NUNAMI STANTEC

City of Iqaluit Sewage Lagoon Operation and Maintenance Manual

March 31, 2020

Prepared for:

City of Iqaluit

Prepared by:

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(signature)

Glenn Prosko

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Annual Updates Page

The annual update pages are to be completed on an approximately annual basis. The update description should contain a brief and concise summary of any additions to the O&M Manual since the last update. Typically, this would include a new DSI/DSR, any repairs/maintenance activities performed, updates to the Permanent Log Book, new construction, alterations, supplementary historical documents, changes to the Water License or the list of responsible personnel, etc.

Each individual that is listed on the updates pages below shall be a competent third-party professional retained by the City of Iqaluit, through the Engineering Department.

Date	Update Description	Name and Signature
Sep 2004	No additions to PRF	Allan Murray (Concentric)
Sep 2005	Completion of 2004 DSI in February 2005; a copy has been added to Tab 6. No DSI conducted in 2005.	Allan Murray (Concentric)
Feb 2005	Completion of DSI dated February 16, 2005 by Concentric; copy added to Tab 6.	
Aug 2006	Completion of DSI dated August 31, 2006 by Concentric; copy added to Tab 6. Repairs/alterations to west berm completed August 2006, see Tabs 5 & 7. Lagoon was taken offline Jun 2006; all effluent to new sewage treatment plant, lagoon now on back-up status, see Tab 5.	
Sep 2006	Completion of 2006 DSI in August 2006, a copy has been added to Tab 6. The sewage lagoon was taken offline on July 21, 2006; all effluent to new treatment plant; see Tab 5.	Allan Murray (Concentric)
Oct 2009	Completion of DSI dated October 29, 2009 by Concentric, a copy has been added to Tab 6.	
Sep 2011	Completion of DSI dated September 21, 2011 by Concentric, a copy has been added to Tab 6.	

Jun 2012	DSR Requirement Investigation dated June 29, 2012 by Concentric, copy added to Tab 6.	
March 2020	PRF developed by Concentric Associates International Incorporated was updated to Sewage Lagoon O&M manual. PRF updates continued and DSR/DSI and Permanent Log Book added to individual appendices, which should continue to be updated. Latest DSI completed by Concentric included in Appendix F. Facility history and background updated with information on WWTP redesign upgrades.	Zach Paquin (Stantec)

Executive Summary

The following Operation and Maintenance Manual for the Wastewater Treatment Plant Sewage Lagoon was developed by Stantec on behalf of the City of Iqaluit.

Wastewater that is bypassed from the City of Iqaluit WWTP is discharged into a single celled anaerobic lagoon system; the volume of which is estimated to be 25,000 m^3. The available piping systems to the lagoon incorporate a combination septage dump station and diversion chamber which allows both the septage and gravity flow from the City's system to be directed to the lagoon on a provisional basis.

The outlet from the lagoon, based on 1991 as-builts, consists of a piped discharge controlled by a valve chamber. The elevation of the discharge is 5.6 metres, which is approximately 2 metres above the bottom of the lagoon. The lagoon is not lined and several features such as a French drain, and an overflow spillway, were incorporated into the design of the lagoon to maintain the geotechnical stability of the system. The discharge point of the outlet directs the flow to the same channel in which the current WWTP outfall discharges.

This manual consists of the operation and maintenance procedures for the Iqaluit WWTP Sewage Lagoon. The manual is developed to ensure the operation and maintenance of the sewage lagoon meets the mandatory requirements as per the Water Licence, 3AM-IQA1626 / Type "A", issued by the Nunavut Water Board and approved by the Minister of Indigenous and Northern Affairs Canada.

Operation and maintenance checklists for daily, weekly, and monthly review have been provided in this manual and should be followed. The inspections and maintenance that takes place for the sewage lagoon should be recorded; a site inspection template has been included in **Appendix D** to record such information.

The Sewage Lagoon O&M manual shall act as a permanent record file for all aspects relating to the Iqaluit WWTP Sewage Lagoon. Any and all changes or additions to the manual shall be logged to ensure the history and operation of the facility has been maintained.

Abbreviations

AANDC	Aboriginal Affairs and Northern Development Canada
BOD	Biochemical Oxygen Demand
CAEAL	Canadian Association of Environmental Analytical Laboratories
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
DSG	Dam Safety Guidelines
DSI	Dam Safety Inspections
DSR	Dam Safety Review
FC	Fecal Coliform
PRF	Permanent Record File
SNP	Surveillance Network Program
TSS	Total Suspended Solids
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

The Canadian Dam Safety Guidelines (DSG's) requires that all structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The City of Iqaluit (the City) sewage lagoon falls under the requirements of the DSG's. The first DSR conducted on the sewage lagoon was undertaken in 2001. One of the documentation requirements of the DSR is that a Permanent Record File (PRF) be created and maintained for the life of the dam structure/facility. The City retained the company Concentric Associates International Incorporated to prepare the PRF in 2012.

This Sewage Lagoon O&M Manual encompasses the records produced in the PRF in relation to the sewage lagoon, along with additional information to safely maintain and operate the Iqaluit WWTP Sewage Lagoon in accordance with the Water License. Details provided in this O&M Manual include information on the licensee and the operations staff for the sewage lagoon, detailed history and information on the sewage lagoon, fundamentals of sewage lagoon operation and operational requirements/check lists.

1.1 INFORMATION OF THE LICENSEE

City of Iqaluit
Building 901 (City Hall)
Nunavut Drive
Iqaluit, NU X0A OHO

1.2 LIST OF REPONSIBLE PERSONNEL

The personnel responsible for the sewage lagoon facility are, in ascending order:

- Iqaluit WWTP Operator
- Utilidor Foreman
- Public Works Operations Superintendent
- Director of Public Works
- Chief Administrative Officer

The Iqaluit WWTP Operators, Utilidor Foreman, and Public Works Superintendent are responsible for regularly scheduled inspections other than DSR's and DSI's. Contact information for the applicable personnel are provided in the table below. The table should be updated regularly to reflect any changes to personnel or designated roles.

Table 1.1 List of Responsible Personnel for Iqaluit WWTP Sewage Lagoon

Role	Name	Contact Information
Director of Public Works & Engineering	*Vacant*	Phone: Fax: Email:
Public Works Operations Superintendent	Shane Turner	Phone: Fax: Email: S.Turner@iqaluit.ca
Iqaluit WWTP Operator	Pat Wolfe	Phone: 867-222-2424 Fax: Email: P.Wolfe@iqaluit.nu.ca
Iqaluit WWTP Operator	Emmanuel Kayode	Phone: Fax: Email: E.Kayode@iqaluit.nu.ca
Iqaluit WWTP Operator		Phone: Fax: Email:
Iqaluit WWTP Operator		Phone: Fax: Email:
		Date Updated: 03/31/2020

1.3 ROLE OF THE MANUAL

This manual consists of the operation and maintenance procedures for the sewage lagoon. The manual is developed to ensure the operation and maintenance of the Iqaluit WWTP Sewage Lagoon meets the mandatory requirements as per the Water License, 3AM-IQA1626, issued by the Nunavut Water Board. The Nunavut Water Board's mandate is to regulate the use of land and waters and the disposal of waste to provide conservation, development and utilization of land and water resources. The manual is developed to manage the waste generated at the Iqaluit WWTP Sewage Lagoon in such a way that adverse impacts to public health and safety, and to the environment are minimized.

Therefore, all aspects of the sewage lagoon operation and maintenance manual must not be in contravention of the requirements stated by the City of Iqaluit's current Water License: 3AM-IQA1626, attached in **Appendix B** for reference**.**

This O&M manual should be reviewed at each annual update, to ensure all relevant information has been added to the manual. If significant changes/alterations have occurred during the previous year, it is recommended to have the O&M manual properly updated/revised to reflect the changes as appropriate.

1.4 COMMUNITY INFORMATION

The City of Iqaluit is located on Baffin Island, at the northern end of Frobisher Bay in the Territory of Nunavut. The City is geolocated as follows:

Lat/Long:	68° 31' 2" West	63° 45' 49" North
UTM:	523824m East	7068908m North

The community is surrounded by hills close to the Silvia Grinnell River and looks across the bay to the mountains of the Meta Incognita Peninsula. The City is marked by cool summers and long, very cold winters; classified as a tundra climate. The City is north of the tree line, therefore only low-lying vegetation exist in the area such as shrubs, willows, and lichen. The surface of the ecoregion is covered with steeply sloping to undulating glacial drift, colluvium, and organic deposits in the form of polygonial peat plateaus. Permafrost is extensive and discontinuous with low to medium ice content and is characterized by sparse ice wedges.

Annual precipitation in the City of Iqaluit averages 200 millimetres of rainfall and 230 millimetres of snowfall, resulting in an annual total equivalent precipitation of approximately 400millimetres represented as rain. The mean high and low annual temperatures are -5.6°C and -13.1°C.

As of the 2016 Census, the estimated current population of the City of Iqaluit is 7740 people. Population projections are estimated at 13,000 for the year 2030 (based on City of Iqaluit Community Development Plan; 2015).

The location of the City's sewage lagoon and WWTP is shown below in **Figure 1.1** and on the drawings found in **Appendix A** of this manual.

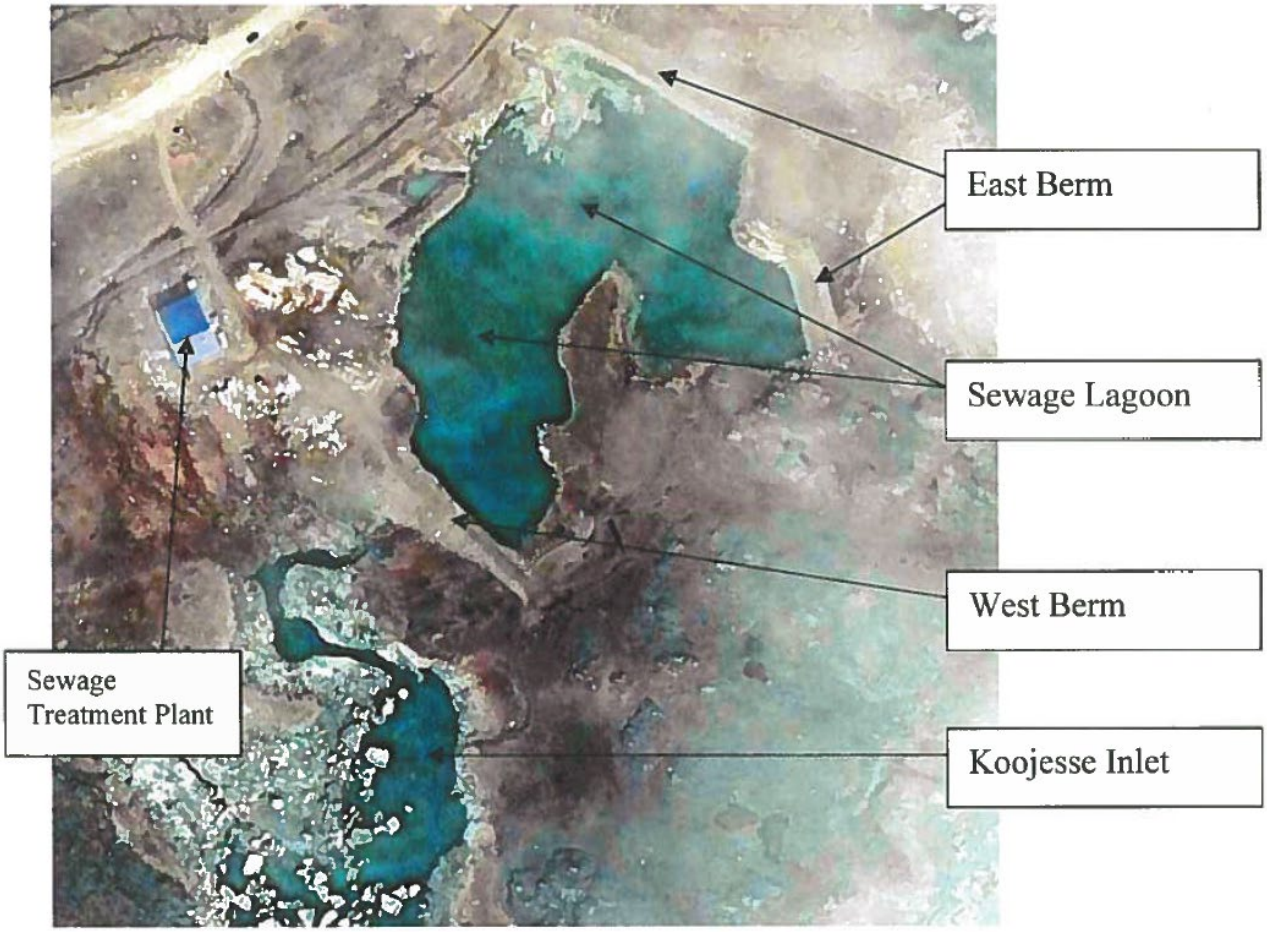


Figure 1.1 City of Iqaluit Sewage Lagoon and WWTP Aerial

2.0 BACKGROUND

2.1 WATER SUPPLY AND DISTRIBUTION

The City of Iqaluit's raw water source is supplied from the Lake Geraldine reservoir. The reservoir has an approximate full volume capacity of 1,361,000 m^3. When reservoir water levels are low, water supply from Lake Geraldine is supplemented by the Apex River.

Water is transmitted from Lake Geraldine by gravity to the water treatment plant, where it is treated by sand and anthracite filtration, chlorination, and lime stabilization. Treated water is stored in clear wells, filtered water tanks, and a main storage reservoir at the plant prior to entering the main distribution system. Networks of pipes deliver water to the surrounding community, which are aided by two water booster stations. To prevent the water from freezing in the distribution system, re-heat stations continuously circulate and temper the water.

2.2 WASTEWATER COLLECTION

Wastewater from the City of Iqaluit is received at the WWTP via 2 methods: The incoming sewer lines and by truck, which discharges the hauled sewage into the dump station manhole upstream of the WWTP. The wastewater received at the WWTP has the ability to be bypassed to the sewage lagoon via the upstream dump station manhole.

Figure 2.1 Truck Dump Station

2.3 SEWAGE LAGOON

The sewage lagoon is located to the west of the City adjacent to the Iqaluit WWTP and was constructed at this location circa 1978.

The sewage lagoon was formed by the construction of two berms that connected the shoreline to a natural island formation. The man-made structures form the east and west boundaries of the lagoon; the north and south boundaries therefore utilize the natural topography (see Figure 2.2).

Figure 2.2 Sewage Lagoon - Facing South Toward Koojesse Inlet

At the time of construction, the original sewage lagoon had an area and capacity of approximately 17,000 m^3 and 32,000 m^3 respectively.

In 1981, a partial wash out occurred during high tide, which was subsequently repaired. The repair reportedly washed out again that same year. Subsequent upgrades in 1983 had increased the capacity of the lagoon at the time to approximately 56,000 cubic meters.

According to the literature, the lagoon was the subject of investigative studies in 1983 and 1984, which proposed various upgrades, including the following:

- Lining of exterior slopes with filter cloth and riprap
- Construction of an overflow (spillway) in the west berm
- Construction of a positive outlet control
- Installation of an impermeable liner on the interior slopes

In June 1991, a breach of the west berm caused a major effluent spill into Koojesse Inlet.

A preliminary engineering report from July 1991 indicated that the spillway and impermeable liner upgrades had not been done, and that as-built drawings for any upgrades could not be located. The 1991 report recommended specific repairs and improvement for the berm reconstruction area. These included erosion protection (filter cloth and riprap) on the upstream and downstream sides, section conformity (2H:1V and 3H:1V on the upstream and downstream sides respectively), and construction of an overflow spillway section.

Background

In a December 1991 supplementary report concerns over material suitability prompted the recommendation to further flatten slopes to 3H: 1V and 4H: 1V on the upstream and downstream sides, respectively, of the west berm.

In December 1997, significant seepage developed on the west berm. Recommendations were made in a February 1998 engineering report to increase monitoring, to develop a spill preparedness plan, and to maintain the lagoon at its lowest possible level. In June 1998, a Spill Contingency Plan was prepared for the Town by an engineering consultant, which included a Sewage Lagoon Preparedness Plan. In that document, it is stated that the potential existed for further uncontrolled sewage releases due to berm failure.

A Dam Safety Review (DSR) for the Lake Geraldine Dam and Sewage Lagoon was prepared in 2001, which was followed-up by a Dam Safety Inspection (DSI), which was conducted in October 2002. The DSI noted no significant changes since the 2001 DSR but highlighted the seepage concerns of the east berm and the threat of overtopping in the spring. The DSI reiterated the recommendations of the 2001 DSR, as follows:

- There is inadequate information concerning the as-built conditions of the berms
- The berms are not considered safe in their current condition and are non-compliant with the design and performance standards of the DSG
- Remedial measures included three (3) options - an impermeable liner; buttressing the berms; and building a new lagoon

No DSI was conducted in 2003, based on previous documentation searches. However, a geotechnical investigation was conducted in 2003. The scope of the geotechnical investigation was to undertake a topographic survey of the lagoon and conduct a slope stability analysis of the berms. A separate hydrologic report is referenced but has not been located. It appeared that the geotechnical investigation was attempting to address some of the as-built issues discussed in the 2002 DSI. Conclusions from the geotechnical investigation included:

- Adequate (satisfying the Dam Safety Guidelines) factors of safety exist for steady state seepage and rapid drawdown scenarios
- The west berm should remain stable provided it is protected against overtopping and adequate erosion protection is installed on the downstream face

The report indicated that catastrophic failure is unlikely with the above provisos, however, localized failures or seeps were to be expected until such time as the lagoon was lined with an impervious material or rebuilt. The recommendations from the 2004 DSI are consolidated as follows:

- Preparation of the Permanent Record File (PRF) remains outstanding
- Undertake the next DSI prior to October 2005

- The safety/stability recommendations from the 2003 geotechnical report (discussed above) should be implemented in 2005

The above recommendations were not acted on in 2005. In August 2006, the west berm was upgraded to address the recommendations contained in past reports. In August 2006 a DSI was completed, which took into consideration the upgraded west berm, and acknowledged the preparation of a PRF.

A sludge survey was completed for the lagoon in 2018, which indicated that approximately 1600 m^3 of dry sludge was being held within the lagoon. Desludging of the lagoon was recommended, and occurred in October 2019. Inaccuracy in the estimate of percent solids in the lagoon resulted in a total of 475 m^3 of dry sludge being removed to complete the desludging process.

With the completion of the Iqaluit WWTP upgrades, the sewage lagoon shall remain as an emergency storage facility, should the WWTP require to be bypassed.

2.4 IQALUIT WWTP

The City of Iqaluit WWTP was contracted to be designed and constructed by a design-builder in 1998 to replace the treatment operation of the existing primary sewage lagoon. Construction commenced in 1999, which consisted of two aerobic tanks, two anoxic tanks, aeration blowers, cassette filters, and a Fournier press. Concerns arose in 2000 regarding the structural integrity of the aerobic tanks. A consultant (CH2M Gore & Storrie Ltd) was retained by the City to complete investigations and provide recommendations on the structural integrity. The consultant recommended shotcrete be applied to all wall sections in the tanks, which was completed. Ultimately the WWTP was never commissioned because the design builder abandoned the project.

Significant deficiencies were found in both the design and construction during the Sewage Treatment Plant Investigation in 2002.The deficiencies included code violations, inappropriate process selection and poor engineering practices such as not sizing the plant to include future population growth.

