stream along a natural meandering course over 1.5 km to Coronation Gulf. The stream traverses through a naturally occurring wetland, which is currently providing a significant degree of treatment for the effluent discharges from the lagoon. There are deficiencies in the existing wastewater treatment system that services the Hamlet of Kugluktuk. - There is insufficient storage in the lagoon to provide adequate retention of sewage volume, - Sewage generated by the community exceeds the capacity of the sewage lagoon, - The berms breach in the spring and overflow. - The berms are too porous and do not properly retain flow, - Discharge is haphazard, the lagoon does not meet current Nunavut Regulations and is not operating in compliance with the Water Board license. The discharge route crosses a major snowmobile/ATV route that is used year round.
Purpose of the Project: *What is going to be achieved by carrying out the project?*	To provide a wastewater system for the community that can meet the regulatory requirements as well as the needs of the community over the next 20 years.
Alternatives Considered: *Different ways to meet the project need and achieve the project purpose*	Several options were considered: - Null option, not a viable solution due to existing system deficiencies (insufficient capacity and environmental concerns and non-compliance with regulations) - Upgrade the current wastewater treatment facility with updated operational and maintenance procedures. Most cost effective option as long as existing location can accommodate the required treatment facilities. - Wastewater treatment facility relocation. Decommissioning the existing site and relocating the lagoon and wetland treatment area should only be considered if existing site is found unsuitable.

4) PROJECT DESCRIPTION

Proposed Start Date: *(year-month-day, if known)*	July 2006	**Estimated Completion Date:** October 2007
Estimated Total Cost:	Approximately $1,426,000	
Description of Project: *(attach/reference supporting material as required)*	The existing lagoon will be rehabilitated and a new lagoon constructed. A new wetland treatment area will also be constructed. The project will involve the following: - Minor roadwork to reach the discharge point of the new lagoon - Construct an HDPE Arctic liner on interior side slopes to be draped over berm - Existing lagoon to remain in place until new lagoon is constructed. - Ditches to be constructed around new lagoon to divert surface water - Excavate 1 m from interior footprint to provide materials for berm construction. - 900 metres of berm will be constructed - blast rock will hold liner in place.	
Project Management Team Members & Affiliation	Mr. Navjit Sidhu, B.Sc. E.I.T., Project Officer, Community and Government Services – Kitikmeot Region Nuna Burnside Engineering and Environmental Ltd., Mike O'Hara, P.Eng. Tom Livingston, Regional Municipal Planning Engineer, Government of Nunavut	

5) CONSULTATION

(a) Government Departments, Agencies, Non-Governmental Organizations, Community Councils, etc.

Department, Agency, or Organization:	Contact Person & Telephone Number:	Nature of Consultation & Response Received:
Community and Government Services – Kitikmeot Region	Mr. Navjit Sidhu, B.Sc. E.I.T., Project Officer (867) 983-4142	Was consulted before, during and after the field inspection stage of the study to ensure that the community needs were being met. Was provided a copy of the Schematic Design Report identifying options available to meet the community's needs. Discussed and identified preferred alternative. Teleconference held on February 16, 2006 to discuss comments and questions.
Regional Municipal Planning Engineer, Government of Nunavut	Tom Livingston	As above.

(b) Public Consultation, including Community Members

Public Consulted:	Method Used:	Date:	Details/Issues Raised:
Residents	Meetings with Hamlet council and Hamlet public works staff	Between Oct 3 & 6 2005.	The Hamlet residents concerns and comments were expressed through council and the public works department (landfill site operator, managers). Concerns were raised regarding the lagoon capacity and design and the ability to meet future demands. Obtained information from residents regarding trails, stream crossings, areas of future development or sensitive areas.

6) EXISTING ENVIRONMENT

<table>
<tr><td>COMPONENT</td><td>DESCRIPTION (describe features; indicate sensitivity to disturbance)</td></tr>
<tr><td colspan="2">6.1 PHYSICAL FEATURES - VALUED ECOSYSTEM COMPONENTS</td></tr>
<tr><td>Topography/Terrain:
(hilly, flat)</td><td>Costal lowlands of sand and clay plains dotted with shallow lakes. The area is generally flat to undulating. Most of the ground surface is covered with turf consisting of various grasses. Sedges and moss underlain by a thin (10 to 30 cm) layer of topsoil and/or peat.</td></tr>
<tr><td>Soil and Geology:
(soil type, quality and use; bedrock geology)</td><td>The ground surface consists of bedrock and glacial deposits. Boulders and cobbles cover some areas. The bedrock geology is described as shaly sandstone, siltstone and shale of the Proterozoic Hadrynian Rae Group. The area around the sewage lagoon is comprised of well sorted medium sand from raised beaches. Test pitting in the area revealed groundwater perched on top of the permafrost. Groundwater was encountered between 0.4m and 0.9 m below surface. Permafrost was at approximately 0.9 m below surface.</td></tr>
<tr><td>Surface Water:
(presence & quality)</td><td>A total four surface water samples were collected in 2005 along the intermittent stream that drains the lagoon with WS-1 being closest to the discharge point and WS-4 being the furthest downstream.