Based upon the facility assessment, AECOM was retained to complete the detailed design of a new WWTP incorporating the existing structure as much as possible. The design was advanced for both a primary and secondary treatment system. Phase 1 of the design, which consisted of a primary treatment system, proceeded to construction and was completed in 2006. The treatment processes consisted of influent pumps, auger screens and a primary filter (Salsnes Filter). The Salsnes Filter was selected as a substitute for ‘traditional’ primary clarification as a simple, low cost and robust alternative considered appropriate for Iqaluit. Phase 2 of the WWTP (secondary treatment), which was planned to include bioreactors, a DAF, and a belt filter press, was put on hold during detailed design, pending the availability of capital funding for the project. Secondary treatment was never put in operation.

In March 2013, the City received an Inspector’s direction from Aboriginal Affairs and Northern Development Canada and Environment Canada that required the City to complete upgrades to the WWTP to bring the quality of effluent into compliance with applicable standards by December 2018.

Nunami Stantec was selected to perform the upgrades to the WWTP facility in 2016. Upon completion of detailed design, it was determined that the associated costs with the proposed upgrades to the WWTP would exceed the available government funds. In order to determine the feasibility of design and reduce the overall upgrade costs, a value engineering session was held in July 2017, which resulted in several recommendations to help cut project costs.

Nunami Stantec was retained to perform the redesign of the WWTP based on the results of the value engineering session, in September 2017. The redesign consisted of the replacement of the existing primary treatment system and the installation of a new secondary treatment system, all within the existing footprint of the original WWTP. The primary treatment process consists of influent pumps, auger screens, and a primary filter (Salsnes Filter), similar to the existing primary treatment setup. The secondary treatment process consists of two trains of moving bed biofilm reactors (MBBR), which is proceeded by two dissolved air flotation (DAF) units. The overall process was selected to ensure a low cost, robust system that could be installed within the limited space of the existing building.

2.5 SEWAGE LAGOON FACILITY INFORMATION

The lagoon is a single-celled, naturally aerobic lagoon which has a current handling capacity of 25,000 m^3. The effluent from the lagoon flows into a low-lying area, which eventually discharges to Koojesse Inlet approximately 1.1 km away.

The purpose of the sewage lagoon is to act as a bypass/overflow system for the Iqaluit WWTP, should the plant experience an unexpected shutdown where it must divert away from the plant. Currently, all sewage flows are being directed to the Iqaluit WWTP. Flow can be diverted to the sewage lagoon by closing the upstream isolation gate located within the truck discharge manhole and opening the isolation gate to the sewage lagoon within the same manhole.

The sewage lagoon facility has no operable controls, systems and/or components, with the exception of the outlet control valve and structure near the west berm. The outlet control valve may be used to regulate the level in the lagoon. The lagoon is an older retaining structure built on “leaky dam” technology, which signifies that there is no liner for the lagoon and no significant operating controls or components. The pervious nature of the berms allows for percolation through the berm section.

2.6 EMERGENCY PLANNING & CONTACT

In the event an accidental/unauthorized discharge of waste occurs or if such a discharge is foreseeable, the Spill Contingency Plan (Ref. No. XXX, dated 20XX) for the City of Iqaluit shall be employed.

1. The first contact shall be to the WWTP Superintendent (867) 979-5636
2. If contact is not able to be made with the WWTP Superintendent and the situation is deemed an emergency, local enforcement can be contacted at (867) 979-5650
3. The incident shall be reported to the NWT/NU 24-Hour Spill Report Hotline at (867) 920-8130; and to the Inspector at (867) 975-4295

4. A report regarding the incident shall be submitted to the Aboriginal Affairs and Northern Development Canada (AANDC) Inspector within 30 days of reporting the incident

3.0 SEWAGE LAGOON FUNDAMENTALS

Sewage for the City of Iqaluit will be treated via the upgraded WWTP. The expectation for the sewage lagoon is to act as an emergency overflow and storage facility, should the WWTP be unavailable to treat the sewage. Bypassing to the sewage lagoon is expected to occur minimially during the year, if at all.

The City of Iqaluit Sewage lagoon is considered an intermittent discharge lagoon, as the lagoon will only be in operation while the WWTP is unavailable. When the sewage lagoon is required to be in operation, it will be operated in one of two methods:

1. Filling the lagoon, and intermittently discharging effluent. The lagoon is discharged at a semi-constant rate through an effluent pipe located within a coarse rip-rap section of the west berm. Effluent quality will need to be tested prior to releasing through the lagoon outfall for regulatory reporting purposes.

2. Overland pumping from the lagoon back to the WWTP, via the truck dump station upstream of the WWTP wet well. This method is subject to the WWTP coming back into operation prior to the sewage lagoon completely filling.

3.1 CHECKING THE SYSTEM

Once a week, a walk around inspection of the lagoon should be undertaken to observe if there are any obvious concerns. Action needs to be taken immediately if major problems such as significant erosion are apparent. A Site Inspection Template is attached in **Appendix D**. This form is to be completed upon each weekly, monthly, and annual site inspection visit undertaken by City of Iqaluit Employees.

During weekly inspections, all the major components of the sewage lagoon system should be checked to see if they are operating properly. If they are not, a repair work order should be generated, and the repairs made immediately. Once identified, repairs to lagoon systems cannot wait, as the consequences of failure can be very costly.

The sewage lagoon itself has four main areas to inspect:

- Inlet Structures (Lagoon Inlet and Truck Dump Station)
- Berms
- Outfall Structure
- Colour of lagoon liquid

3.2 FREEBOARD

The sewage lagoon has been designed to have a minimum of 1.0 metre of freeboard along the containment berms, which is the distance between the water surface and the top of the berm, when the lagoon is full (reached the design high water level). This is to protect the berm from erosion and over topping. The sewage lagoon has a minimum of 0.8 metre of freeboard along the overflow spillway portion of the lagoon, which allows a controlled release through a specific area of the lagoon berm should the lagoon be overtopped.

It is important to ensure that the sewage lagoon level does not exceed the design high water level mark of 6.50 meters (21 feet) as indicated on the lagoon as-built drawings. Exceeding the design high level mark will create unwanted pressure along the west berm and potentially cause flooding to other areas beyond the lagoon.

3.3 RUNOFF AND DRAINAGE CONTROL

The outside cell berms are gradually sloped away, at a 3:1 to 4:1 slope, depending on the berm in question. The sloped berms allow any accumulated precipitation to drain to the perimeter ditches that surround the site. The lagoon influent, which is conveyed from the sewage truck discharge station, is received along the Northeast side of the lagoon. The sewage truck discharge station is constructed of a precast concrete manhole which connects to a 250mm diameter HDPE that drains into the lagoon. Precipitation that falls on the discharge area which could be contaminated by any spilled sewage is drained down the inside cell berm (which is sloped 3:1), into the cell and is processed through the lagoon system.

3.4 TREATMENT OF CONTAMINATED DRAINAGE

Drainage contaminated by effluent will be contained using temporary dykes/berms and pumped or trucked to the lagoon area as per the Government of Nunavut's *Environmental Guideline for the General Management of Hazardous Waste*.

3.5 COLOUR

The colour of the liquid in a lagoon is an indicator of how well it is working. If the lagoon is operating well, it is usually bright green. If the contents of the lagoons are any other colour then green, there may be something wrong with the treatment process of the lagoon. The City of Iqaluit WWTP Operators should be contacted to determine the problem, and an engineer should be contacted to assess the condition of the lagoon.

Table 3.1: Lagoon Colour Identification

Colour	Lagoon Health	Comments
Green	Great	Good treatment conditions; neutral pH and high dissolved oxygen
Dull Green – Yellow	Okay	pH and dissolved oxygen generally dropping
Tan – Brown	Poor	Dissolved oxygen level and pH may be dropping; may also indicated physical issues with the lagoon or collection system
Grey – Black	Very Poor	Possibly full anaerobic conditions (no dissolved oxygen); lagoon is not treating wastewater well. Odours are most likely present.

3.6 PH

pH measurements are valuable because pH is one of the environmental factors that affect the activity and health of the microorganisms. Sudden changes, or abnormal values, indicate that the process has been upset in some way, usually from a toxic waste. Once the lagoon is completely thawed, pH measurements should be taken monthly during effluent sampling.

3.7 BERM MAINTENANCE

3.7.1 Maintenance Inspections

There are three main functions of the lagoon berms:

1. To form part of a storage container for retention of the wastewater for treatment
2. To provide access to all parts of the la goon
3. To provide a system for flow rate control

The objective of a berm inspection is to make sure that failure does not result from undue leakage. Wastewater leakages through the berms mean that there is not proper containment of the wastewater within the lagoon, which is a source of contamination and needs to be addressed immediately. The two major concerns, and visual evidence of potential berm issues, are excessive growth of vegetation, which may hide developing problems, and erosion. Erosion of berms can be caused by the occurrence of waves

on the inside of the lagoon cells, and surface runoff on the inside or outside of the lagoon cells. Leakage problems in berms can also be further aggravated by animal burrows.

Regular monitoring and maintenance are required to control berm erosion. The most frequent areas are:

1. Around the effluent discharge structure, (located in the southwest corner of the lagoon cell)
2. At all corners of the lagoon
3. Along the inside banks which are downwind
4. Areas with insufficient vegetative cover
5. Areas with insufficient berm compaction

Wind-induced water erosion is usually more serious for large lagoons, particularly with surface areas over 50 000m^2 (5 hectares). The City of Iqaluit Sewage Lagoon is much smaller (approximately 17 605m^2 or 1.76 Hectares), and therefore wind induced erosion is not a primary concern. If it is found that excessive erosion is occurring, additional riprap can be placed to reduce its effects.

Another method of berm protection uses grass or other vegetative cover. Vegetation may not be present directly following construction of the lagoon, however once vegetation begins to establish, it is important that regular cutting of grass or vegetative cover is carried out. A well-maintained berm is less likely to be the target for burrowing animals.

Surface runoff is prevented from entering the lagoon through sloping of the berms and interceptor ditches at the bottom of the outer berm slope. The ditches must be properly maintained to prevent the blockage of drainage.

The berms and drainage ditches should be visually checked on a regular basis. This should be recorded weekly as shown in the **Appendix D**.

3.7.2 Dam Safety Inspections and Guidelines

The Canadian Dam Safety Guidelines (DSG) requires that all structures exceeding both 7.5m height and 10,000 m^3 storage capacity follow the requirements of the DSG. Dam Safety Reviews (DSR) and Dam Safety Inspections (DSI) are required at regular intervals for dam structures that are high, very high, or extreme classifications. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The City of Iqaluit sewage lagoon falls under the requirements of the DSG's. The first DSR conducted on the sewage lagoon was undertaken in 2001.

One of the documentation requirements of the DSR is that a Permanent Record File (PRF) be created and maintained for the life of the dam structure/facility. This O&M manual constitutes the PRF for the dam safe reviews and inspections completed for the Iqaluit WWTP Sewage Lagoon.

The DSG's stipulate that a Permanent Record File (PRF), suitable for transfer to the regulatory agency, (in this case the Nunavut Water Board), should be maintained as an ongoing historical reference. The file is required to contain the following:

- History and Background
- Operations, Maintenance & Surveillance Requirements
- Permanent Log Book (PLB)
- Records of all DSR's and DSI's
- As-Built Drawings (and Design Data)

The records for the DSR's and DSI's are provided as part of **Appendix F**.

An updated DSR was completed in 2012, which reviewed the classification of the sewage lagoon. It was determined the sewage lagoon classified as a low risk dam structure, as there is very minimal risk for loss of life, or any socio-economic impacts as a result of a dam failure. Therefore, the sewage lagoon does not require DSR's to be completed. Regular reviews of the DSG's and sewage lagoon should still be completed to monitor revisions to the guidelines, and if any changes are made to the structure of the sewage lagoon.

3.8 INLET STRUCTURE – TRUCK DUMP STATION

The truck dump station is a 2.0m x 2.0m concrete chamber, which receives the gravity flows from the City, as well as the trucked sewage. The truck sewage is discharged to the dump station through several discharge connections at the top of the chamber. At the bottom of the chamber, a 300mm diameter HDPE line receives gravity sewage, and the sewage exits either through the 300mm diameter HDPE line to the WWTP, or through the 250mm diameter HDPE line to the sewage lagoon. As flows are mainly directed to the WWTP, the flow to the sewage lagoon is blocked with a series 20 Fontaine Sluice Gate. The dump station was modified in 2019 to include a 250mm diameter HPDE overflow to the sewage lagoon, which ties into the existing HDPE line to the sewage lagoon. Refer to drawings in Appendix A for truck dump station details.

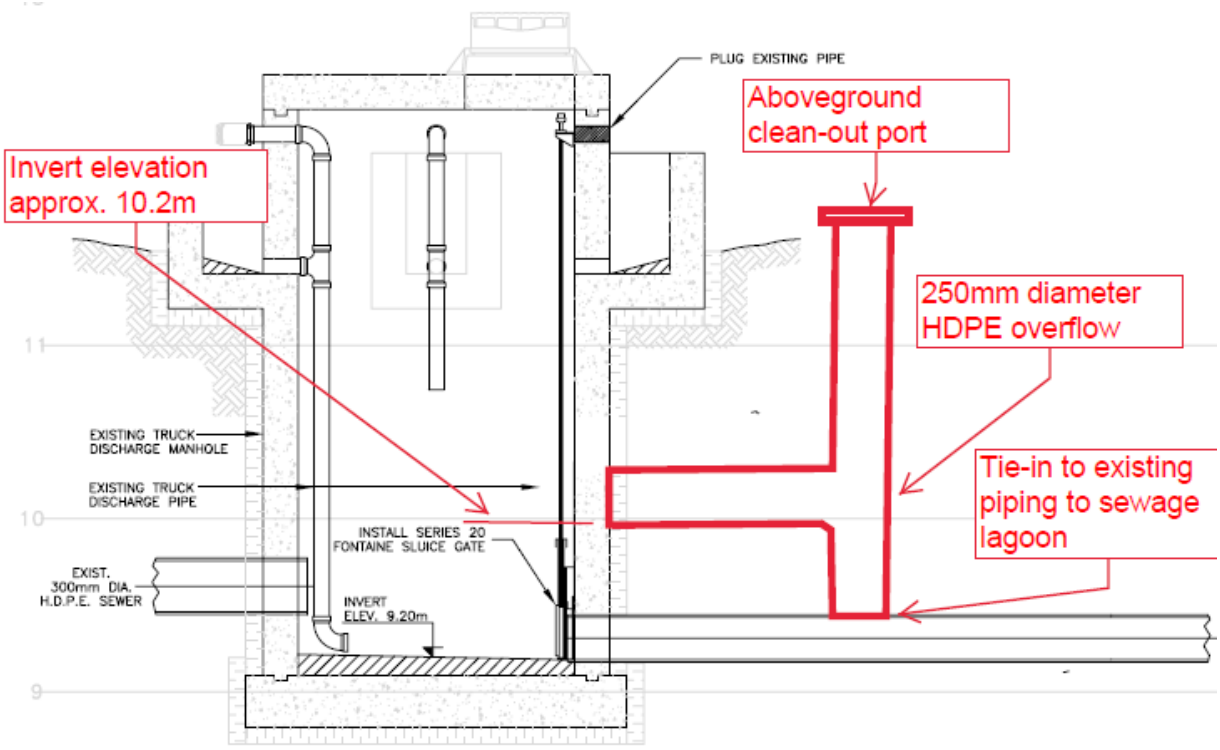


Figure 3.1 Truck Dump Station Section

At the truck dump station manhole, major problems can occur as a result of freezing within the manhole, snow accumulation, uncontrolled spillage, and waste accumulation in the discharge line.

Freezing within the manhole could result in the inability to open/close the bypass valve to the lagoon (i.e. inability to control discharge to lagoon). Allowing snow to accumulate around the truck dump station could result in an inability to access the site, which could result in the trucks being unable to discharge wastewater at this location or actuate the bypass gate to the lagoon if necessary.

Freezing of the dump station lagoon influent line has also been previously noted to occur at the discharge point into the lagoon. This can have severe consequences if not monitored, as the lagoon influent is a last line of defense to protect overflows from occurring at the WWTP and the upstream manholes. Freezing of lagoon influent line occurs due to snow accumulation around the discharge point, or obstruction from ice heaving up from the lagoon. The discharge point for the lagoon influent line should be monitored and maintained regularly in the winter to remove any build-up of snow and ice that occurs. It is also recommended to keep the level in the lagoon below the influent discharge to the lagoon to minimize the development of ice blockage.

Uncontrolled spillage at the truck dump station would result in notification to regulatory bodies. Waste accumulation would result in an inability to discharge to the lagoon.

Snow accumulation at the dump station can be mitigated by clearing the snow periodically. This should occur each time the road access to the WWTP is cleared.

If spillage is to occur from one of the sewage trucks at or around the truck dump station, all spilled material should be removed and disposed to the lagoon, along with any snow or ice which becomes contaminated by the spill.

Waste accumulation within the dump station can be mitigated by regularly inspecting the manhole and checking if any build-up is occurring within the manhole. Any build-up should be broken up to allow proper discharge to the lagoon.

3.9 OUTLET STRUCTURES

Two types of outlet structures exist at the City of Iqaluit Sewage Lagoon:

1. Effluent outlet structure
2. Emergency overflow section

The effluent outlet structure consists of an insulated, 200mm HDPE pipe which passes through the west dyke and is connected to a control vault, which allows the lagoon effluent discharge and lagoon water levels to be controlled. The control vault consists of two, 200 CWP Crane knife gate valves, which are spaced by a blind flanged tee in the middle. The valves are used to isolate the flow of the lagoon outfall, and typically remain closed unless a release from the lagoon is required.

The outlet structure is designed to allow continuous discharge of the lagoon effluent, which should have the valve in the control vault remain open while the lagoon is in operation and receiving flows. A section of the dyke adjacent to the outlet structure contains a French drain to provide greater stability to the berm structure. The outlet has an elevation of 5.60 meters, which is 0.9 meters below the max high level of the lagoon (6.50 meters).

An emergency overflow section is designed to allow for a controlled discharge from the lagoon over a section of the west berm, in the case where the lagoon cannot properly discharge through the outlet structure. The emergency overflow prevents the lagoon from overtopping and/or failing at any of the berms, which would have serious implications. The overflow consists of a recessed section of the berm, which was designed to be 0.2 meter lower than the remaining berms, allowing for the overflow to discharge adjacent to the existing lagoon outlet structure. Maintenance inspections should be completed routinely to detect any settling, blockage, or damage to the overflow structure. The overflow section should always be kept open and well maintained. Refer to drawings in Appendix A for details on overflow.

The sewage lagoon system is designed to minimize any short-circuiting of the wastewater. The inlet is located approximately opposite to the outlet location, maximizing the effective use of the designed cell volume and retention time.

3.10 ODOUR, VEGATION, AND INSECT PROBLEMS

3.10.1 Odour Problems

Under normal operating conditions, the lagoon will not experience or cause serious odour problems. However, at certain times significant odours may occur.

The most troublesome odour conditions occur:

1. During the period immediately following ice break-up; this problem will normally be of short duration. It is also likely to occur annually
2. At the end of an extensive period of cloud cover (in spring to fall when there is no ice cover), resulting in reduced sunlight and therefore reduced algae activity and low oxygen production. The problem will decrease as sunlight returns or ice-cover forms
3. Extensive floating sludge mats. In this case, floating scum, septic sludge and algae mats need to be broken up and dispersed using manual mechanical means such as a rake
4. If insufficient water level is maintained in the lagoon. A minimum of 1 meter of standing water will help cap the lagoon sludge, which will reduce the amount of odours experienced

3.10.2 Vegetation Control

Plants around the outside slope of the lagoon berm are good and necessary. Small-size vegetation on the outside slopes of the berms are beneficial, however large weeds and shrubs can cause deep root-related problems and must be removed. Proper maintenance on the outside slopes, including regular cutting and removal, must be addressed on a routine basis.

Riprap protection should not be covered with vegetation as the vegetation will be difficult and dangerous to control. Similarly, vegetation should not be allowed to grow on the inside slope of the lagoon berms.

A number of surface weeds can develop in lagoons. The problem with these weeds is that they block out the sunlight, which is needed to produce oxygen. A second problem is that when floating plants die, they begin to decompose, using up oxygen which is needed by the bacteria and lowering the dissolved oxygen.

Duckweed is one of the most common of the problem weeds. It is a three-leaved plant. It develops long hair-like roots which harden in the water. It varies in colour from light green during normal growth to brownish yellow in its death phase.

The ways to control surface weeds are to skim them off the lagoon (often difficult and requires repeating). The removed weeds should be taken to the landfill and buried, where possible, to prevent odour and insect problems.

General guidelines for regular vegetation control are to:

1. Remove all shrubs from the lagoon area
2. Allow, plant, or maintain shallow-dense rooted, perennial grasses such as Perennial Ryegrass, on the outside slopes of the berms
3. Cut grass regularly during warm weather. Mowing equipment should have a low centre of gravity to minimize the potential of overturning the tractor when mowing along the berm slopes. The slopes are constructed at a 3:1 ratio

3.10.3 Insects

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

Puddles of water outside the lagoon will also harbour insects. Berm maintenance and the filling of potholes and puddles will reduce the opportunity for insect reproduction.

3.11 FLOATING MATERIAL REMOVAL

The City of Iqaluit Sewage Lagoon is not fenced, which can allow windblown garbage to enter the facility. Any debris that is observed on the surface of the cell should be removed at the first opportunity and taken to the landfill.

3.12 SIGNS

As per Water License requirement B.5, warning signs must surround the lagoon and be located near the high traffic locations. All lost or damaged signs must be replaced. All signs shall include warnings in all official languages of Nunavut to coincide with the languages of the area. Lagoon signage was installed as part of the WWTP upgrades in October 2019.

Due to the history of finding large debris (mattresses, bikes, etc.) in the sewage lagoon by the public, it is recommended to add “No Dumping” signs to the existing warning signs placed around the perimeter of the sewage lagoon.

3.13 SLUDGE MANAGEMENT

Sludge is the non-liquid portion of waste that accumulates on the bottom of the lagoon cell. General sludge management activities are required very infrequently. Sludge removal will likely be required every 10 to 15 years. Sludge volumes are to be measured and recorded every 2 to 5 years to determine when an actual sludge removal is required. Refer to the following sections regarding sludge removal frequency and procedures.

3.13.1 Sludge Survey

A sludge survey involves two steps: locating the top of the sludge layer and measuring the sludge thickness at several locations in a lagoon. Refer to write-up below for a description of the procedure.

The sludge survey should be conducted from a boat on the lagoon. Special care should be taken when going on to the lagoon in a boat. For safety reasons, at least three people should be present: two in the boat and one on the lagoon bank. The extra person(s) on shore may be needed as a rescuer(s), should anything go awry. The extra person on the boat assists with getting in and out of the boat and anchoring the boat at the measurement locations. Also, it is more efficient if one person in the boat uses the measuring instruments and the other records the data. Flat-bottom or johnboats are preferred over canoes or V-bottom boats, as they are more stable. All persons working within the inner slopes of the lagoon, and especially those in the boat, should wear appropriate flotation devices.

The sludge layer is generally a "mobile" fluid, but it may form peaks and valleys within the lagoon. Small lagoons, such as the City of Iqaluit Sewage Lagoon, seem to have more variation in sludge layer thickness. For this reason, at least 25 depth measurements should be taken for the lagoon. The locations for measurements should be determined by a uniform grid, if possible. Avoid measuring over the slope of the lagoon embankments. All measurements from the various locations on the grid should be averaged to produce an average sludge layer thickness to calculate the volume of sludge.

For a more detailed measurement of the lagoon profile, an infrared sludge interface detector and acoustic reflectors can be used to measure the bottom profile and the depth of the sludge blanket. The infrared measurements can be further correlated with the use of a sludge judge. Sludge samples are also collected throughout the lagoon and measured for total solids and total volatile solids to approximate dry material volumes in the lagoon.

In 2018, Lambourne Environmental was selected to perform a sludge survey of the lagoon. The survey was completed using infrared sludge detectors, and a sludge judge, as listed above. The estimated dry sludge volume of the lagoon was estimated at 1,597 m^3 with a percent solids of 30% for the settled sludge. **Figure 3.1** shows the lagoon depth measurements obtained as a result of the sludge survey completed in 2019.

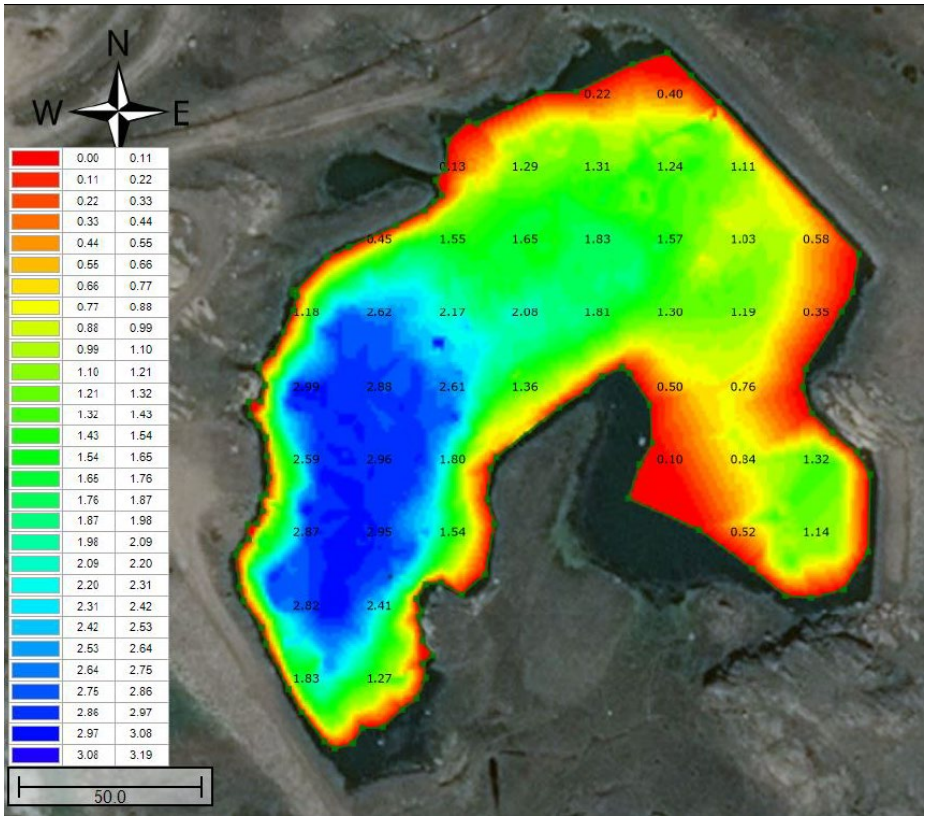


Figure 3.2 Lagoon Depths from infrared sludge survey completed in 2019

3.13.2 Sludge Removal and Frequency

When a sludge survey determines that excessive sludge has accumulated in any one of the cells, sludge removal should be completed. In the case where more than 1/3 of the designed water storage depth is accumulated sludge, the sludge should be planned to be removed.

After draining or pumping of the free water, the solids can be removed using an excavator. To protect the bottom of the lagoon, do not try to remove the bottom 250mm of sludge. Refer to the facility drawings to determine lagoon elevations.

Care must be taken to prevent damage to the berm surfaces during this method of cleaning. It is important to have a skilled operator doing this work to reduce the potential for surface damage.

Sludge removal can also be completed by dewatering the lagoon and pumping into geotube containment vessels. One method to perform the desludging is to use lagoon pumps, which are connected to a piece of mechanical equipment, such as a tractor (see Figure 3.3 below). Lagoon supernatant is mixed with settled sludge via the lagoon pumps, which is conveyed to a polymerization unit. Polymer is dosed into the pumped sludge before entering the geotubes to increase dewaterability of the sludge. The geotubes

then slowly dewater and dry the sludge, which can be removed from the geotubes via an excavator and disposed of at the landfill. The geotubes should be placed on a containment pad, which ensure the proper stability of the tubes when being filled (see Figure 3.4). It is beneficial to have the containment pad for the geotubes located adjacent to the sewage lagoon, so that the water which drains from the geotubes can be gravity drained back to the lagoon. This reduces the need for additional dewatering pumps to return the water back to the lagoon.

Figure 3.3 Mixing of lagoon supernatant and settled sludge during desludging

Sampling should be performed prior to dewatering to determine the approximate solids content of the water in the sewage lagoon, which assists in determining appropriate polymer dosage required during pumping, as well as provide a more defined quantity of anticipate solids removed per unit of water pumped from the lagoon. Anticipated dry solids content, combined with flow totalization during the desludging process, will help monitor the quantity of sludge removed with the expected quantities.

Figure 3.4 Desludging of sewage lagoon using geotubes placed on containment pad

3.13.3 Sludge Disposal

Removed sewage sludge will be allowed to accumulate, treat naturally, and dewater in a future specified location. This location and its characteristics will be chosen with approvals from the NWB. Currently, the City is developing a solids management plan which will determine the ultimate disposal option. Potential exists to utilize the dried sludge as organic cover/mix material for the landfill.

During the winter, freezing will encourage consolidation of the sludge and, upon thawing, further dewatering. Any liquid accumulating with the removed sewage sludge will be pumped back into the sewage lagoon, if it was unable to gravity drain back to the lagoon.

3.13.4 Health and Safety Concerns

Prior to undertaking any sludge survey, removal or disposal, operators should be well aware of safety and health considerations. All operations conducted at the lagoon facility shall adhere to the applicable Workers Safety and Compensation Commission policies and legislations[1].

A minimum of two people shall be on site when working in and around the wastewater filled lagoon cell. Safety belts and lanyards shall be used when a worker is required to work on the sloped surfaces of the lagoon cells. Proper flotation devices shall be on site to prevent drowning in the event that someone falls in. Protective masks should also be worn by operators when working around the lagoon to protect against pathogens and odours. Refer to City Safety policies and procedures for full safety requirements

Raw untreated sludge may contain pathogens harmful to human health. When working with raw untreated sludge, proper clothing shall be worn to eliminate skin contact such as gloves and appropriate boots. Immediately upon completion of work, the hands and face of those working with the sludge should be washed with soapy warm water to prevent any contamination.

It is recommended to maintain a minimum level of standing water in the lagoon after completion of desludging. Full removal of the lagoon sludge is not recommended, if the lagoon is to continue operating as an emergency overflow and treatment option for the WWTP. It is recommended to maintain some settled sludge as seed sludge, which will help maintain anaerobic conditions in the lagoon for treatment during emergency overflows. The standing water will also help cap the lagoon sludge and reduce the occurrence of any odors that are generated from the sludge.

3.14 QUALITY ASSURANCE/QUALITY CONTROL PLAN

The SNP sampling is completed in accordance with Indigenous and Northern Affairs Canada's (CIRNAC) *QA and QC Guidelines for Use by Class A Licensees in Meeting Surveillance Network Program Requirements and for Submission of a QA/QC Plan, 1996*; see **Appendix C** for a copy of this guideline.

[1] *If unfamiliar with the appropriate WSCC policies and legislations, consult an OHS member to provide the correct resources.*

The purpose of taking samples is threefold: one, to measure, determine, or quantify how well the lagoon is working; two, to determine if the effluent meets the regulatory requirements; and three, to adhere to the requirements stated in the governing Water License.

There are six important parts to the process of sampling:

1. Taking the sample at the time called for
2. Using the correct sample container
3. Taking the sample from the correct location
4. Careful and correct labelling of the sample container
5. Using proper sampling procedures
6. Shipping the sample in proper containers so it arrives on time at the laboratory for testing

Sample analysis will be conducted by a laboratory accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) as a testing laboratory for specific tests registered with CAEAL. The laboratory shall also be accredited according to ISO/IEC Standard 17025. Routine methods of sampling and analysis are based on recognized procedures such as Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, Environmental Canada, USEPA.

The sampling information outlined in Section 3.3 should be used for sampling the lagoon effluents. As per the Water License requirements, effluent from the lagoon shall meet the following effluent quality requirements at IQA-02 (SP-1 location shown in **Figure 4.1** below).

Table 3.2: Effluent Quality Requirements

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Suspended Solids (TSS)	50.0 mg/L	100.0 mg/L
pH	Between 6 and 9	

3.15 RECORD KEEPING

Records of all inspections, preventive maintenance, repairs, and operational procedures should be meticulously kept. The records should be kept for the lifetime of the facility.

Site Inspection Templates are provided for record keeping in **Appendix D**. Copies of these reports should be kept in an organized and convenient location.

4.0 OPERATIONAL INSTRUCTIONS

4.1 FLOATING MATERIAL REMOVAL

In the event that debris or vegetation is observed on the surface of any cell, it is to be removed at the first opportunity using a skimming device. Algae growth on the surface of the lagoon does not need to be removed.

4.2 WASTEWATER SAMPLING

The following effluent sample station for the Iqaluit WWTP Sewage Lagoon shall be sampled monthly during periods of active flow to the lagoon and analyzed for the following parameters listed in the table below. Locations of the sample station is shown in **Figure 4.1** below.

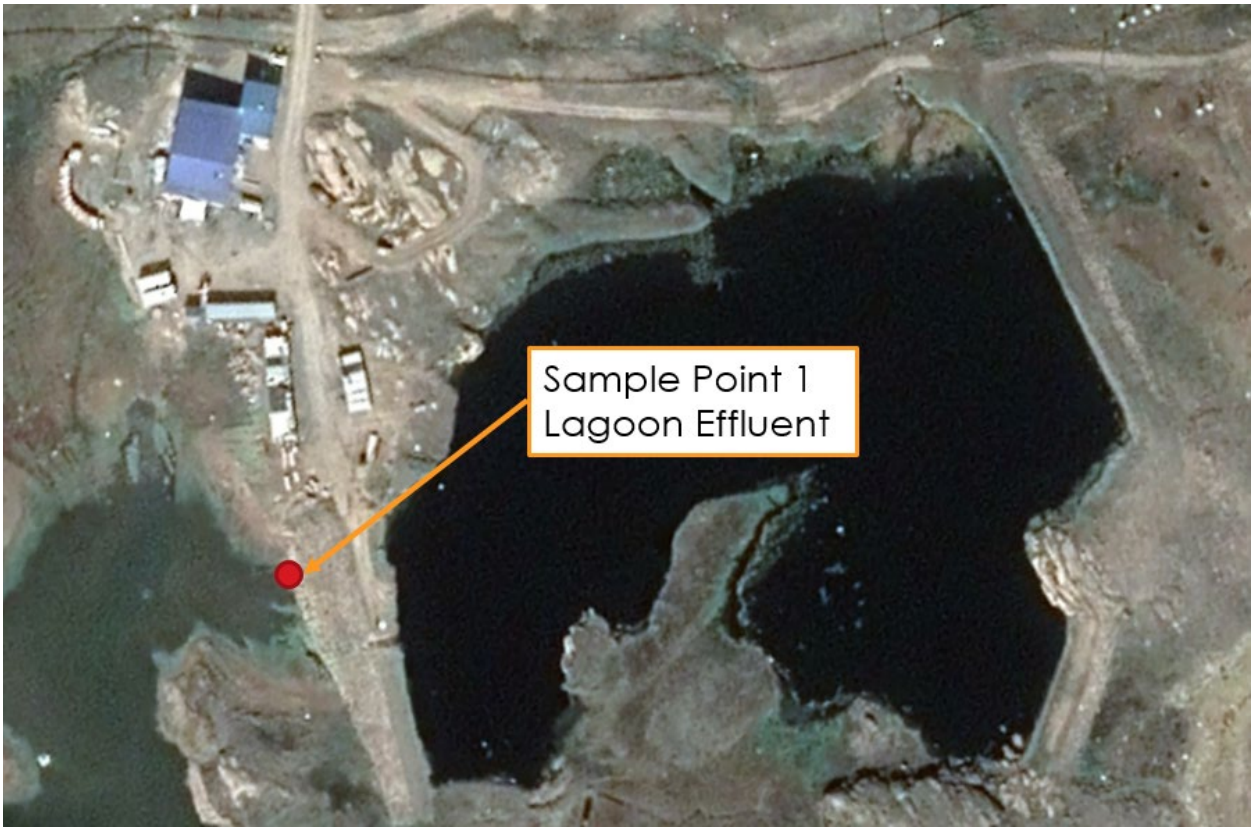


Figure 4.1: Sewage Lagoon Sampling Location

Table 4.1: Sample Point 1 Characteristics

SNP ID: IQA-02 (SP-1): Lagoon Effluent **UTM Coordinates: 7068682m N 522821m E**	**Description:** *At the lagoon site effluent discharge piping.* **Rational**: *To monitor lagoon final effluent water quality to determine the quality of treatment being provided by the sewage lagoon, along with the quality of effluent discharging into the Koojesse Inlet.*
1	BOD_5
2	Fecal Coliform (FC)
3	Total Suspended Solids (TSS)
4	pH
5	Temperature
6	Conductivity
7	ICP- Metal Scans

Information on sampling of effluents and receiving waters is in the Indian and Northern Affairs Canada's *QA and QC Guidelines for Use by Class A Licensees in Meeting Surveillance Network Program Requirements and for Submission of a QA/QC Plan, 1996*; a copy of this guideline is attached in **Appendix C** for reference.

Follow all quality control and quality assurance procedures required by the laboratory conducting the analysis. Chemical testing shall use appropriate analytical methods as contained in the most recent edition of *Standard Methods for the Examination of Water and Wastewater* or other recognized testing methods. A copy of the laboratory sampling requirements will be included in **Appendix E** of this manual.

4.3 SLUDGE SURVEY

The basic sludge survey approach is to measure the depth from the liquid surface to the top of the sludge layer, and then measure the depth from the liquid surface to the lagoon bottom (soil contact); calculate the difference to obtain the thickness of the sludge layer. The following approach has been provided for information only, as it is recommended that a sludge survey be performed by an expert contractor that has the necessary experience and tools required for the work.

A disk-on-rope can be used for detecting the top of the sludge layer using a disk or plate that sinks through the liquid and settles on the sludge. When used carefully, this method generally agrees within 22mm (1 inch) with infrared detectors. A PVC disk 1/4-inch thick and about 8 to 12 inches in diameter or of square shape (specific gravity = 1.4) has shown results consistent with the infrared detectors. The size (area) of the disk should make little difference because the pressure exerted on the sludge is constant per

unit area. Disks of Lexan (specific gravity = 1.2) give similar results. Materials that are heavier than PVC could exert more pressure and penetrate the sludge.