<table>
<tr><th>Parameter</th><th>Guidelines[1]</th><th>WS-1 (Raw sewage)</th><th>WS-4 (wetland treatment area)</th></tr>
<tr><td>BOD (mg.L)</td><td>45</td><td>276</td><td>8</td></tr>
<tr><td>TSS (mg/L)</td><td>45</td><td>95</td><td>7</td></tr>
<tr><td>T-PO_4 (mg/L)</td><td>1.0</td><td>0.24[2]</td><td>na</td></tr>
<tr><td>TKN (mg/L)</td><td>10</td><td>94</td><td>12.4</td></tr>
<tr><td>Faecal coliform</td><td>2,000</td><td>13,000,000</td><td>4,000</td></tr>
</table>
1. Anticipated Nunavut Water Board Guidelines
2. Sample collected July 2004 by FSC

The water quality improve significantly as it progresses downstream of the sewage lagoon. There are however some parameters that current do not meet the anticipated Nunavut guidelines even at the furthest downstream point. The system is currently not operating within the guidelines.</td></tr>
<tr><td>Distance to Water:</td><td>(from project area/activity, in metres): Surface water generally flows toward the north to northeast toward Coronation Gulf. There is an intermittent stream adjacent to the lagoon that drains the sewage outflow toward a wetland area that ultimately drains to Coronation Gulf (1.5 kilometres north). The Coppermine River is located approximately 3 kilometres east of the Site. There is no surface water connection the River and the sewage lagoon.</td></tr>
<tr><td>Aquatic Sediment/Substrate:
(type & quality)</td><td>Not known</td></tr>
</table>

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
Groundwater: *(local use & quality)*	Groundwater is not used. The entire area is permafrost below approximately 2.0 m. Groundwater quality was tested in the vicinity of the landfill site not the sewage lagoon.
Air Quality: *(local air quality)*	Good

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Vegetation: *(e.g. forest, ground cover, aquatic plants*)	The existing facilities are located within areas of disturbed tundra covered with turf consisting of various grasses, sedges and moss underlain by a thin (10 to 30 cm) layer of topsoil or peat. The proposed facilities will be immediately adjacent to the existing ones thus minimizing environmental impacts on the area.
Wetlands: *(e.g. fens, swamp)*	The intermittent stream flows through a wetland north of the proposed facility. The existing sewage lagoon discharges to this wetland and eventually discharges into Coronation Gulf. The conditions in the wetland are expected to improve with a better-designed sewage system. The wetland will continue to provide seasonal habitat for species of birds and other wildlife in the area.
Fish & Fish Habitat: *(types of habitat and common species found)*	The intermittent stream is not considered to be a significant habitat. Coronation Gulf (1.5 kilometres north) and Coppermine River (more than 3 kilometres east) are significant habitat for many species. Fishing is a significant part of traditional life in Kugluktuk. Improvements to the existing system will significantly reduce the potential of impacting the fish habitat. Fishing for char is an important part of daily life. Arctic Char (*Salvelinus alpinus),* Arctic Grayling (*Thymallus arcticus*) and Lake Trout (*Salvelinus namaycush*) are likely the primary fish species being harvested in the area.
Migratory Birds: *(e.g. waterfowl, songbirds)*	Several species of shorebirds and waterfowl are likely to be found in the general area, although it is unlikely that birds use the lagoon area for nesting or staging. There is a limited amount of suitable habitat on the site and there are more suitable habitats in the general area including: the wetland area to the north of the site, the shores of Heart Lake, Coppermine River and Coronation Gulf.
Other Fauna: *(mammals/amphibians reptiles/insects; game & protected species)*	Kugluktuk is located on west end of Coronation Gulf. Hunting and fishing are still important parts of daily life in this area. Locals often hunt Ringed Seal and to a lesser degree Narwhal and Walrus. These hunts are not expected to take place in the vicinity of the site. Local residents have been reported to consume a variety of terrestrial species including Barren Ground Caribou (*Rangifer tarandus groenlandicus*), Musk Ox (*Ovibos moschatus*) and Polar Bear *(Ursus maritimus).* Carnivores such as Arctic Wolves (*Canis lupus arcticos*) and Arctic Fox (*Alopex lagopus*) also have historical ranges that include this area and are likely hunted by local residents. None of these species have status under the Species At Risk Act (SARA).
Special Habitat Areas *(specially designated or protected habitats)*	No special habitat areas were identified in the Study Area during the preliminary review. No Important Bird Areas (IBAs) were identified in the vicinity of Kugluktuk. The Kugluk/Blood Falls Territorial Park is located 13 kilometres from Kugluktuk.

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Species at Risk	The Site is within the historical range of the Eskimo Curlew (*Numenius borealis*) a bird listed as endangered under the federal Species at Risk Act. The bird's current distribution is unknown and no nests have been reported since 1978 when it was estimated that fewer than 20 Eskimo Curlews remained. It is highly unlikely that the species is present at or near the site.