The wire, rope, or string by which the infrared detectors or disks are lowered into the lagoon should be marked using metric measurements of 10cm. This line should not be elastic because stretching will cause variations in readings. The disk should be lowered slowly to keep it from swaying off vertical line. Holes should be drilled in the disk to allow liquid to pass through and reduce swaying. The rope or string can be attached to the disk at the center or at 2 to 4 symmetrically place d locations to keep the disk more stable. The depth to the sludge layer should be measured with the disk before using a pole to measure depth to the lagoon bottom because the pole may disturb the sludge layer. The following is a list of instructions to perform a sludge survey:

1. Gather the necessary personnel and equipment, including the following: boat, life jackets, paddles, map or sketch of lagoon, clipboard and pencils, sludge detection device such as a disk-on-rope with interval markings to determine the top of the sludge layer, and a solid rod or pole with interval markings to determine the depth to the lagoon bottom. A small johnboat is recommended. There should be a minimum of two people in the boat and one on the bank.

2. Measure sludge at a minimum of 25 points over the area of the lagoon. Set up a uniform grid on a lagoon sketch to show the location of each point.

3. Measure the depth from the surface of the liquid to the top of the sludge. Record this depth. Insert a pole vertically at the same location until the lagoon bottom (soil contact) is felt. Record this depth. The sludge thickness is the difference between the two readings.

4. Proceed to all other sample points, and record measurements similarly.

5. To determine the average sludge layer thickness in the lagoon, add all sludge layer thickness determinations and divide by the number of readings taken. This average, along with the difference from the top of berm to the water level in each cell should be recorded.

5.0 O&M CHECKLIST

5.1 WEEKLY CHECKLIST

1. Walk around the lagoon site and conduct a visual inspection

2. Determine the colour of the liquid in the lagoon cells during open water season. If the water is a very dark black, contact the City of Iqaluit Superintendent (see Section 2.5)

3. Check berms, drainage ditches for damage caused by animals, vegetation, or any type of erosion. If damage is observed, repair the problem immediately to eliminate further damage and expenses

4. Verify a one-meter freeboard is always maintained, at all berms. Contact the City of Iqaluit Superintendent if considerable different elevations exist as this may be an indication that settlement is occurring, or discharge structures are not operating correctly

5. Inspect major components:

    a. Operation of sluice gate in inlet structure

    b. Operation of knife gate valves in outlet structure

5.2 MONTHLY CHECKLIST

1. Inspect signage; repair as required

2. Visual inspection of sewage lagoon area to ensure run-off or seepage is not occurring

3. Sample effluent and record pH/colour as required by Water License (see **Section 3.3**)

4. Remove excess floating debris and any vegetation (see **Section 3.1**)

5.3 AS REQUIRED

1. Determine sludge levels in lagoon cells (see **Section 3 .2**) and remove sludge as required

2. Clear drainage ditches and culverts of excess snow/ice and repair any damage from erosion

6.0 REFERENCES

CIRNAC. (1996, July). Quality Assurance (QA) and Quality Control (QC) Guidelines For Use By Class "A" Licensees in Meeting SNP Requirements and For Submission of A QA/QC Plan. NWT, Canada.

Government of Nunavut. (2010, October). Environmental Guideline for the General Management of Hazardous Waste. NU, Canada.

Nunavut Water Board. (2016, June 17). Type "A" Water License No: 3AM-IQA1626. Iqaluit, NU, Canada.

APPENDICES

City of Iqaluit Sewage Lagoon O&M Manual

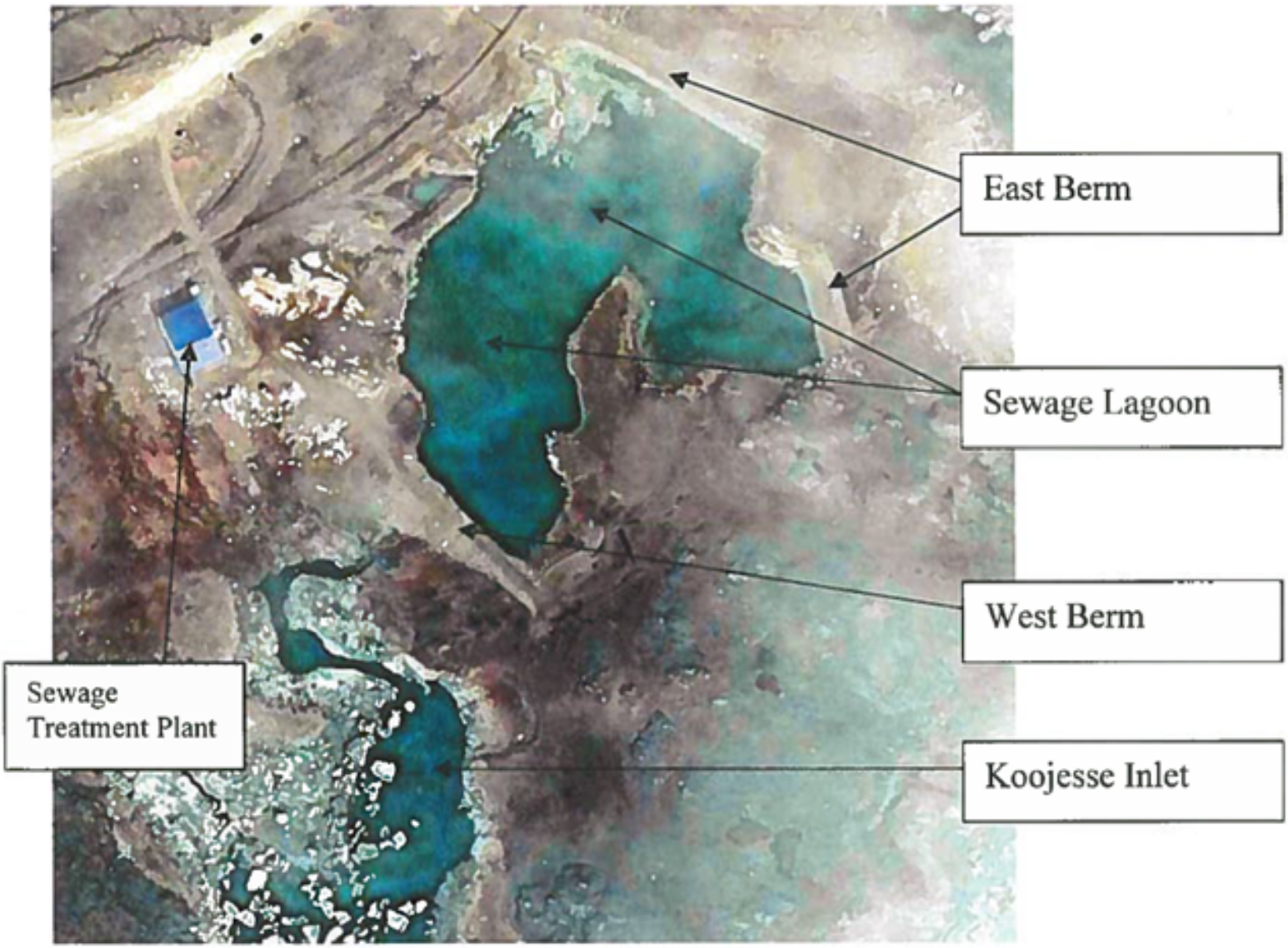
Appendix A SEWAGE LAGOON DRAWINGS

Copies of all As-Built drawings and related design data available for the Iqaluit WWTP Sewage Lagoon shall be contained in this section. The documents should be placed in chronological order for ease of reference.

New documents that are added to this section should be noted in the annual updates page at the beginning of the O&M manual, in the Permanent Log Book for the associated site inspection, and in the As-Built drawings register listed below.

Date	Document	Completed By
Dec 1991	Lagoon Reconstruction and Drainage Improvements Record Drawings	UMA Engineering Ltd.
May 2006	City of Iqaluit WWTP Phase 1 – Dump Station Modifications	Earth Tech
Sep 2006	Sewage Lagoon West Berm Upgrades	Concentric

City of Iqaluit Sewage Lagoon and WWTP Aerial



TOWN OF IQALUIT

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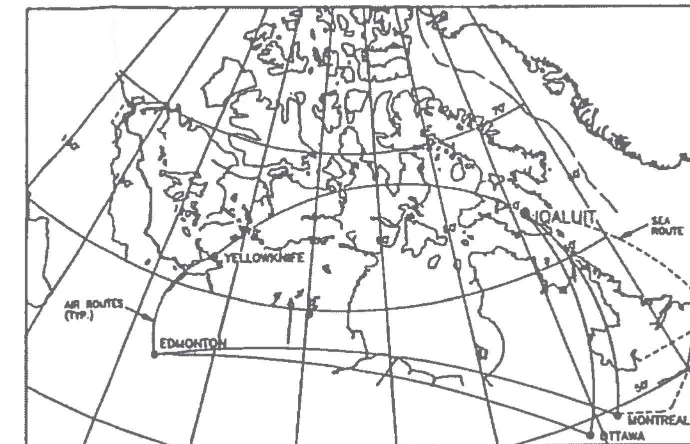

LOCATION PLAN
N.T.S.
IQALUIT - N.W.T. - CANADA

LAGOON RECONSTRUCTION AND DRAINAGE IMPROVEMENTS

RECORD DRAWINGS

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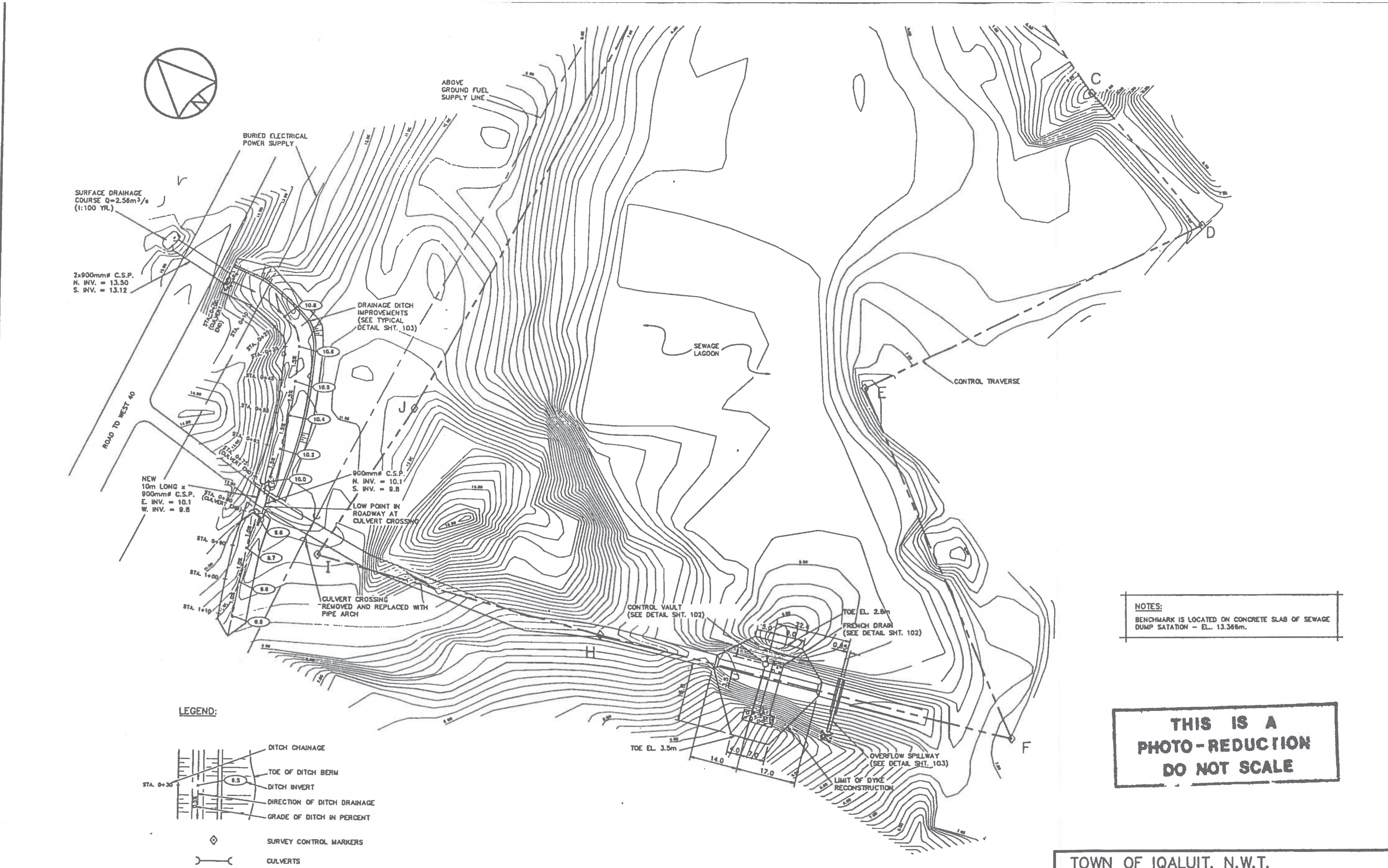
CONTRACT No.

UMA Engineering Ltd.
Engineers, Planners & Surveyors



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PERMIT

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER P 007
UMA ENGINEERING LTD

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2	01	12	10	RECORD DRAWING	ME	KRJ		KRJ	KRJ
1	01	08	08	FOR CONSTRUCTION	ME	KRJ	JVA	BCS	KRJ
0	01	07	24	FOR REVIEW	ME	KRJ	JVA	KRJ	KRJ

UMA Engineering Ltd.
Engineers, Planners & Surveyors
British Columbia Alberta Saskatchewan Manitoba Ontario Yukon Territory Northwest Territories

ENGINEER
REGISTERED PROFESSIONAL ENGINEER N.W.T.

TOWN OF IQALUIT, N.W.T.

LAGOON RECONSTRUCTION AND DRAINAGE IMPROVEMENTS

OVERALL SITE PLAN AND GRADING

uma 0202 - 4396 - 00 EDMONTON

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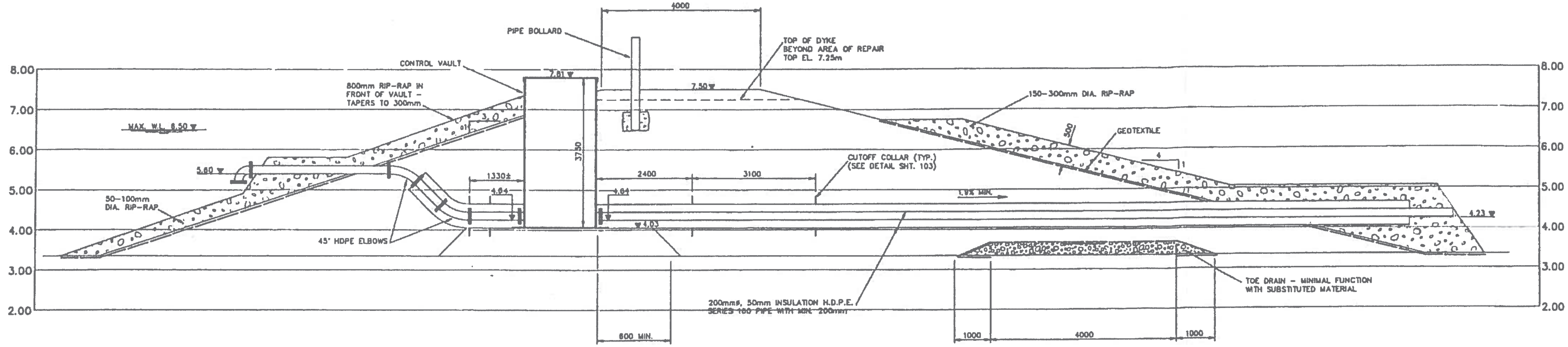

DYKE RECONSTRUCTION

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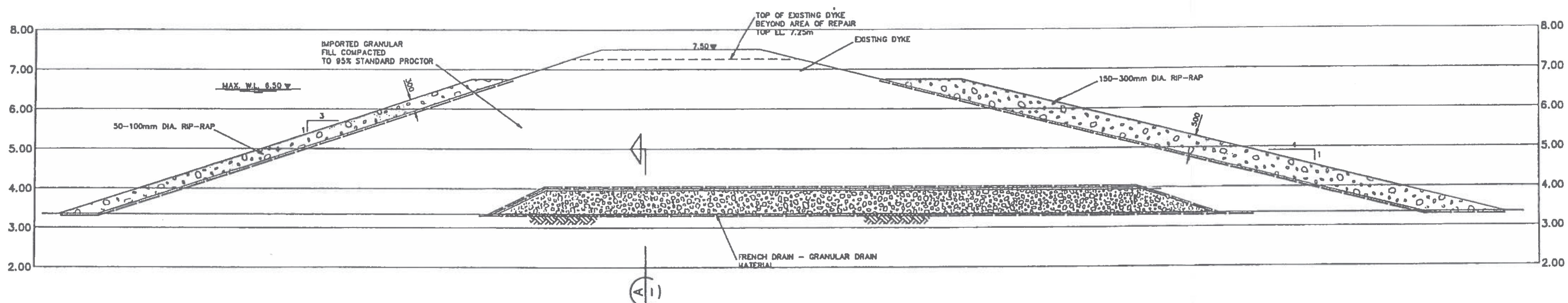

FRENCH DRAIN (MINIMAL FUNCTION WITH SUBSTITUTED MATERIAL)

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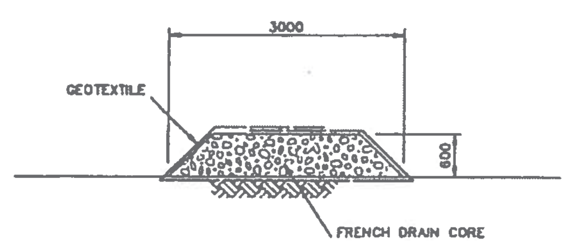

SECTION A

SCALE 1:50

NOTE: IMPORTED GRANULAR FILL CLASS D2 NOT UTILIZED ABOVE ELEVATION OF FRENCH DRAIN. MATERIAL WITH LARGER FINES COMPONENT SUBSTITUTED BY TOWN OF IQALUIT. DESIGN SLOPES OF 4:1 (EXTERIOR) AND 3:1 (INTERIOR) ACCOMMODATE THIS MATERIAL.

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PERMIT NUMBER
P 007
UMA ENGINEERING LTD

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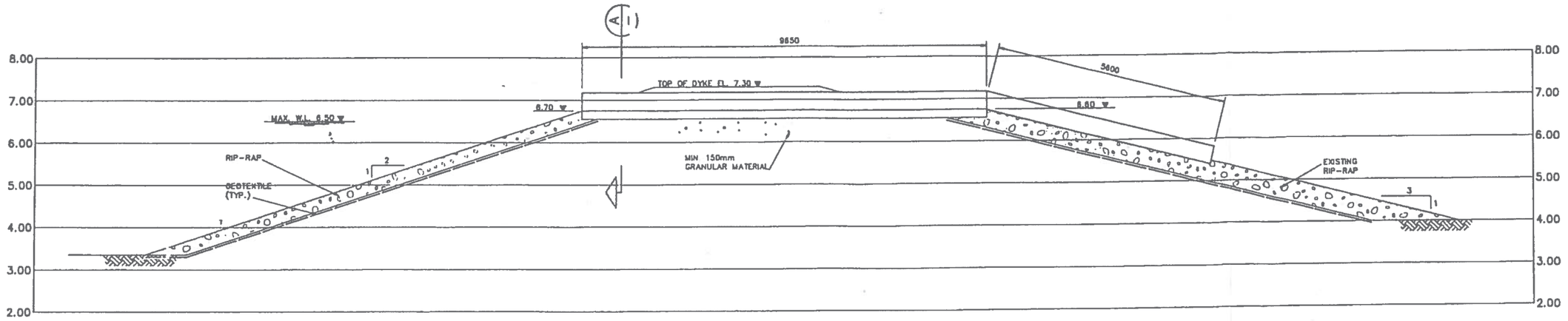
TOWN OF IQALUIT, N.W.T.

LAGOON RECONSTRUCTION AND DRAINAGE IMPROVEMENTS

SECTIONS & DETAILS

CODE | DRAWING | REV



SECTION THROUGH OVERFLOW SPILLWAY

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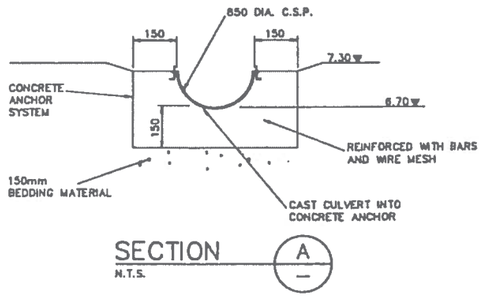

SECTION A — A

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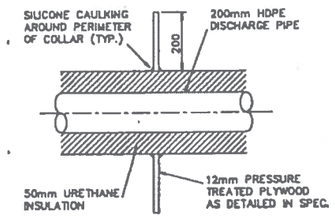

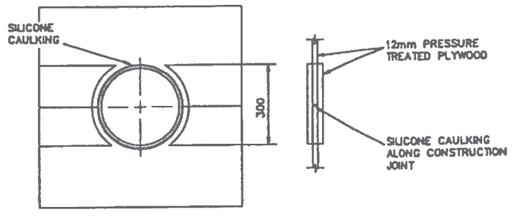

CUTOFF COLLAR DETAIL

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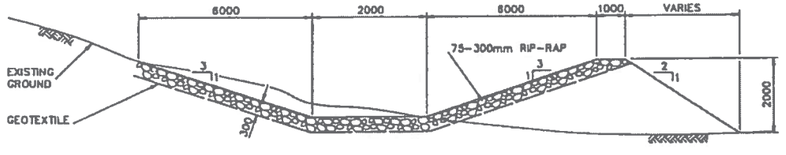

DITCH X-SECTION DETAIL

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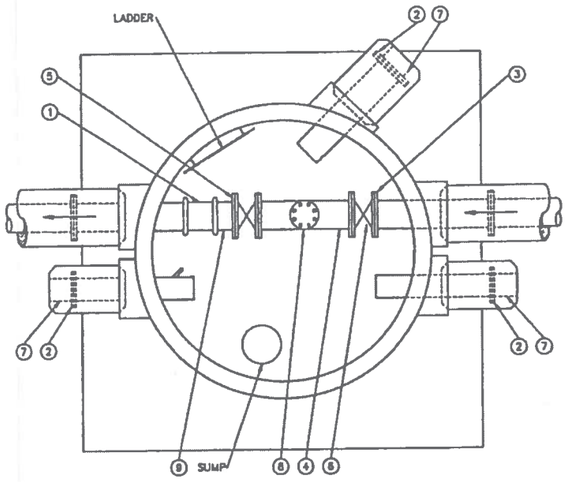


REFERANCE

1. VICTAULIC SPOOL PIECE
2. BLIND FLANGE - GALVANIZED
3. VICTAULIC STYLE #741 FLANGE - GALVANIZED
4. FLANGE SPOOL PIECE - GALVANIZED
5. PINCH VALVE
6. 200 KNIFE GATE VALVE (200 CWP CRANE)
7. MASTIC COATED P.U. INSUL. PLUG
8. TEE WITH BLIND FLANGE
9. FLANGE BY VICTAULIC SPOOL PIECE

CONTROL VAULT

N.T.S.

THE ASSOCIATION OF PROFESSIONAL ENGINEERS GEOLOGISTS AND GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER P 007
UMA ENGINEERING LTD.

2	01	12	10	RECORD DRAWING	ME	KRJ		KRJ	KRJ	
1	01	08	08	FOR CONSTRUCTION	ME	KRJ	JVA	BCG	KRJ	

UMA Engineering Ltd.
Engineers, Planners & Surveyors
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories

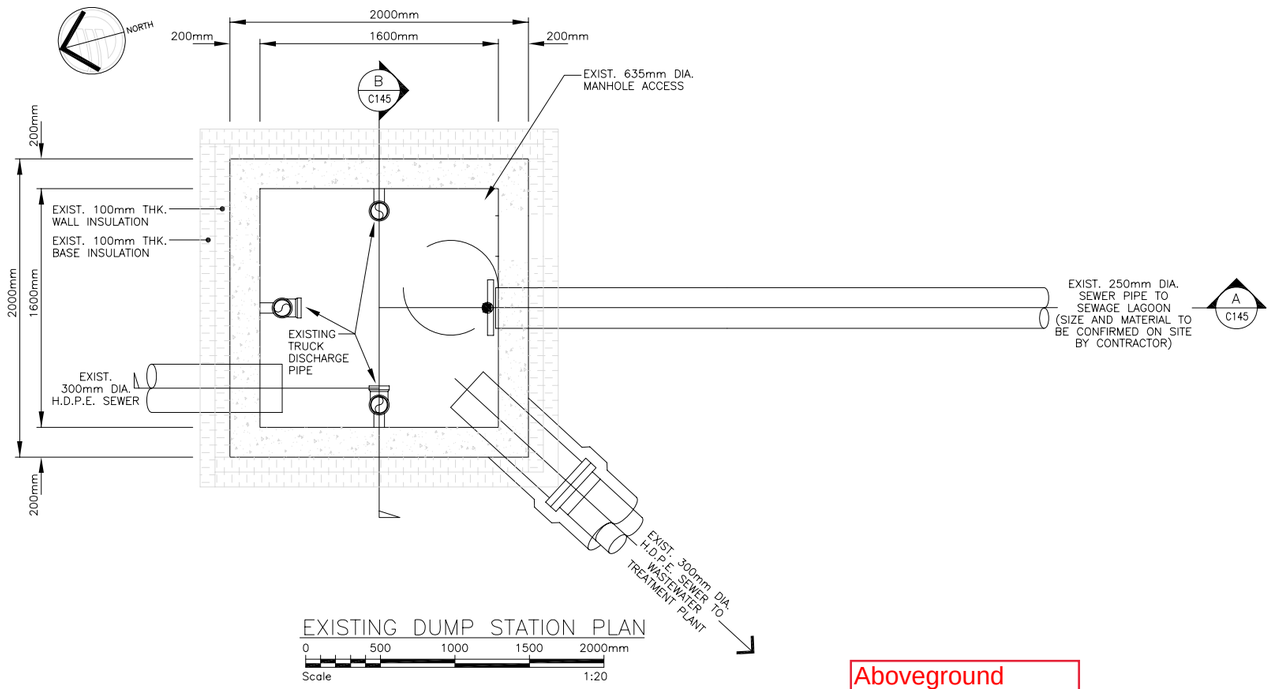
REGISTERED PROFESSIONAL ENGINEER

TOWN OF IQALUIT, N.W.T.

LAGOON RECONSTRUCTION AND DRAINAGE IMPROVEMENTS

SECTIONS AND DETAILS

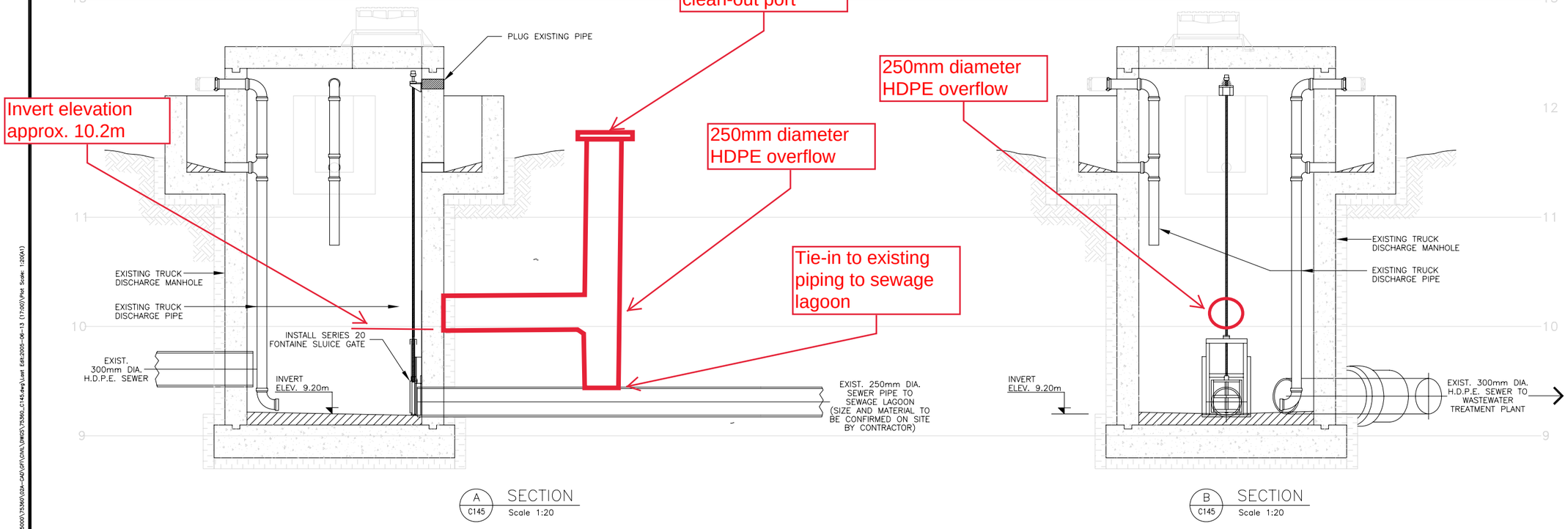
CODE	DRAWING	REV
OD-90-47-A1	103	2



EXISTING DUMP STATION PLAN

0 500 1000 1500 2000mm

Scale 1:20



A C145 SECTION Scale 1:20

B C145 SECTION Scale 1:20

EarthTech
A Tyco International Ltd. Company
17203–103rd Avenue
EDMONTON, ALBERTA
T5S 1J4 CANADA
Tel. 780–488–6800
Fax. 780–488–2121
www.earthtech.ca

No.	Date	Description
2	2006 05/11	RECORD DRAWING
1	2005 6/13	ISSUED FOR CONSTRUCTION
0	2005 3/14	ISSUED FOR TENDER

REVISIONS

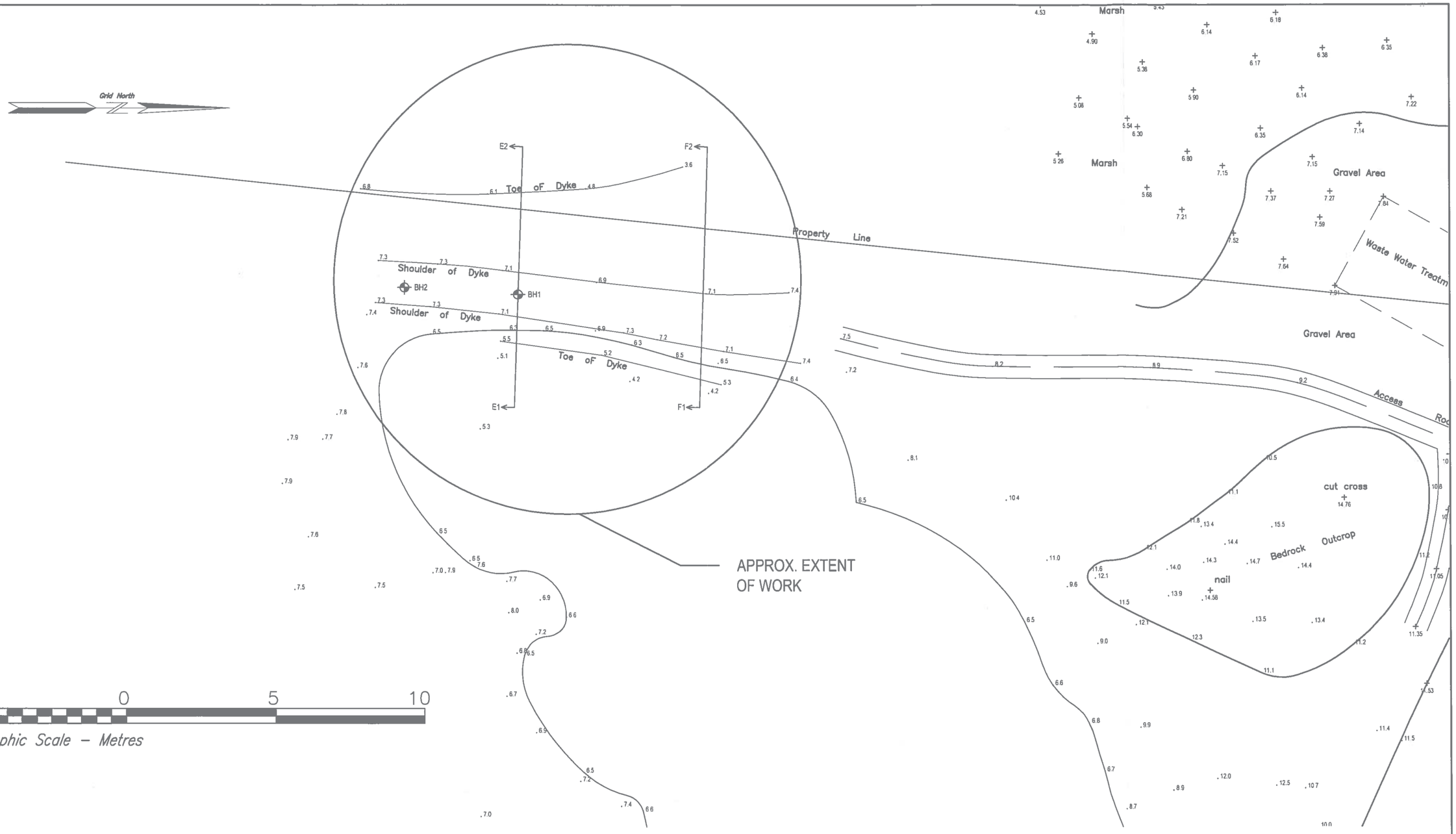
Iqaluit
CITY of IQALUIT,
Nunavut

Design R.H.B./G.A.P.
Drawn R.J.H.
Approved
Checked

Project Title
CITY OF IQALUIT
WASTEWATER
TREATMENT PLANT
PHASE 1

Drawing Title
EXISTING
DUMP STATION
MODIFICATIONS

Scale AS NOTED
Project No. 75360
Date 2005–03–09
Drawing No. C145
Revision 2



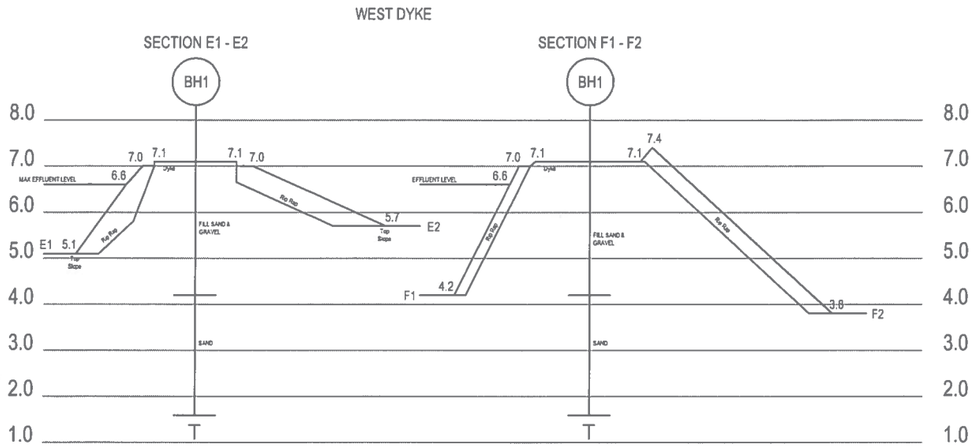
LOCATION OF WORK- LAND SURVEY

SCALE: 3/4"= 1'-0"

NO.	REVISION / ISSUED TO	DATE
3	ISSUED FOR TENDER	JUNE. 22/06
2	ISSUED FOR TENDER	JUNE. 15/06
1	ISSUED FOR CLIENT REVIEW	JUNE. 2/06

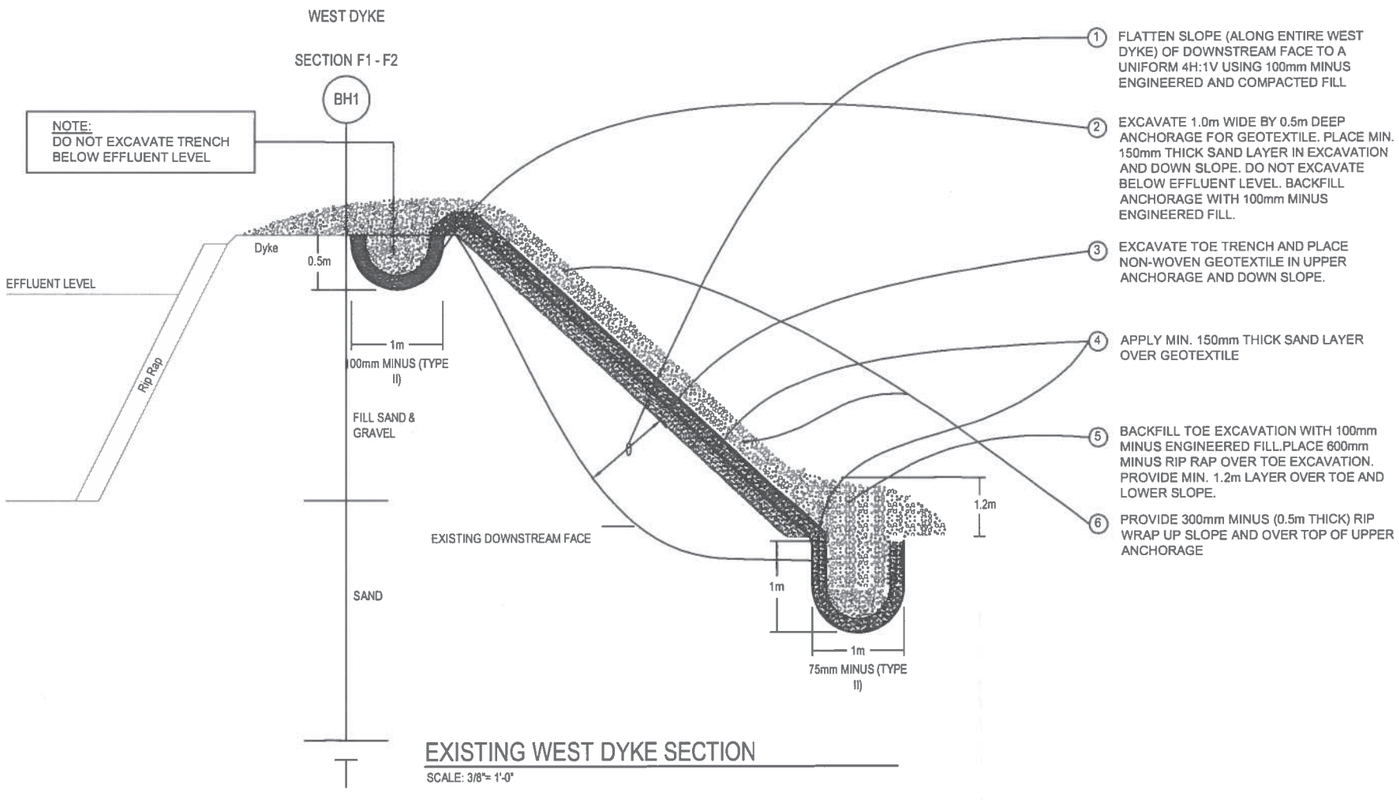
CONCENTRIC ASSOCIATES INTERNATIONAL INC.
700 Richmond St., Suite 104, London, ON. N6A 5C7, Tel. 519 452.7700, Fax 519 452.1712
1420 Blair Place, Suite 104, Ottawa, ON. K1J 9L8, Tel. 613.824.8900, Fax 613.824.8901