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
6.3 SOCIO-CULTURAL FEATURES – VALUED ECOSYSTEM COMPONENTS	
Sensitive Areas: *(e.g. residential zones, parkland, hospitals, schools)*	The wastewater treatment facility is more than 4 kilometres from the main community. There are no known sensitive areas near the site.
Human Health and Safety: *(any persons whose health and safety may be affected by the construction and operation of the project)*	The wastewater treatment facility is more than 4 kilometres from the main community therefore it is not likely to affect human health and safety. Improving the wastewater treatment system for the community will result in improved human health reduced impact to the natural environment.
Traditional Land Use Activities: *(e.g. trapping, fishing, medicinal plant collection, ceremonial grounds)*	The area is already occupied by the existing lagoon. The wetland area will continue to be used as part of the natural treatment process. Expansion is not expected to cause an impact to traditional land use activities. Hamlet staff indicate the area has no traditional land uses.
Aesthetics: *(general character of the surrounding area; and if the project is compatible)*	There is already a lagoon in this area and the project is removed from the main community therefore aesthetics are not an issue. The area has been designated by the community for use such as the landfill, bulky metals disposal, and wastewater lagoon.
Archaeological Resources: *(recorded, or potential)*	The area is removed from the main community and the site has already been developed. Hamlet staff indicate there are no known archaeological resources in this area.
Special Designations: *(parks, protected areas)*	There are no known areas with special designations in the vicinity of the proposed wastewater treatment facility expansion.

7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES – SUMMARY

The next table summarizes the following:

(A) List of Project Activities

Key project activities associated with **construction, operation, maintenance and decommissioning**, if applicable. Includes locations, scheduling details, and estimates of magnitude and scale.

(B) Potential Environmental Effect(s) associated with each project activity.

An *Environmental Effect* is defined as:

i) any change that the project may cause in the environment,
Including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes, or on any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance; and

ii) any change to the project that may be caused *by* the environment.
(Example: ice break-up damaging a bridge or dock; freezing and bursting of unprotected water lines.)

(C) Mitigation Measures

A *Mitigation Measure* is:

i) an action or provision made that will eliminate, reduce or control the adverse environmental effects of the project, and may include restoration, compensation or replacement of any damages or impacts.

(D) Determination of Significance

A determination of the significance of the environmental effects, taking into account appropriate mitigation measures if applicable. Mitigation measures are intended to prevent or reduce any potentially negative effects. The abbreviations used are:

N/S - effect not significant, or rendered insignificant with mitigation
SP - significant positive effect
SN - significant negative effect
U - outcome unknown or cannot be predicted, even with mitigation.

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		**(B) Potential Environmental Effect(s)**	**(C) Mitigation Measures**	**(D)**
1	Clearing and grubbing of new lagoon area and areas to be disturbed	a) Very minor loss of vegetation b) Potential for soil erosion c) Dust	a) Smallest possible area will be cleared b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period c) Limit exposed area. Use water to control dust	N/S
2	Construction of a new lagoon adjacent to the existing one and improve ditching.	a) Potential for soil erosion b) Noise c) Minimal odours d) Dust	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limit work during spring thaw period b) Activities to be scheduled to avoid sensitive times for people and animals c) Activities to be scheduled to avoid sensitive times for people and animals d) Limit exposed area and use water to control dust	N/P
3	Construction of access road a turn around	a) Very minor loss of vegetation b) Noise c) Dust	a) Smallest possible area will be cleared b) Activities to be scheduled to avoid sensitive times for people and animals c) Limit exposed area and use water to control dust	

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		**(B) Potential Environmental Effect(s)**	**(C) Mitigation Measures**	**(D)**
4	Installation of necessary ditches to improve drainage	a) Very minor loss of vegetation b) Minor potential for soil erosion	a) Area cleared is small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies	N/P
5	Construction of discharge outlet piping and culvert	a) Potential for soil erosion b) Noise	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limit work during spring thaw period. b) Activities to be scheduled to avoid sensitive times for people and animals.	N/P
6	Installation of snowmobile bridge crossing over intermittent stream.	a) Noise b) Minor potential for soil erosion	a) Activities to be scheduled to avoid sensitive times for people and animals b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies	N/P

8) CUMULATIVE EFFECTS ASSESSMENT

The natural environment is interconnected, and does not recognize project boundaries or lines on maps. The impacts caused by one project, which may be considered minor and insignificant on their own, combined with other environmental impacts from other projects or developments planned or already underway in the area. Together, these impacts may combine to become significant, and adverse. The consideration and assessment of these "cumulative" effects is therefore an important part of the environmental assessment process.

The following table should be completed to help identify the potential for cumulative effects, and to assess their significance (e.g. N/S - not significant; SP - significant positive effect; SN - significant negative effect; U - unknown, unable to assess).