OWNER NAME	CITY OF IQALUIT
PROJECT ADDRESS	CITY OF IQALUIT NUNAVUT
DRAWING TITLE	LOCATION OF WORK PROPOSED
PROJECT NAME	SEWAGE LAGOON WEST DYKE UPGRADES
DESIGN	R.A.H.
DRAWN	C.Y.
APPROV	A.D.M.
SCALE	AS NOTED
DATE	OCT/2005
PROJECT NO	05-1292
DWG. NO.	SK1
	1 OF 1



WEST DYKE ELEVATION

SCALE: 3/8"= 1'-0"
*AS PER TROW'S GEOTECHNICAL REPORT (OTGEOOD16794A) DATED OCT 8/2003



EXISTING WEST DYKE SECTION

SCALE: 3/8"= 1'-0"

GENERAL NOTES:

1. BIDDERS/CONTRACTORS SHALL CAREFULLY EXAMINE AND STUDY THE DRAWING AND THE SITE OF THE WORK IN ORDER TO SATISFY THEMSELVES BY EXAMINATION AS TO ALL CONDITIONS AFFECTING THE CONTRACT, THE DETAILED REQUIREMENTS OF THE CONSTRUCTION AND EXTENT OF WORK INVOLVED.
2. ALL BIDDERS/CONTRACTORS SHALL CONFIRM OVERALL DIMENSIONS AND QUANTITY OF WORK AND NOTIFY CONSULTANT OF ANY DISCREPANCIES NOTED. NO CONSIDERATION SHALL BE GIVEN FOR CLAIMS FOR EXTRA COMPENSATIONS BEYOND THAT SHOWN ON THE DRAWINGS.
3. NO CLAIM SHALL BE MADE AT ANY TIME AFTER SUBMISSION OF A QUOTATION THAT THERE WAS ANY MISUNDERSTANDING OF THE TERMS AND CONDITIONS OF THE CONTRACT RELATING TO THE SITE CONDITIONS.
4. OBSERVE AND ENFORCE ALL CONSTRUCTION SAFETY MEASURES REQUIRED BY THE OCCUPATIONAL HEALTH AND SAFETY ACT, WCB, MUNICIPAL REGULATIONS, AND OTHER REGULATIONS GOVERNING CONSTRUCTION WORK. THE MOST STRINGENT REQUIREMENTS WILL APPLY.
5. ANY DAMAGES TO EXISTING SERVICES INCURRED BY THE CONTRACTOR DURING THE WORK SHALL BE REPAIRED AND/OR REPLACED TO THE ENTIRE SATISFACTION OF THE PARTIES CONCERNED AT THE CONTRACTORS EXPENSE.
6. BACKFILL SHALL NOT BE PLACED UNLESS SUBGRADE IS COMPLETELY FREE OF FROST.
7. DO NOT USE ANY MATERIAL WITHOUT APPROVAL FROM THE CONSULTANT.
8. MATERIALS SHALL BE PLACED IN LIFTS BY APPROVED EQUIPMENT, FOR FULL WIDTH OF THE EXCAVATION AS SHOWN ON THE DRAWINGS, AND COMPACTED TO 98% STANDARD PROCTOR DRY DENSITY.
9. MATERIAL SHALL BE MOISTENED OR DRIED AS REQUIRED FOR MAXIMUM DENSITY AND THOROUGHLY COMPACTED BY MECHANICAL VIBRATORS CAPABLE OF PRODUCING REQUIRED COMPACTION.

TECHNICAL NOTES:

1. THE DESIGN DETAILS PRESENTED ARE INTENDED TO PROVIDE ENHANCED EROSION PROTECTION FOR THE DOWNSTREAM FACE OF THE WEST DYKE, AS PER RECOMMENDATIONS MADE IN THE TROW GEOTECHNICAL REPORT (OTGE00D16794A) DATED OCT 8/2003.
2. THE EROSION CONTROL MEASURES ARE CONSIDERED TEMPORARY. LAGOON TO BE INSPECTED ANNUALLY.
3. PREVENTION OF OVERTOPPING OF THE LAGOON IS REQUIRED TO ENSURE CONTINUED SLOPE STABILITY.
   CONTINUIING TO OPERATE THE LAGOON AT MINIMAL LEVELS AND CONTROLLING THE AMOUNT OF DISCHARGE USING THE CONTROL STRUCTURE CAN PREVENT OVERTOPPING.

NO	REVISION / ISSUED TO	DATE
3	ISSUED FOR TENDER	JUNE. 22/06
2	ISSUED FOR TENDER	JUNE. 15/06
1	ISSUED FOR CLIENT REVIEW	JUNE. 2/06

CONCENTRIC ASSOCIATES INTERNATIONAL INC.
700 Richmond St., Suite 104, London, ON. N6A 5C7, Tel. 519 452.7700, Fax 519 452.1712
1420 Blair Place, Suite 104, Ottawa, ON. K1J 9L8, Tel. 613.824.8900, Fax 613.824.8901

CLIENT NAME: CITY OF IQALUIT
PROJECT ADDRESS: CITY OF IQALUIT NUNAVUT
DRAWING TITLE: EXISTING WEST DYKE ELEVATION
PROJECT NAME: SEWAGE LAGOON WEST DYKE UPGRADES

DESIGN	R.A.H.
DRAWN	C.Y
APPROV.	A.D.M.
SCALE	AS NOTED
DATE	OCT/2005
PROJECT NO.	05-1292

DWG. NO. SK2
1 OF 1

Appendix B CURRENT WATER LICENSE

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NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI
OFFICE DES EAUX DU NUNAVUT

File No: **3**AM-IQA1626/
Replacement/Amendment of Expired Licence 3AM-IQA0612

June 17, 2016

By Courier, Email and Regular Mail

Honourable Carolyn Bennett, PC, MP
Minister of Indigenous and North Affairs Canada
21st Floor, 10 Wellington, North Tower
Gatineau, QB, K1A 0H4

Email: Carolyn.bennett@parl.gc.ca; minister@aadnc-aandc.gc.ca

Subject: **Licence No. 3AM-IQA1626 – Licence to Replace and Amend Expired Type "A" Water Licence 3AM-IQA0612 Issued to the City of Iqaluit for a Municipal Undertaking**

Dear Honourable Minister Bennett:

Please find attached a copy of Type "A" Water Licence No. 3AM-IQA1626 (the "Licence"), duly issued by the Nunavut Water Board to the City of Iqaluit (the "City") for a Municipal undertaking in accordance with Schedule 1 of the *Nunavut Waters Regulations*. The Licence replaces the expired Type "A" Water Licence 3AM-IQA0612, which authorizes the City to use Waters and deposit Wastes during the construction, operation, and eventual decommissioning of relevant facilities, infrastructure, and works situated within the municipal boundaries of the City of Iqaluit, in the Qikiqtani Region, Nunavut.

In its decision to issue the Licence and consistent with the *Nunavut Land Claims Agreement* (NLCA), the Board considered the outcome of its review process as well as the determinations made by the Nunavut Planning Commission (NPC) and the Nunavut Impact Review Board (NIRB)

with respect to the undertaking. The NPC in it May 5, 2012 correspondence[1] confirmed that the undertaking proposed by the City was outside the boundaries of the two approved land use plans in place. Further, following the implementation of the *Nunavut Planning and Project Assessment Act* (NuPPAA) on July 9, 2015, the NPC provided confirmation[2] that the proposal for the City of Iqaluit undertaking did not require additional review in accordance with section 235(1) of NuPPAA. The NIRB in its November 2014 Screening Decision Report issued a 12.4.4(a) determination under the Nunavut Land Claims Agreement,[3] indicating that the undertaking proposed by the City may be processed without a review under Article 12, Part 5 or 6 of the NLCA.

In accordance with section 56 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, the above referenced Licence requires your approval and, as such, the NWB submits the attached Reasons for Decision including the Record of Proceedings along with a copy of Licence No. 3AM-IQA1626 for your consideration.

Should you have any questions, require clarification with respect to the above or wish to discuss further, please contact the undersigned in writing at your earliest convenience.

Sincerely,

Norman Mike
Chair, P6 Panel (City of Iqaluit Panel)
Nunavut Water Board

Cc: Qikiqtani Distribution List

Enclosures: Water Licence No. 3AM-IQA1626
Reasons for Decision Including Record of Proceedings

[1] Email from C. Tickner, Nunavut Planning Commission (NPC) to M. Leach (City of Iqaluit) and B. Aglukark, NPC, Re: City of Iqaluit –Water Licence Renewal, May 5, 2012.
[2] Letter from P. Scholz, NPC, to M. Hassan, City of Iqaluit, Re: NWB 3AM IQA0612 – Type "A", Amendment, August 28, 2015.
[3] NIRB, Screening Decision Report, NIRB File No.: 13UN034, November 3, 2014.

NUNAVUT WATER BOARD

TYPE "A" WATER LICENCE NO. 3AM-IQA1626

TABLE OF CONTENTS

Licence No. 3AM-IQA1626

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 the

CITY OF IQALUIT

(Licensee)

P.O. BOX 460 IQALUIT, NU X0A OHO

(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use Water or deposit Waste for a period subject to restrictions and conditions contained within this Licence:

Licence Number / Type:	**3AM-IQA1626 / TYPE "A"**
Water Management Area:	**FROBISHER BAY WATERSHED (53)**
Location:	**WITHIN CITY OF IQALUIT'S MUNICIPAL BOUNDARIES, QIKIQTANI REGION, NUNAVUT**
Classification:	**MUNICIPAL UNDERTAKING**
Purpose:	**USE OF WATERS AND DEPOSIT OF WASTE**
Quantity of Water not to be Exceeded:	**1,100,000 CUBIC METRES ANNUALLY**
Date Licence Issuance:	**JUNE 17, 2016**
Expiry of Licence:	**JUNE 16, 2026**

This Licence issued **(Motion Number: 2016-02-P6-14)** and recorded at Goji Haven, Nunavut, includes and is subject to the annexed conditions.

Norman Mike
Nunavut Water Board,
Hearing Chair

APPROVED BY: Minister of Indigenous and Northern Affairs Canada

APPROVAL DATE:

PART A: **SCOPE, DEFINITIONS, AND ENFORCEMENT**

1. SCOPE

a. This Type "A" Water Licence No. 3AM-IQA1626 ("Replacement and Amended Licence" or "Licence") authorizes the City of Iqaluit ("Licensee" or the "City") to use Water and deposit Waste in support of a Municipal undertaking, as classified under Schedule 1 of the *Regulations*, within the City's municipal boundaries at the following approximate geographic coordinates:

Undertaking	Latitude	Longitude
Overall Extents	63° 50' 56.31" N	68° 39' 49.87" W
	63° 50' 57.30" N	68° 33' 41.94" W
	63° 43' 48.91" N	68° 18' 12.53" W
	63° 41' 06.60" N	68° 18' 18.82" W
	63° 41' 04.08" N	68° 32' 44.20" W
	63° 44' 46.02" N	68° 39' 43.1 0" W
West 40 Landfill	63° 43' 58.15" N	68° 32' 08.54" W
Water Treatment Plant	63° 45' 12.24" N	68° 30' 22.79" W
Wastewater Treatment Plant	63° 44' 45.15" N	68° 32' 19.80" W

The scope of activities, works, and undertakings authorized in accordance with the terms and conditions of this Replacement and Amended Licence is as follows:

a. Use, management, and protection of the Lake Geraldine drainage basin;
b. Management and protection of Waters surrounding the West 40 Landfill site;
c. Management, collection, and monitoring of leachate from the West 40 Landfill site and adjacent Sludge Management Facility;
d. Management of improved drainage works at the West 40 Landfill site;
e. Management, operation, and eventual closure and reclamation of the current West 40 Landfill site and associated solid waste disposal facilities;
f. Upgrades, operation, maintenance, monitoring, and eventual closure and reclamation of a Wastewater Treatment Plant (WWTP);
g. Operation, maintenance, monitoring, and eventual closure and reclamation of a Sludge Management Facility;
h. Operation, maintenance, monitoring and eventual closure and reclamation of a Sewage Lagoon Facility;
i. Implementation of contingency measures for the Wastewater and Landfill management facilities; and
j. Implementation of changes to the monitoring requirements including frequency, parameters, and stations being monitored.

b. This Licence is issued subject to conditions contained herein with respect to the taking of Waters 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 Act, or other statutes imposing more stringent conditions relating to the quantity, type or manner under which any such Waste may be so deposited, this Licence shall be deemed to be subject to such requirements; and

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from the responsibility for compliance with all applicable legislation, guidelines, and directives.

2. DEFINITIONS

a. The Licensee shall refer to Schedule A for definitions of terms used in this Licence.

3. ENFORCEMENT

a. Failure to comply with this Licence shall be a violation of the Act, subjecting the Licensee to the enforcement measures and the penalties provided for in the Act.

b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the Act.

c. For the purpose of enforcing the terms and conditions of this Licence with respect to the use of Water and deposit or Discharge of Waste in Waters, Inspectors appointed under the Act, hold all powers, privileges, and protections that are conferred upon them by the Act or by other applicable laws.

PART B: GENERAL CONDITIONS

1. The Licensee shall file, with the Board for review, no later than the 31st of March of the year following the calendar year being reported, an Annual Report formulated in accordance with the requirements under Schedule B of this Licence.

2. The Licensee shall maintain a copy of this Licence at the Municipal Office, potable Water Treatment Facility, and the Waste Treatment Facilities at all times.

3. The Licensee shall file an application for renewal of this Licence at least one (1) year prior to the Licence expiry.

4. The Licensee shall, to the satisfaction of an Inspector, install, operate, and maintain metres, devices or other appropriate methods for measuring the volumes of Water used and Waste Discharged or deposited.

5. The Licensee shall post the necessary signs to identify the stations of the Monitoring Program included under Schedule I of this Licence. All signage shall be in the Official Languages of Nunavut.

6. The Licensee shall, for all Plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted cannot be undertaken without subsequent written approval and/or directions from the Board. The Board may alter or modify a Plan if necessary to achieve legislative objectives and will notify the Licensee in writing of acceptance, rejection, or alteration of the Plan.

7. The Licensee shall, for all Plans submitted under this Licence, implement the Plan as approved by the Board in writing.

8. The Licensee shall, within thirty (30) days of notification or within the timeframe specified by the Board, submit for review and/or Board's approval revisions for any plan found to be unacceptable to the Board.

9. Every Plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of the Licence, and any additional terms and conditions imposed upon approval of a Plan by the Board shall also become part of the Licence. All relevant terms and conditions of the Licence should be contemplated in the development of a Plan where appropriate.

10. The Licensee shall review the Plans referred to in this Licence as required by changes in operation and/or technology and modify the Plans accordingly. Revisions to any Plan shall be submitted in the form of an addendum to be included within the Annual Report required under Part B, Item 1, complete with the lists of revisions detailing where significant content changes are made.

11. The Licensee shall immediately report to the NWT/NU 24-Hour Spill Report Line (867-920-8130) any spills of Waste associated with the Undertakings under this Licence including the potable Water Treatment Facility and Waste Treatment Facilities, which are reported to or observed by the Licensee.

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

Manager of Licensing
Nunavut Water Board
P. O. Box 119
Goji Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: licensing@nwb-oen.ca

13. Any notice made to an Inspector shall be made in writing to the attention of:

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4295
Fax: (867) 979-6445

14. The Licensee shall submit, to the Board for information or as otherwise directed, one (1) paper copy and one (1) electronic copy of all reports, studies, and Plans generated for the works, activities, and undertakings under this Licence. All Reports, studies or Plans submitted to the Board by the Licensee shall include an executive summary in English, Inuktitut, and French.

15. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the Board is received by the Board and maintain on file a copy of the acknowledgment of receipt issued by the Manager of Licensing or his/her designate.

16. This Licence is assignable as provided for in section 44 of the Act.

17. The expiry or cancellation of this Licence does not relieve the Licensee from any obligation imposed by the Licence, or any other regulatory requirement.

PART C: CONDITIONS APPLYING TO SECURITY

1. The Licensee is not required to post reclamation security for the activities, works, and undertakings authorized under this Licence.

PART D: CONDITIONS APPLYING TO THE USE OF WATERS AND WATER MANAGEMENT PLANS

1. The Licensee is authorized to withdraw, from the Lake Geraldine Reservoir at Monitoring Station No. IQA-01, up to 1,100,000 cubic metres of Water annually for the relevant activities, works, and undertakings authorized under the scope of this Licence.

2. The Licensee shall submit to the Board for approval, within sixty (60) days of the Effective Date of the Licence, an updated manual for the potable Water Treatment Facility. The Manual shall be prepared in accordance with relevant aspects of the format outlined in the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (GNWT, 1996). The manual shall, address among other items, the following:

    a. Purpose of facility;
    b. Site setting;

c. Operational procedures for storage, treatment and distribution of potable Water; Waste generated and hazardous substances associated with the facility; site inspections; and personnel training;
d. Maintenance procedures including equipment servicing;
e. Sampling and monitoring requirements; and
f. Emergency response measures.

3. The Licensee shall equip all freshwater intake structures with screens of appropriate mesh size that meet the requirements of Fisheries and Oceans (DFO) Canada's *Freshwater Intake End-of-Pipe Fish Screen Guidelines* (1995 or the most current) so as to prevent the entrainment of fish and control Water withdrawal rates such that fish do not become impinged within the screens.

4. The Licensee shall undertake Dam Safety Inspections (DSI) and/or Dam Safety Reviews (DSR) of the Lake Geraldine water supply facility in accordance with requirements of the Canadian Dam Association (CDA), *Dam Safety Guidelines* (2007, or the most current version). The Licensee shall submit for the Board's review, within the Annual Report required under Part B, Item 1, the report generated for the DSIs or DSRs along with the Licensee's recommended actions to address any deficiencies identified in the inspections and/or reviews.

5. The Licensee shall not remove any material from below the ordinary High Water Mark of any Water body unless otherwise approved by the Board in writing.

6. The Licensee shall not cause erosion to the banks of any body of Water and shall provide the necessary controls to prevent such erosion.

7. The Licensee shall implement necessary measures to control sediment and erosion prior to and during operations to prevent entry of sediments into Water.

8. The Licensee shall maintain the potable Water Treatment Facility in accordance with applicable guidelines, procedures, and regulations and to the satisfaction of an Inspector.