(A) **Other projects or developments planned, or underway in the area**	**(B)** **Potential Cumulative Effects:** *The potentially adverse impacts of this Project; which could combine with those from the other projects identified in (A)*	**(C)** **Mitigation Measures** *needed to effectively manage or prevent any cumulative, adverse effects;* and **Significance of residual impacts after mitigation (N/S, SP, SN, U)**
Landfill site expansion is proposed approximately 200 m east of the site.	Both the wastewater treatment lagoon and the landfill site already exist at these locations. Upgrades to the existing landfill will involve similar activities of earth moving and construction. Cumulative impacts are expected to be minimal	This project will improve existing conditions as well as reduce existing cumulative impacts. No mitigation required. NP.
No other projects anticipated within 1 kilometre of the site.	Not applicable	Not Applicable.

9) SUMMARY OF ENVIRONMENTAL EFFECTS

Assuming that all mitigation measures are implemented as proposed in Sections 7 and 8, the following effects are predicted for the Valued Ecosystem Components identified in Section 6:

(N/S not significant; SP significant positive effect; SN significant negative effect; U unknown; N/A not applicable)

VALUED ECOSYSTEM COMPONENT	**Summary of Effects** *(check box)*					**comments**
	N/S	SP	SN	U	N/A	
Topography/terrain	√					
Soil/geology	√					
Aquatic sediment/substrate		√				
Surface water		√				Significant drainage improvements
Groundwater	√					
Air quality	√					
Vegetation	√					
Wetlands		√				
Fish & fish habitat	√					
Migratory birds	√					
Other fauna	√					
Special habitat					√	
Sensitive areas					√	
Human health and safety		√				
Traditional land use activities		√				Snowmobile bridge to be constructed over creek.
Aesthetics	√					
Archaeological resources					√	
Specially-designated areas					√	

Screening Report Completed by:		
Jim Walls		March 10, 2006
Name and signature		Date

10) CEAA SCREENING DECISION

	[00]	DECISION PENDING. Assessment not final.
√	**[01]**	PROJECT MAY PROCEED. All potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant (*CEAA s. 20(1)(a)).*
	[02]	PROJECT MAY NOT PROCEED. The project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances *(CEAA s.20(1)(b)).*
	[03]	ENVIRONMENTAL ASSESSMENT IS TO BE REFERRED TO THE MINISTER FOR MEDIATION OR A REVIEW PANEL, since it is uncertain whether the project is likely to cause significant adverse environmental effects *(CEAA s. 20(1)(c)(I))*; significant public concern has been raised, warranting a referral to a mediator or a review panel *(CEAA s. 20(1)(c)(ii))*; and/or public concerns warrant a reference to a mediator or a review panel *(CEAA s. 20(1)(c)(iii)*.

Reviewed and Recommended by:		
Representative of Council, or designate *(name & signature)*		Date
INAC Environmental Officer *(name & signature)*		Date
Other Federal RA(s) *(specify details)*		Date

INAC USE ONLY

SCREENING DECISION by LEAD RESPONSIBLE AUTHORITY (enter code):		
Approved by:		

INAC Responsibility Centre Manager *(name + signature)*		Date

11) KEY REFERENCES & SOURCES

Nuna Burnside Engineering and Environmental Ltd., "*Schematic Design for the Improvements to the Wastewater Lagoon and Solid Waste Disposal Facility, The Hamlet of Kugluktuk, Nunavut*", December 2005. (file: N-O 09755/FOE 09754)

Additional references are included in the above noted report.

12) LIST OF ATTACHMENTS

Detailed Design Report listed above.

I:\Kim\CEAA Lagoon.doc

Appendix J2
Solid Waste Management Facility

Indian and Northern Affairs Canada

Environmental Screening Report

C A N A D I A N E N V I R O N M E N T A L A S S E S S M E N T A C T

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FEAC[1] ("LEAD RA")	
Other RAs	
Expert FAs	
Project also subject to a provincial EA: YES/NO - (if YES, provide details)	
CEAR[2] Reference #	
Env. Officer	
Reviewing Officer	
RCM & Directorate	

[1] FEAC - Federal Environmental Assessment Coordinator
[2] CEAR - Canadian Environmental Assessment Registry

1) PROJECT IDENTIFICATION

Location:	Hamlet of Kugluktuk, Nunavut
Project Title:	Improvements to Waste Disposal Site
Project proponent(s):	Government of Nunavut, Community and Government Services

2) LOCATION

Detailed Location:

If project is not on reserve, specify latitude and longitude coordinates, and nearest town, highway, lake, etc.

The Hamlet of Kugluktuk (formerly Coppermine) is located on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River at Latitude 67°49'N, longitude 115°06'W. The waste disposal area will located approximately 4 kilometres southwest of the main community. (It will remain at its current location.)

YES **All or part of the project is <u>OFF</u> Reserve Land (YES/NO)**

Definition of Project Area

The geographical extent of the project, and those areas affected during construction and operation. For example:
- key transportation routes for equipment and materials
- staging & refueling areas
- main activity/construction site, traffic routes, etc.

Most of the work will take place in the immediate vicinity of the existing waste disposal area. There are two components to the existing waste disposal facility: the bulky materials disposal area and the municipal solid waste disposal area (landfill). The existing landfill facility will be upgraded with updated operational and maintenance procedures. The access route will remain the same as it is currently. It is assumed that refueling will take place at the existing fuel depot, in the main community.

Adjacent Land:

Land use and description to the North, East, South, and West of project

N: The areas to the north include vacant and undeveloped tundra. Coronation Gulf is 1.5 kilometres to the north. There is a sand quarry near the Coronation Gulf shoreline. The main community is located more than 4 kilometres to the northeast.

E: There is a rock quarry approximately 200 m to the east. The access road servicing the waste disposal facilities runs southwest northeast between the bulk material storage area and the main landfill area. Vacant undisturbed tundra is located further east.

S: The access road continues southwest towards Heart Lake approximately 1 kilometre to the southwest. Vacant, undisturbed tundra occupies the remaining areas to the south.

W: The sewage lagoon 200 m to the west and vacant undisturbed tundra.

3) PROJECT JUSTIFICATION

Need for the Project: *Rationale: e.g. what problem is the project going to solve or what opportunity is the project going to provide?*	The community has been operating a bulk metals disposal area and a municipal solid waste disposal area (landfill). The combined facilities have operated under Water Board License NWB3KUGO308 issued November 20, 2003. The bulky material storage is currently operating as efficiently as possible given the remote nature of this community. The fluids (oil, fuel etc) should be drained to reduce the potential for subsurface contamination. The main landfill area will reach capacity in approximately 5 years if operation continues at its current pace. Although current operations are not causing a significant environmental impact operational procedures need to be revised and the fill needs to be properly covered. The community needs the landfill capacity to accommodate the next 20 years therefore the landfill site needs to be expanded and rehabilitated.
Purpose of the Project: *What is going to be achieved by carrying out the project?*	To provide a municipal solid waste disposal area that can meet the regulatory requirements as well as the needs of the community over the next 20 years.
Alternatives Considered: *Different ways to meet the project need and achieve the project purpose*	Several options were considered: - Null option, not a viable solution due to existing system deficiencies (insufficient capacity and inadequate operating procedures) - Upgrade the current solid waste disposal area with updated operational and maintenance procedures. Most cost effective option. Assumes that burning will continue. - Move the site to an alternate location. There is no reason to move the site and moving the site would involve closure of the existing facility. - Incineration or other disposal technology would be prohibitively expensive given the size of the community.

4) PROJECT DESCRIPTION

Proposed Start Date: *(year-month-day, if known)*	July 2006	**Estimated Completion Date:** October 2007
Estimated Total Cost:	Approximately $250,000	
Description of Project: *(attach/reference supporting material as required)*	The existing landfill site will be expanded and rehabilitated. The project will involve the following: - Construction of 3 m high berms around the required 20 year fill area (2 m above and 1 m below existing grade) 3:1 side slopes and flat tops - 1.5 m high fencing constructed on top of the berms. - Surface water drainage ditching would be constructed to divert run off away from the fill area. - A thin layer of interim cover would be applied to the existing exposed waste - A hazardous waste depot and waste oil storage facility would be established to handle waste batteries and other waste not suitable for the landfill or the bulky materials area.	
Project Management Team Members & Affiliation	Mr. Navjit Sidhu, B.Sc. E.I.T., Project Officer, Community and Government Services – Kitikmeot Region Nuna Burnside Engineering and Environmental Ltd., Mike O'Hara, P.Eng. Tom Livingston, Regional Municipal Planning Engineer, Government of Nunavut	

5) CONSULTATION

(a) Government Departments, Agencies, Non-Governmental Organizations, Community Councils, etc.

Department, Agency, or Organization:	Contact Person & Telephone Number:	Nature of Consultation & Response Received:
Community and Government Services – Kitikmeot Region	Mr. Navjit Sidhu, B.Sc. E.I.T., Project Officer (867) 983-4142	Was consulted before, during and after the field inspection stage of the study (October 2005) to ensure that the community needs were being met. Was provided a copy of the Schematic Design Report identifying options available to meet the community's needs. Discussed and identified preferred alternative. Teleconference held on February 16, 2006 to discuss comments and questions.
Regional Municipal Planning Engineer, Government of Nunavut	Tom Livingston	As above.

(b) Public Consultation, including Community Members

Public Consulted:	Method Used:	Date:	Details/Issues Raised:
Residents	Meetings with Hamlet council and Hamlet public works staff	Between Oct 3 & 6 2005.	The Hamlet residents concerns and comments were expressed through council and the public works department (landfill site operator, managers). Concerns were raised regarding the landfill capacity and operations and the ability to meet future demands. Obtained information from residents regarding trails, areas of future development or sensitive areas.