9. The Licensee shall, as part of any proposal to supplement the Lake Geraldine Reservoir, evaluate the potential impact on freshwater resources, including fish and fish habitat. The results of the evaluation must be included as part of any application to augment the Lake Geraldine Reservoir with Water from proximal water bodies.

PART E: CONDITIONS APPLYING TO THE DEPOSIT OF WASTE AND WASTE MANAGEMENT PLANS

1. The Licensee is authorized to use the Sewage Lagoon Facility and the Wastewater Treatment Plant to treat and dispose of Wastewater generated by the Undertaking authorized under this Licence until such time that the Upgraded Wastewater Treatment Plant authorized by the

Licensee is constructed and commissioned, or as otherwise approved by the Board in writing.

2. The Licensee shall provide written notice to an Inspector and the Board at least ten (10) days prior to any planned Discharges from the Solid Waste Facility, Sewage Lagoon Facility, Wastewater Treatment Plant, and the Upgraded Wastewater Treatment Plant once commissioned.

3. The Licensee shall establish the relevant monitoring stations for the facilities authorized under this Licence in accordance with Schedule I.

4. The Licensee shall ensure that Surface Drainage or surface Water runoff associated with site activities or generated during the construction of any facility designed to withhold, divert, or retain Water or Waste, does not exceed the following Effluent criteria:

Parameter	Maximum Average Concentration	Maximum concentration of Any Grab Sample
Total Suspended Solids (TSS)	50.0 mg/L	100.0 mg/L
pH	Between 6 and 9.	

5. Upon commissioning of the Upgraded Wastewater Treatment Plant, the Sewage Lagoon Facility shall be used as a back-up facility or closed and reclaimed in accordance in Part J, Item 4.

6. The Licensee shall submit to the Board for approval in writing, within four (4) months of the Effective Date of the Licence, an Operation and Maintenance Manual for the Sewage Lagoon Facility that addresses requirements for both the Sewage Lagoon and Sludge Management Facilities. The manual shall be prepared in accordance with the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (GNWT, 1996).

7. The Licence shall submit to the Board for approval in writing, by December 21, 2018 or as otherwise directed by the Board in writing, an Operations and Maintenance Manual for the Upgraded Wastewater Treatment Plant that incorporates the requirements of Part E, Item 6. The manual shall be prepared in accordance with the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (GNWT, 1996).

8. The manual referred to in Part E, Item 7 shall supersede the manual referenced in Part E, Item 6, following approval by the Board in writing.

9. The Licensee shall submit to the Board for approval in writing, by December 31, 2018, an updated version of the plan entitled *City of Iqaluit Solid Waste Management Plan*, dated January 2014 that addresses relevant intervener's comments and recommendations made during the licensing process, such as inclusion of details related to future uses of the landfill, timeframe for closure, and ongoing activities within the scope of this Licence.

10. The Licensee shall undertake Dam Safety Inspections (DSI) and/or Dam Safety Reviews (DSR) of the Wastewater Treatment Facilities in accordance with requirements of the Canadian Dam Association (CDA), *Dam Safety Guidelines* (2007, or most current version). The Licensee shall submit for the Board's review, within the Annual Report required under Part B, Item 1, the report generated for the DSIs or DSRs along with the Licensee's recommended actions to address any deficiencies identified in the inspections and/or reviews.

11. The Licensee shall dispose of and contain all municipal solid waste generated by the City at the West 40 Landfill as associated site(s) authorized under this licence or as otherwise approved by the Board in writing.

12. The Licensee shall submit to the Board for approval, within sixty (60) days of the Effective Date of the Licence, an updated Landfill Operation and Maintenance Manual that addresses concerns raised by intervening parties during the licensing process including the following:

    a. Management of Leachate from the facility;
    b. Updated sampling and monitoring requirements; and
    c. Open burning practices.
    d. Ongoing activities within

13. The Licensee shall collect and contain all leachate generated by the West 40 Landfill within the Landfill.

14. The Licensee shall submit to the Board for review, by December 31, 2017, an updated version of the document entitled *West 40 Landfill Drainage Management Review*, dated September 16, 2011, that addresses the concerns raised by intervening parties including information on the absence of permafrost related data.

15. The Inspector may authorize an emergency Discharge ,following the Licensee's written submission to the Inspector and to the Board, at least fifteen (15) days prior to discharge or as instructed by the Inspector, that includes the following information:

    a. Proposed quantity of discharge;
    b. Reason for discharge;
    c. Identification of the Final Discharge Location;
    d. Proposed sampling and analysis to be conducted; and
    e. Proposed mitigation measures to implemented.

16. The Licensee shall submit to the Board and the Inspector for review, within sixty (60) days following any emergency Discharge authorized by the Inspector, a report that includes, among other items, an analysis of results for the emergency Discharge.

17. The Licensee shall maintain the Licensed Facilities to the satisfaction of an Inspector.

18. The Licensee shall remove from the site associated with the undertaking, all Hazardous Wastes, waste oil and non-combustible waste generated through the course of the operation, for disposal at a licensed waste disposal facility.

19. The Licensee shall maintain records of all Waste removed from site and records of confirmation of proper disposal of removed Waste. These records shall be made available to an Inspector or the Board upon request.

PART F: CONDITIONS APPLYING TO CONSTRUCTION

1. The Licensee shall, submit to the Board for review, within thirty (30) days prior to commencing construction of any facilities or infrastructure authorized under this Licence, for-construction designs and drawings, signed and stamped by an Engineer.

2. The Licensee shall ensure that all relevant approved facilities are designed and constructed to engineering standards such that, at a minimum, they comply with the most current version of the *Canadian Dam Safety Guidelines*.

3. The Licensee shall implement measures to ensure that all materials used in the construction of relevant facilities or infrastructure included under the scope of this Licence are free of contaminants, to the extent that they do not cause harmful or significant effects to Water.

4. The Licensee shall maintain shoreline stability during construction.

5. The Licensee shall ensure that all final designs and drawings are qualified by an Engineer confirming that:

    a. Works are designed under sound engineering principles;
    b. Design limitations are understood and communicated within the report; and
    c. Measures are implemented to minimize impact to Water.

6. The Licensee shall, submit to the Board for review, within ninety (90) days of completion of any structure authorized under this licence, to contain, withhold, divert or retain Water or Wastes; a construction summary report prepared by an Engineer that includes, among other relevant information, as-built drawings, documentation of field decisions that deviated from original plans, and any data used to support these decisions.

7. The Licensee shall, if contamination of surface and/or ground water is encountered during construction and excavation, notify the Inspector immediately and implement the Spill Contingency Plan.

8. The Licensee shall develop and implement measures necessary to prevent and mitigate erosion and/or the release of sediment into Water during the construction of the Upgraded Wastewater Treatment Plant or during any construction activities associated with the Undertaking.

PART G: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written consent from the Board, carry out Modifications to the potable Water Treatment Facility and Waste Treatment Facilities provided that such Modifications are consistent with the terms of this Licence and the following requirements are met:

    a. the Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications;
    b. Such Modifications are consistent with the NPC Land Use Planning (NPC) Conformity Determination and the NIRB Screening Decision;
    c. such Modifications do not place the Licensee in contravention of the Licence or the *Act*;
    d. 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
    e. The Board has not rejected the proposed Modifications.

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

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

PART H: CONDITIONS APPLYING TO SPILL CONTINGENCY PLANNING

1. The Licensee shall, submit to the Board for approval in writing, within thirty (30) days of the Effective Date of this Licence, an amalgamated and updated Spill Contingency Plan. The Plan shall address spill contingency planning requirements for all relevant aspects of works, activities, and undertakings associated with the scope of this Licence including the Sewage Lift Station.

2. The Licensee shall, subject to section 16 of the Regulations, report any unauthorized deposits of Waste or foreseeable unauthorized deposits of waste and/or Discharges of Effluent, and:

    a Employ, as required, the approved Spill Contingency Plan;
    b Report the incident immediately via the NWT/NU 24-Hour Spill Reporting Line (867) 920-8130 and to the Inspector at (867) 975-4295; and
    c For each spill occurrence, submit a detailed report to the Inspector, no later than thirty (30) days after initially reporting the event. The report shall include the amount and

type of spilled product, the GPS location of the spill, and the measures taken to contain, clean up and restore the spill site.

3. The Licensee shall, in addition to Part H, Item 2, regardless of the quantity of release of a harmful substance, report to the NWT/NU Spill Line if the release is near or into a Water body.

PART I: CONDITIONS APPLYING TO MONITORING

1. The Licensee shall monitor the relevant potable Water Treatment Facility and Waste Treatment Facilities authorized under this Licence in accordance with requirements included under Schedule I.

2. The Licensee shall, submit Board for approval in writing, within sixty (60) days of the Effective Date of this Licence, an updated Monitoring Program that addresses monitoring requirements for the Water Treatment Facility and Waste Treatment Facilities. The Monitoring Program shall address, among other items, the requirements outlined in Schedule I.

3. All analyses required under Schedule I shall be conducted using methods as described in the most recent edition of "*Standard Methods for the Examination of Water and Wastewater*", or by such other methods as approved by the Board in writing.

4. All laboratory analyses shall be performed at a laboratory accredited according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.

5. The Licensee shall, submit to the Board for review, within sixty (60) days of the Effective Date of the Licence, an updated Quality Assurance/Quality Control (QA/QC) Plan prepared in accordance with *Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan* (INAC, 1996 or most current version). The updated plan shall be accompanied by a letter from an Analyst of an accredited laboratory confirming acceptability of the Plan.

6. The Licensee shall measure by instrument and record in cubic metres, the monthly quantities of freshwater extracted from the Lake Geraldine Reservoir, at Monitoring Program Station No. IQA-01, used for all purposes under this Licence.

7. The Licensee shall measure, by instrument and record in cubic metres, the quantities of Effluent released from the Sewage Lagoon Facility at Monitoring Station No. IQA-02, Wastewater Treatment Plant and/or Upgraded Wastewater Treatment Plant at Monitoring Station No. IQA-04 and the West 40 Landfill at Monitoring Station No. IQA-08.

8. The Licensee shall measure and record in cubic metres, the monthly and annual volumes of sludge removed from the Wastewater Treatment Facilities.

9. The Licensee shall provide the GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of all locations of sources of Water utilized and Waste deposited under this Licence.

10. The Licensee shall include all of the data and information required by the Monitoring Program under Schedule I within the Annual Report required under Part B, Item 1 of the Licence or as otherwise requested by an Inspector and/or the Board.

11. Additional Monitoring may be requested by the Board and/or the Inspector.

12. The Monitoring Program and compliance dates specified in the Licence may be modified at the discretion of the Board in writing and do not constitute an application for Amendment as defined in the *Act.*

PART J: CONDITIONS APPLYING TO CLOSURE AND RECLAMATION

1. The Board has accepted the document entitled *Iqaluit Solid Waste Management Plan West 40 Landfill Decommissioning Technical Memorandum*, dated January 2014, submitted as additional information with the Application.

2. The Licensee shall submit to the Board for approval in writing, at least one (1) year prior to commencing the decommissioning of the West 40 Landfill, a Final Closure and Reclamation Plan prepared by an Engineer in accordance with industry's best practices and relevant guidelines.

3. The Licensee shall, for the Plan required under Part J, Item 2, include a presentation of data and a discussion of environmental conditions existing before the use of the site by the Licensee as a municipal landfill, as well as remediation objectives.

4. The Licensee shall notify the Board in writing, at least one year prior to the implementation of final closure, of its intentions to proceed with final closure of any Water use or Waste disposal facilities included within the scope of this Licence, excluding the Facility under Part J, Item 2.

SCHEDULES

Schedule A: Definitions

In this Licence, 3AM-IQA1626:

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

"**Addendum**" means the supplemental text that is added to a full plan, manual, or report, usually included at the end of the document and is not intended to require a full resubmission of the revised report. It may also be considered as an appendix or supplement;

"**Amendment**" means a change to any terms and conditions of this Licence through application to the NWB, requiring a change, addition, or deletion of specific terms and conditions of the Licence not considered as a modification;

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

"**Annually**" means, in the context of monitoring frequency, one sampling event occurring every 365 days with a minimum of 200 days between sampling events;

"**Application**" means, for the purposes of this License, the totality of the NWB Public Register opened as a result of the filing of the application to replace and amend expired Water Licence 3AM-IQA0611(3AM-IQA0612);

"**Biannually**" means, in the context of the monitoring frequency, two sampling events occurring per calendar year, with a minimum of 150 days and a maximum of 210 days between sampling events;

"**Board**" means the Nunavut Water Board established under Article 13 of the *Nunavut Land Claims Agreement* and under section 14 of the Act;

"**Discharge**" means the release of any Water or Waste to the receiving environment;

"**Effective Date**" means the date on which the Minister of Indigenous and Northern Affairs Canada approves the Licence;

"**Effluent**" means treated or untreated liquid Waste material that is Discharged into the environment from the site water management facilities such as a settling pond or a treatment plant;

"**Engineer**" means a professional engineer registered to practice in Nunavut in accordance with the *Consolidation of Engineers and Geoscientists Act S. Nu 2008, c.2* and the *Engineering and Geoscience Professions Act S.N.W.T. 2006, c.16 Amended by S.N.W.T. 2009, c.12*;

"**Engineered Structure**" means any facility, designed and approved by a Professional Engineer who is registered with the Association of Professional Engineers, Geologists and Geophysicists of Nunavut;

"**Grab Sample**" means an undiluted quantity of material collected at a particular time and place that may be representative of the total substance being sampled at the time and place it was collected;

"**Greywater**" means the component of Effluent produced from domestic use (i.e. washing, bathing, food preparation and laundering), excluding Sewage;

"**Hazardous Waste**" means materials or contaminants categorized as dangerous goods under the *Transportation of Dangerous Good Act* (1992), no longer used for their original purpose and intended for recycling, treatment, disposal or storage at appropriate facilities;

"**High Water Mark**" means the usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land (ref. *Department of Fisheries and Oceans Canada, Operational Statement: Mineral Exploration Activities*);

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

"**Licence**" means this Type "A" Water Licence No. 3AM-IQA1626, issued by the Nunavut Water Board to the City of Iqaluit in accordance with the Act;

"**Licensee**" means the entity to whom Licence No. 3AM-IQA1626 is issued or assigned;

"**Minister**" means the Minister of Indigenous and Northern Affairs Canada (INAC);

"**Modification**" means an alteration to a physical work that may introduce a new structure or eliminates an existing structure and does not alter the purpose or function of the work;

"**Monitoring Program**" means the program to collect data on surface water and groundwater quality to assess impacts to the environment of an appurtenant undertaking;

"**Monthly**" means, in the context of monitoring frequency, one sampling event occurring within calendar month with a minimum of twenty-one (21) days between sampling events;

"**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;

"**Quality Assurance / Quality Control (QA/QC)**" Quality Assurance means the system of activities designed to better ensure that quality control is done effectively; Quality Control means the use of established procedures to achieve standards of measurement for the three principle components of quality: precision, accuracy and reliability;

"**Quarterly**" means divisions of the calendar year, comprised of three month intervals from January to December, inclusive (January – March, April – June, July – September and October – December);

"**Regulations**" means the *Nunavut Waters Regulations* (SOR/2013/669 18th April, 2013);

"**Sewage**" means all toilet wastes and greywater;

"**Sewage Lagoon Facility**" refers to the waste disposal facility and associated structures designed and constructed to treat Sewage in the City of Iqaluit since 1978, which has also been upgraded in subsequent years;

"**Sludge Management Facility**" means the facility located within the West 40 Landfill that is used for the disposal and treatment of sludge generated by the Wastewater Treatment Plant;

"Solid Waste Facility" means the West 40 Landfill, Sludge Management Facility and all other facilities identified in the Application that are designed and constructed to manage solid waste generated by the City of Iqaluit;

"Surface Drainage" means all surface waters resulting from the flow over, through or out of an operations area and is collected by means of Engineered structures;

"**Undertaking or Undertakings**" means an undertaking or undertakings in respect of which Water is to be used or Waste is to be deposited, as classified in Schedule 1 of the *Regulations*;

"**Upgraded Wastewater Treatment Plant (UWWTP)**" means the current Wastewater Treatment Plant, which was designed, constructed, and commissioned under Phase 1, for the preliminary treatment of Wastewater, in addition to the infrastructure scheduled for construction and commissioning by December 2018, under Phase 2, for the secondary treatment of Wastewater as described in the Application;

"**Use**" means use as defined in section 4 of the Act;

"**Waste**" means Water as defined in section 4 of the Act;

"**Waste Treatment Facilities**" refers to all facilities constructed and operated by the City of Iqaluit to manage solid and liquid Waste associated with this licence.

"**Wastewater**" means the water generated by site activities or originates on-site that requires treatment or any other water management activity;

"**Wastewater Treatment Facilities**" means the Sewage Lagoon, Wastewater Treatment Plant, Upgraded Wastewater Treatment Plant and associated facilities authorized under this Licence;

"**Wastewater Treatment Plant**" means the engineered system, located adjacent to the Sewage Lagoon Facility that is designed for the containment and preliminary treatment of Sewage generated by the City of Iqaluit as described in the Application;

"**Water or Waters**" means water as defined in section 4 of the *Act*;

"**Water Treatment Facility**" means the engineered facilities and appurtenances designed and constructed for the withdrawal storage treatment and distribution of fresh water for domestic purposes, described in the Application; and

"**West 40 Landfill**" means the Solid Waste Facility or original landfill facility along with its Northern Expansion and Sludge Management Facility that is designed to manage solid waste generated by the City of Iqaluit.

Schedule B: Annual Reporting Requirements

The Annual Report referred to in Part B, Item 1, shall include the following:

a. The monthly and annual quantities in cubic metres of fresh Water withdrawn from the Lake Geraldine Reservoir at Monitoring Station No. IQA-01;
b. The monthly and annual quantities in cubic metres of any Discharges from the Wastewater Treatment Facilities at Monitoring Stations IQA-02, IQA-04, and IQA-08;
c. Copy of reports generated from Dam Safety Inspections and Dam Safety Reviews along with the Licensee's proposed actions to address issues identified and/or updates on continuing actions to address issues;
d. The monthly and annual quantities in cubic metres of sludge removed from the Wastewater Treatment Facilities;
e. The monthly and annual quantities of Wastes disposed of at the West 40 landfill;
f. A summary report which includes all data and information generated under the Monitoring Program, including the QA/QC program, in electronic and printed formats acceptable to the Board;
g. A summary of all construction activities carried out for facilities under the Licence;
h. A summary of modifications and/or major maintenance work carried out on the potable Water Treatment and Waste Treatment Facilities, including all associated structures;
i. A progress report and revisions (if applicable) to any studies requested by the Board that relate to Waste management, Water use or reclamation and a brief description of any future studies planned by the Licensee including, a non-technical executive summary for the general public, translated into Inuktitut;
j. Any revisions required, in the form of addenda, to Plans, Manuals and Reports approved under the Licence;
k. A list and description, including volumes and Spill Report Line Identification Number, of all un-authorized Discharges, spills and summaries of follow-up action taken;
l. A summary of any closure and reclamation work undertaken and an outline of any work anticipated for the next year, including any changes to implementation and scheduling;
m. A summary of actions taken to address concerns or deficiencies listed in the inspection reports and/or compliance reports filed by an Inspector;
n. A brief update on the implementation plan of all facilities within the scope of this Licence including changes projected implementation and status of the Upgraded Wastewater Treatment Plant;
o. A summary of any studies, reports and plans requested by the Board that relate to Waste disposal, Water use or reclamation and a brief description of any future studies planned; and
p. Any other details on the use of Water or Waste disposal requested by the Board by November 1st of the year being reported.