6) EXISTING ENVIRONMENT

<table>
<tr><td>COMPONENT</td><td>DESCRIPTION (describe features; indicate sensitivity to disturbance)</td></tr>
<tr><td colspan="2">6.1 PHYSICAL FEATURES - VALUED ECOSYSTEM COMPONENTS</td></tr>
<tr><td>Topography/Terrain:
(hilly, flat)</td><td>Costal lowlands of sand and clay plains dotted with shallow lakes. The area is generally flat to undulating. Most of the ground surface is covered with turf consisting of various grasses. Sedges and moss underlain by a thin (10 to 30 cm) layer of topsoil and/or peat.</td></tr>
<tr><td>Soil and Geology:
(soil type, quality and use; bedrock geology)</td><td>The ground surface consists of bedrock and glacial deposits. Boulders and cobbles cover some areas. The bedrock geology is described as shaly sandstone, siltstone and shale of the Proterozoic Hadrynian Rae Group. The area around the sewage lagoon is comprised of well sorted medium sand from raised beaches. Two test pits in the area revealed groundwater perched on top of the permafrost. Groundwater was encountered between 0.4 m and 0.9 m below surface. Permafrost was at approximately 0.9 m below surface. The groundwater quality in the sandy soils encountered in the testpits was tested and did not show evidence of landfill related impacts.</td></tr>
<tr><td>Surface Water:
(presence & quality)</td><td>A total four surface water samples were collected in 2005 along the intermittent stream that drains the lagoon west of the landfill site. WS-1 is the closest to the lagoon discharge point and WS-4 is the furthest downstream.

<table>
<tr><th>Parameter</th><th>Guidelines[1]</th><th>WS-1 (Raw sewage)</th><th>WS-4 (wetland treatment area)</th></tr>
<tr><td>BOD (mg.L)</td><td>45</td><td>276</td><td>8</td></tr>
<tr><td>TSS (mg/L)</td><td>45</td><td>95</td><td>7</td></tr>
<tr><td>T-PO_4 (mg/L)</td><td>1.0</td><td>0.24[2]</td><td>na</td></tr>
<tr><td>TKN (mg/L)</td><td>10</td><td>94</td><td>12.4</td></tr>
<tr><td>Faecal coliform</td><td>2,000</td><td>13,000,000</td><td>4,000</td></tr>
</table>
1. Anticipated Nunavut Water Board Guidelines
2. Sample collected July 2004 by FSC

The water quality improve significantly as it progresses downstream of the sewage lagoon. There are however some parameters that current do not meet the anticipated Nunavut guidelines even at the furthest downstream point. The system is currently not operating within these guidelines.</td></tr>
<tr><td>Distance to Water:</td><td>(from project area/activity, in metres): Surface water generally flows toward the north to northeast toward Coronation Gulf. There is an intermittent stream adjacent to the lagoon (approximately 150 m west of the landfill site) that drains the sewage outflow toward a wetland area then ultimately drains to Coronation Gulf (1.5 kilometres north). The Coppermine River is located approximately 3 kilometres east of the Site. There is no surface water connection the Coppermine River and the landfill site.</td></tr>
</table>

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
Aquatic Sediment/Substrate: *(type & quality)*	Not known
Groundwater: *(local use & quality)*	Groundwater is not used. The entire area is permafrost below approximately 1.0 m. Groundwater quality was tested in the vicinity of the landfill site not the sewage lagoon.
Air Quality: *(local air quality)*	Good

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Vegetation: *(e.g. forest, ground cover, aquatic plants*)	The existing facilities are located within areas of disturbed tundra covered with turf consisting of various grasses, sedges and moss underlain by a thin (10 to 30 cm) layer of topsoil or peat. The proposed facilities will be immediately adjacent to the existing ones thus minimizing environmental impacts on the area.
Wetlands: *(e.g. fens, swamp)*	The intermittent stream flows through a wetland north of the proposed facility. The existing sewage lagoon discharges to this wetland and eventually discharges into Coronation Gulf. The conditions in the wetland are expected to improve with a better-designed sewage system. The wetland will continue to provide seasonal habitat for species of birds and other wildlife in the area.
Fish & Fish Habitat: *(types of habitat and common species found)*	The intermittent stream is not considered to be a significant habitat. Coronation Gulf (1.5 kilometres north) and Coppermine River (more than 3 kilometres east) are significant habitat for many species. Fishing is a significant part of traditional life in Kugluktuk. Improvements to the existing system will significantly reduce the potential of impacting the fish habitat. Fishing for char is an important part of daily life. Arctic Char (*Salvelinus alpinus),* Arctic Grayling (*Thymallus arcticus*) and Lake Trout (*Salvelinus namaycush*) are likely the primary fish species being harvested in the area.
Migratory Birds: *(e.g. waterfowl, songbirds)*	Several species of shorebirds and waterfowl are likely to be found in the general area, although it is unlikely that birds use the lagoon area for nesting or staging. There is a limited amount of suitable habitat on the site and there are more suitable habitats in the general area including: the wetland area to the north of the site, the shores of Heart Lake, Coppermine River and Coronation Gulf.
Other Fauna: *(mammals/amphibians reptiles/insects; game & protected species)*	Kugluktuk is located on west end of Coronation Gulf. Hunting and fishing are still important parts of daily life in this area. Locals often hunt Ringed Seal and to a lesser degree Narwhal and Walrus. These hunts are not expected to take place in the vicinity of the site. Local residents have been reported to consume a variety of terrestrial species including Barren Ground Caribou (*Rangifer tarandus groenlandicus*), Musk Ox (*Ovibos moschatus*) and Polar Bear *(Ursus maritimus).* Carnivores such as Arctic Wolves (*Canis lupus arcticos*) and Arctic Fox (*Alopex lagopus*) also have historical ranges that include this area and are likely hunted by local residents. None of these species have status under the Species At Risk Act (SARA).
Special Habitat Areas *(specially designated or protected habitats)*	No special habitat areas were identified in the Study Area during the preliminary review. No Important Bird Areas (IBAs) were identified in the vicinity of Kugluktuk. The Kugluk/Blood Falls Territorial Park is located 13 kilometres from Kugluktuk.

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Species at Risk	The Site is within the historical range of the Eskimo Curlew (*Numenius borealis*) a bird listed as endangered under the federal Species at Risk Act. The bird's current distribution is unknown and no nests have been reported since 1978 when it was estimated that fewer than 20 Eskimo Curlews remained. It is highly unlikely that the species is present at or near the site.

COMPONENT	DESCRIPTION *(describe features; indicate sensitivity to disturbance)*
6.3 SOCIO-CULTURAL FEATURES – VALUED ECOSYSTEM COMPONENTS	
Sensitive Areas: *(e.g. residential zones, parkland, hospitals, schools)*	The waste disposal facility is more than 4 kilometres from the main community. There are no known sensitive areas near the site.
Human Health and Safety: *(any persons whose health and safety may be affected by the construction and operation of the project)*	The waste disposal facility is more than 4 kilometres from the main community therefore it is not likely to affect human health and safety. Improving landfill site operations and maintenance will result in improved human health reduced impact to the natural environment.
Traditional Land Use Activities: *(e.g. trapping, fishing, medicinal plant collection, ceremonial grounds)*	The area is already occupied by the existing landfill site. Expansion is not expected to cause an impact to traditional land use activities. Hamlet staff indicate the area has no traditional land uses.
Aesthetics: *(general character of the surrounding area; and if the project is compatible)*	There is already a landfill in this area and the project is removed from the main community therefore aesthetics are not an issue. The area has been designated by the community for use such as the landfill, bulky metals disposal, and wastewater lagoon.
Archaeological Resources: *(recorded, or potential)*	The area is removed from the main community and the site has already been developed. Hamlet staff indicate there are no known archaeological resources in this area.
Special Designations: *(parks, protected areas)*	There are no known areas with special designations in the vicinity of the proposed waste disposal facility expansion.

7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES – SUMMARY

The next table summarizes the following:

(A) List of Project Activities

Key project activities associated with **construction, operation, maintenance and decommissioning**, if applicable. Includes locations, scheduling details, and estimates of magnitude and scale.

(B) Potential Environmental Effect(s) associated with each project activity.

An *Environmental Effect* is defined as:

i) any change that the project may cause in the environment,
Including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes, or on any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance; and

ii) any change to the project that may be caused *by* the environment.
(Example: ice break-up damaging a bridge or dock; freezing and bursting of unprotected water lines.)

(C) Mitigation Measures

A *Mitigation Measure* is:

i) an action or provision made that will eliminate, reduce or control the adverse environmental effects of the project, and may include restoration, compensation or replacement of any damages or impacts.

(D) Determination of Significance

A determination of the significance of the environmental effects, taking into account appropriate mitigation measures if applicable. Mitigation measures are intended to prevent or reduce any potentially negative effects. The abbreviations used are:

N/S - effect not significant, or rendered insignificant with mitigation
SP - significant positive effect
SN - significant negative effect
U - outcome unknown or cannot be predicted, even with mitigation.

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		**(B) Potential Environmental Effect(s)**	**(C) Mitigation Measures**	**(D)**
1	Clearing and grubbing of new landfill area and areas to be disturbed	a) Minor loss of vegetation b) Potential for soil erosion c) Dust	a) Smallest possible area will be cleared b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period c) Limit exposed area. Use water to control dust	N/S
2	Expansion of the existing landfill adjacent to the existing one. Construction of berms 3 m high (2 m above grade and 1 m below grade)	a) Potential for soil erosion b) Noise c) Minimal odours d) Dust	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limit work during spring thaw period b) Activities to be scheduled to avoid sensitive times for people and animals c) Activities to be scheduled to avoid sensitive times for people and animals d) Limit exposed area and use water to control dust	N/P
3	Construct a hazardous waste depot for waste oil, batteries and other waste not suitable for landfill	a) Very minor loss of vegetation b) Noise c) Dust	a) Smallest possible area will be cleared b) Activities to be scheduled to avoid sensitive times for people and animals c) Limit exposed area and use water to control dust	

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		**(B) Potential Environmental Effect(s)**	**(C) Mitigation Measures**	**(D)**
4	Installation of necessary ditches to improve drainage	a) Minor loss of vegetation b) Potential for soil erosion	a) Area cleared is small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies	N/P
5.	Install a thin layer of soil over the existing waste	a) Potential for soil erosion b) Noise c) Dust	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limit work during spring thaw period b) Activities to be scheduled to avoid sensitive times for people and animals. c) Limit exposed area and use water to control dust	N/P

8) CUMULATIVE EFFECTS ASSESSMENT

The natural environment is interconnected, and does not recognize project boundaries or lines on maps. The impacts caused by one project, which may be considered minor and insignificant on their own, combined with other environmental impacts from other projects or developments planned or already underway in the area. Together, these impacts may combine to become significant, and adverse. The consideration and assessment of these "cumulative" effects is therefore an important part of the environmental assessment process.

The following table should be completed to help identify the potential for cumulative effects, and to assess their significance (e.g. N/S - not significant; SP - significant positive effect; SN - significant negative effect; U - unknown, unable to assess).

(A) **Other projects or developments planned, or underway in the area**	**(B)** **Potential Cumulative Effects:** *The potentially adverse impacts of this Project; which could combine with those from the other projects identified in (A)*	**(C)** **Mitigation Measures** *needed to effectively manage or prevent any cumulative, adverse effects;* and **Significance of residual impacts after mitigation (N/S, SP, SN, U)**
Waste water treatment facility expansion is proposed approximately 200 m west of the site.	Both the wastewater treatment lagoon and the landfill site already exist at these locations. Upgrades to the existing wastewater treatment facility will involve similar activities of earth moving and construction. Cumulative impacts are expected to be minimal	This project will improve existing conditions as well as reduce existing cumulative impacts. No mitigation required. (NP)
No other projects anticipated within 1 kilometre of the site.	Not applicable	Not Applicable.

9) SUMMARY OF ENVIRONMENTAL EFFECTS

Assuming that all mitigation measures are implemented as proposed in Sections 7 and 8, the following effects are predicted for the Valued Ecosystem Components identified in Section 6:

(N/S not significant; SP significant positive effect; SN significant negative effect; U unknown; N/A not applicable)

VALUED ECOSYSTEM COMPONENT	**Summary of Effects** *(check box)*					**comments**
	N/S	SP	SN	U	N/A	
Topography/terrain	√					
Soil/geology	√					
Aquatic sediment/substrate		√				
Surface water		√				
Groundwater		√				
Air quality		√				
Vegetation	√					
Wetlands	√					
Fish & fish habitat	√					
Migratory birds	√					
Other fauna	√					
Special habitat					√	
Sensitive areas					√	
Human health and safety		√				
Traditional land use activities					√	
Aesthetics	√					
Archaeological resources					√	
Specially-designated areas					√	

Screening Report Completed by:		
Jim Walls		March 10, 2006
Name and signature		Date

10) CEAA SCREENING DECISION

	[00]	DECISION PENDING. Assessment not final.
√	**[01]**	PROJECT MAY PROCEED. All potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant (*CEAA s. 20(1)(a)).*
	[02]	PROJECT MAY NOT PROCEED. The project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances *(CEAA s.20(1)(b)).*
	[03]	ENVIRONMENTAL ASSESSMENT IS TO BE REFERRED TO THE MINISTER FOR MEDIATION OR A REVIEW PANEL, since it is uncertain whether the project is likely to cause significant adverse environmental effects *(CEAA s. 20(1)(c)(I))*; significant public concern has been raised, warranting a referral to a mediator or a review panel *(CEAA s. 20(1)(c)(ii))*; and/or public concerns warrant a reference to a mediator or a review panel *(CEAA s. 20(1)(c)(iii)*.

Reviewed and Recommended by:		
Representative of Council, or designate *(name & signature)*		Date
INAC Environmental Officer *(name & signature)*		Date
Other Federal RA(s) *(specify details)*		Date

INAC USE ONLY

SCREENING DECISION by LEAD RESPONSIBLE AUTHORITY (enter code):		
Approved by:		

INAC Responsibility Centre Manager *(name + signature)*		Date

11) KEY REFERENCES & SOURCES

Nuna Burnside Engineering and Environmental Ltd., "*Schematic Design for the Improvements to the Wastewater Lagoon and Solid Waste Disposal Facility, The Hamlet of Kugiuktuk, Nunavut*", December 2005. (file: N-O 09755/FOE 09754)

More detailed references are provided in the above report.

12) LIST OF ATTACHMENTS

Detailed Design Report listed above.

I:\Kim\CEAA landfill Kugluktuk.doc