Schedule I: Condition Applying to Monitoring

Table 1 – Water Quality Parameters		
Test Groups	**Analytical Parameters**	**Units**
Routine (R)	Alkalinity, Acidity, Chloride, Carbonate, Bicarbonate, Total Hardness, Hydroxide, Sulphate, Total Suspended Solids (TSS), Total Dissolved Solids (TDS**),** Total Organic Carbon (TOC), Total Inorganic Carbon (TIC)	mg/L
	pH (field and lab)	pH units
	Oxidation-Reduction Potential (ORP) (field)	mV
	Conductivity (field and lab)	uS/cm
	Temperature (field)	^{o}C
	Turbidity	NTU
Effluent (E)	Total Suspended Solids (TSS)	mg/L
	Temperature (field)	^{o}C
	Conductivity (field and lab)	uS/cm
	pH (field and lab)	pH units
Acute Lethality (AL)	Based on Environment Canada's *Procedure for pH Stabilization During the Testing of Acute Lethality of Wastewater Effluent to Rainbow Trout* (EPS 1/RM/50, March 2008), if single concentration test fails and un-ionized ammonia concentration is less than or equal to 1.25 mg/|L	"Pass" / "Fail"
ICP- Metals Scan (Total)	Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Sn, Ag, Sr, Tl, Ti, U, V, Zn, Hg	mg/L
Nutrients (N)	Ammonia-N, Nitrate-N, Nitrite-N	mg N/L
	Total Phosphorus, Orthophosphate	mg/L
Biological (B)	Biochemical Oxygen Demand	mg/L
	Total and Fecal Coliform	CFU/100 mL
Potable Water (PW)	Fecal Coliform	CFU/100 mL
	ICP Metals (Total and dissolved)	mg/L
	Total Suspended Solids –TSS	mg/L
Flow (F)	Volume	m^3
Landfill Specific (LS)	Polychlorinated Biphenyls (PCBs) Benzene, Toluene, Ethylbenzene and Xylene (BTEX)	mg/L

Table 2[1] - Water Quality Monitoring Criteria

Station ID	Description	Status	Parameter	Testing / Measurement Frequency	Reporting Frequency
IQA-01	Lake Geraldine Reservoir – Raw Water	Active	R, PW	Monthly	Biannually
			F	Monthly	
IQA-01(#)	Based on Part I, Item 4 of Expired Licence	Inactive	N/A	N/A	N/A
IQA-02	Sewage Lagoon – Effluent Discharge Point	Active	B, N, E, ICP	Once prior to discharge; once during discharge; and once prior to the completion of discharge	Annually
			F	During decant	
IQA-03	Sewage Lagoon – Influent	Inactive	N/A	N/A	N/A
IQA-04	Wastewater Treatment Plant - Effluent	Active	B, N, E, ICP	Quarterly – Prior to commissioning of the WWTP	Annually
			B, N, E, ICP	Monthly – Following commissioning of the WWTP	
			AL	Annually – following commissioning of the WWTP	
			F	During Discharge	
IQA-05	Wastewater Treatment Plant - Influent	Active	B, E, N, ICP	Biannually – Prior to commissioning of the WWTP	Annually
				No testing requirements following commissioning of the WWTP	N/A
IQA-06	Sludge – From WWTP	Active	B, E, N, ICP	Quarterly	Annually
IQA-07	Surface Water entering West 40 Landfill – Based on Part E, Item 4 of the Expired Licence	Inactive	N/A	N/A	N/A

Station ID	Description	Status	Parameter	Testing / Measurement Frequency	Reporting Frequency
IQA-08	West 40 Landfill – Effluent Discharge Point, Based on Part E, Item 4 of the Expired Licence	Active	B, E, N, ICP, F, LS	Once prior to discharge; once during discharge; and once prior to the completion of discharge	Annually
			F	During Discharge	
IQA-08(#)	Based on E, Item 17, Part F, Item 10 & Part I, Item 4 of the Expired Licence	Inactive	N/A[2]	N/A	N/A
IQA-08A	Station situated up-gradient of West 40 Landfill	Active	B, E, N, ICP, F, LS	Annually	Annually
IQA-08B	Station situated down-gradient of West 40 Landfill	Active			
IQA-09	Contaminated soil accepted at the West 40 Landfill	Inactive	NA	N/A	N/A

[1] Table 2 may be modified by the Board and re-issued where necessary. Re-issuance is not considered an Amendment to the application or Licence as defined in the *Act.*
[2] Means not applicable

NUNAVUT WATER BOARD

WATER LICENCE NO: 3AM-IQA1626

REASONS FOR DECISION
INCLUDING RECORD OF PROCEEDINGS

NUNAVUT WATER BOARD

In the Matter of:

Applicant:	City of Iqaluit
Subject:	Application to Replace and Amend Expired Type "A" Water Licence No. 3AM-IQA0612
Date:	June 17, 2016
Precedence:	Where there is any inconsistency or conflict between the *Nunavut Land Claims Agreement* and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act (NWNSRTA)*, the Agreement prevails to the extent of the inconsistency or conflict. Where there is any inconsistency or conflict between the *NWNSRTA* and any other act of Parliament, except the *Nunavut Land Claims Agreement Act*, the *NWNSRTA* prevails to the extent of the inconsistency or conflict.

RECORD OF PROCEEDINGS

Applicant:	City of Iqaluit
Address:	Box 460 Iqaluit, NU X0A 0H0
Purpose:	Application to Replace and Amend Expired Type "A" Water Licence No. 3AM-IQA0612
Original (incomplete) Application Received on:	October 12, 2012
Complete Application Received on:	May 28, 2015
Application Received from:	City of Iqaluit
Date of Public Hearing:	May 4 and 5, 2016
Public Hearing Record Closed:	May 5, 2016

ATTENDEES:

NWB Representatives:

Nunavut Water Board Panel Members (Panel P6):	Chairman	N. Mike
	Member	L. Toomasie
	Member	M. Nartok
Nunavut Water Board Staff:	Executive Director	S. Autut
	Director of Technical Services	D. Hohnstein
	Senior Technical Advisor	S. Joseph
	Licensing Administrator	I. Porter
	Board Secretary/Interpreter	B. Kogvik
	Legal Counsel (Shores Jardine LLP)	T. Meadows
Interpreters:	Inuktitut Translator	B. Kogvik
	Inuktitut Translator	M. Hunt
	French Translator	D. Cuerrier
Court Reporter:	Dicta Court Reporting, Inc.	K. Schumann
Sound Technician:	Innirvik Support Services Ltd.	E. Uniuqsaraq
		E. Cooper
		G. Metuq

Applicant:

City of Iqaluit	Director of Public Works and Engineering	M. Hamp
	Project Officer	P. Clow
	Project Officer	R. Sparham
	Technical Support (Stantec)	D. Lycon

Parties:

Indigenous and Northern Affairs Canada (INAC)	Manager Water Resources	S. Burgess
	Water Management Coordinator	S. Forte
	Manager Field Operations	J. Hack
Department of Justice	Counsel	K. Landa
Environment and Climate Change Canada (ECCC)	Environmental Assessment Coordinator	B. Summerfield
	Head of Water Quality Expert Support Group	A. Wilson
	Environmental Enforcement Officer	C. Didham
Department of Fisheries and Oceans Canada (DFO)	Senior Fisheries Protection Biologist	R. Janusz

Written Record of Submissions:	Available from the Board's public registry using the following link: ftp://ftp.nwb-oen.ca/registry/3%20MUNICIPAL/3A/3AM%20-%20Municipality/3AM-IQA0612/2%20ADMIN/4%20HEARINGS/2%20HEARING/
Hearing Record (including Hearing Transcript):	Available from the Board's public registry using the following link: http://www.nwb-oen.ca/public/registry/3%20MUNICIPAL/3A/3AM%20-%20Municipality/3AM-IQA0612/2%20ADMIN/4%20HEARINGS/2%20HEARING/2016%20Public%20Hearing/

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ABBREVIATIONS

Short Form	Full Name
AANDC	Aboriginal Affairs and Northern Development Canada (as of November 2015 became INAC)
DFO	Fisheries and Oceans Canada
DIO	Designated Inuit Organization
EC	Environment Canada (as of November 2015 became ECCC)
ECCC	Environment and Climate Change Canada (formerly Environment Canada)
GN-CGS	Government of Nunavut, Community and Government Services
INAC	Indigenous and Northern Affairs Canada (formerly AANDC)
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NPC	Nunavut Planning Commission
NuPPAA	*Nunavut Planning and Project Assessment Act*
NWNSRTA	*Nunavut Waters and Nunavut Surface Rights Tribunal Act*
NWB	Nunavut Water Board
PHC	Pre-Hearing Conference
PH	Public Hearing
TM	Technical Meeting

REASONS FOR DECISION

Executive Summary

This decision is in relation to an application before the Nunavut Water Board (NWB or Board), filed by the City of Iqaluit (the Applicant or City), to replace and amend the expired Type "A" Water Licence No. 3AM-IQA0612 (or 3AM-IQA0612) (the Application). The Applicant seeks a Type "A" Licence to authorize the use of water and deposit of waste associated with a "municipal undertaking".[1]

The scope and content of the Application has been revised several times since it was originally received by the NWB on October 12, 2012. After the October 2012 submission, there was an on-going exchange of updated and revised application documentation culminating with the Board determining on May 28, 2015 that the Board had received sufficient information to deem the Application to be administratively complete.

The Application requests that the Board issue a Type "A" Water Licence on substantially the same terms and conditions as the City's former water licence, Water Licence No. 3AM-

[1] As of April 2013, when the *Nunavut Waters Regulations*, SOR/2013-69 came into force, municipal undertaking was defined as "a waste disposal or water system for a municipality."

IQA0612 which expired in July 2012 (the Expired Licence). The Applicant requested three key amendment areas to the Expired Licence:

- The term of the Licence be 10 years;
- Changes to the monitoring requirements for the undertaking; and
- Changes to some aspects of the scope of the undertaking.

The NWB conducted a thorough review of the Application and associated documentation, including a completeness check, technical review, a technical meeting and a pre-hearing conference held in person, in the nearest community, Iqaluit, Nunavut, on January 13 and 14, 2016. On May 4 and 5, 2016 the Board held an in-person Public Hearing in Iqaluit to consider the Application. A Community Session was hosted by the NWB as part of the Public Hearing on the evening of May 4, 2016, but despite publishing Public Notice, radio, print and social media advertising of the event, no members of the public attended the community session.[2]

On the basis of the information provided within the Application by the City of Iqaluit, technical review of the Application by the Board and interveners, commitments and responses to information requests from the parties during the technical review of the Application, comment submissions received throughout the Board's consideration of the Application, the final written submissions filed with the Board in advance of the Public Hearing and the information provided during the Public Hearing, the three-member panel of the Board, Panel (P6 or the City of Iqaluit Panel), duly appointed by the Board to consider the Application, has by way of Motion No. 2016-02-P6-10 and Motion No. 2016-02-P6-14 decided the following:

- To grant the City of Iqaluit's request to replace and amend the expired Water Licence No. 3AM-IQA0612 in accordance with the rationale provided in this decision and the terms and conditions outlined in this Decision and the attached Licence No.: 3AM-IQA1626 (the Licence);
- Specific terms and conditions of note in the Licence include the following:
    - the term of the Licence will be 10 years, expiring on June 16, 2026, the Board is confident that with the City of Iqaluit's commitment to significant upgrades to the City's Wastewater Treatment Facilities, the City's environmental performance will greatly improve and this supports granting the longer term requested;
    - the volume of water the City of Iqaluit is authorized to use remains at 1.1 million cubic metres annually;

[2] For a complete list of all attendees at the Public Hearing and Community Session for this Application, see APPENDIX E - Sign-in Sheets – List of Participants in the Public Hearing.

- items that no longer apply (such as items applicable to construction that has now been completed, items that are no longer in use, requirements to file updated plans for approval that have been submitted and approved by the Board or that are no longer applicable to the undertaking, etc.) have been removed;
- the monitoring requirements in the Licence have been revised to streamline and rationalize the monitoring required under the Licence and also to reflect the anticipated improvements to the Wastewater Treatment Facilities that will be implemented by the City in the next two years; and
- amendments to specific terms and conditions of the Expired Licence have been made to reflect general updates, recent amendments to legislative requirements, and changes requested by regulatory authorities (e.g., changes to the requirements associated with the *Nunavut Waters Regulations*).

SECTION I FILE BACKGROUND AND REGULATORY HISTORY

Current Application

The Application was originally submitted by the City of Iqaluit (Applicant or City) in October 2012, and requested that the Nunavut Water Board (NWB or Board) replace and amend the City of Iqaluit's Type "A" Water Licence No. 3AM-IQA0612 that had expired in July 2012 (the Expired Licence). Between October 2012 and May 2015, the Applicant submitted several application documents and supporting information to the NWB involving varying water uses, waste deposits and scopes. After approximately three (3) years of following-up with the City of Iqaluit, on May 28, 2015 the NWB deemed the Application to be complete and provided Notice of the Application.

The Expired Licence was issued to the City of Iqaluit to authorize the use of water and deposit of waste for a municipal undertaking[3] on May 15, 2006, with the original expiry date set for May 15, 2011. Prior to expiry of that licence, the City applied to the Board for an emergency amendment to extend the term of the licence by one (1) year. The Board granted the emergency amendment on May 13, 2011 with the issuance of the amendment and the Minister of Aboriginal Affairs and Northern Development Canada (AANDC) approved the amendment on June 17, 2011. This extended the expiry date of the Licence to July 15, 2012. Licence No. 3AM-IQA0611 was then used interchangeably as Licence No. 3AM-IQA0612 to denote the changed expiry date.

[3] As that term was defined under the *Northwest Territories Waters Regulations*, SOR/93-303, Schedule II, Item 3, (the Regulations in force at that time) as follows: Any activity in a municipality, or in a settlement comprising a multiplicity of residential units, that uses only a municipal water and sewage system, including domestic, horticultural, fire protection, commercial or industrial activities.

In July 2012, just days before the expiry of Licence No. 3AM-IQA0612 (3AM-IQA0611) the City again applied for an emergency amendment to extend the Licence term by an additional year, but the Board determined at that time that emergency circumstances did not exist and the City's Licence then expired in 2012. Since that time, as set out in s. 46 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, [4] the City of Iqaluit continued to be bound by the obligations under the Expired Licence.

The scope of the Application, which was amended several times since the initial version of the Application was submitted in 2012, now includes the following works, activities and undertakings:

1. Withdrawal and use of up to 1,100,000 cubic metres of freshwater annually from Lake Geraldine for municipal purposes;
2. Upgrade, operation, and eventual decommissioning of infrastructure used for managing wastewater at the existing West 40 Wastewater Treatment Plant and backup Sewage Lagoon;
3. Operation and eventual decommissioning of the solid waste management facility at the existing west 40 landfill and associated infrastructure;
4. Changes to the Monitoring Program requirements of the expired licence; and
5. Term of ten (10) years for the required licence.

It should be noted that as requested by the City of Iqaluit, several works, activities, and undertakings were removed from the scope of the City's Application[5] on the understanding that the City will file an amendment application when the City has sufficient information about these components to provide a complete application.

The various submissions and documentation in support of the City's application to replace and amend the Expired Licence was received over the course of approximately four years, from October 12, 2012 to April 7, 2016 (collectively this documentation is considered to be the Application). The following is a listing of the main documents the NWB received from the City in support of the Application:

[4] S.C. 2002, c. 10, which states: The expiry or cancellation of a licence does not relieve the holder from any obligations imposed by the licence.
[5] For a listing of the items removed from the Scope of the Licence, see Section VII, Part A: Scope of this decision.

2012 Submissions

Water Licence Application

- Final Signed Water Licence Renewal Application Form, dated October 2012;
- Cover Letter Regarding Application for Renewal of Water Licence 3AM-IQA0611 (renamed 3AM-IQA0612), dated November 1, 2012;
- Cover Letter Regarding Application for Renewal of Water Licence 3AM-IQA0611 (renamed 3AM-IQA0612), dated November 2, 2012;
- Executive Summary (English);
- Executive Summary (Inuktitut);
- Application Appendices; and
- 2011 Annual Report and Appendices.

Appendix A: General

- A-1: Topographic map/satellite image (5-metre contours);
- A-2: Water Licence Inspection Reports (July 2008, July 2009, October 2009, July 2010, July 2011, and July 2012);
- A-3: City of Iqaluit Spill Contingency Plan (2004);
- A-4: Alternate Monitoring Plan (2008);
- A-5: Current Monitoring Program Tests Dates (2012);
- A-6: Monitoring Program Test Results (April, July, and September 2012);
- A-7: Spill Reports (2005, 2006, 2007, 2008, 2009, 2010, and 2011;
- A-8: Allangua Road Culvert Installation;
- A-9: Water Licence Reports (2009, 2010, and 2011) ;
- A-10: Audited Financial Statements (2011); and
- A-11: Compliance Assessment (2012).

Appendix B: Water Use

- B-1: Picture of Water Source Sign;
- B-2: Lake Geraldine Dam Expansion Drawings (2006);
- B-3: Water Treatment Plant; Drawings (2003);
- B-4: Water Treatment Plant Operation & Maintenance Manual (2004);
- B-5: Underwater Dive Report (2010);
- B-6: Watershed Mapping and Monitoring for Northern Community Impact Assessment;
- B-7: Lake Geraldine Dam - Dam Safety Review (2006);
- B-8: Lake Geraldine Dam - Dam Safety Inspections (2009, 2010, 2011, and 2012); and
- B-9: Lake Geraldine Dam - Permanent Record File (2011).

Appendix C: Wastewater

- C-1: Picture of Lagoon Identification;
- C-2: Sewage Lagoon Drawing (1988);
- C-3: Wastewater Treatment Plant Phase 1 Drawings (2005);
- C-4: Lift station No. 1 - As-Built Drawings (2007);
- C-5: Lift Station No. 2 - As-Built Drawings (2011)
- C-6: Sludge Management Operation & Maintenance Manual (2006);
- C-7: Wastewater Treatment Plant Operation & Maintenance Manual (2006);

- C-8: Sewage Lagoon West Berm Rehabilitation Reports and Drawings (2006);
- C-9: Iqaluit Wastewater Treatment Plant Technical Overview of 2005 Secondary Sewage Treatment Plant Design (2011);
- C-10: Sewage Lagoon Dam Safety Inspections (2006, 2009, and 2011);
- C-11: Sewage Lagoon Permanent record File (2012); and
- C-12: Sewage Lagoon Dam Safety Review Requirement Investigation (2012).

Appendix D: Solid Waste

- D-1: Picture of Landfill Sign;
- D-2: Landfill Facility Expansion Drawings (2001);
- D-3: Landfill Drawings (2006);
- D-4: Landfill Berm Repair Drawings (2011);
- D-5: Solid Waste Facility Operations & Maintenance Manual (2005);
- D-6: Landfill Water Management Improvements Report (2009);
- D-7: West 40 Landfill Drainage Management Review (2011);
- D-8: Iqaluit Sewage Sludge Management Composting Pilot Project Report (2009); and
- D-9: Iqaluit Waste Management Project Terms of Reference (2010).

Copy of Final NIRB Application

- NIRB Form Part 1 (English);
- NIRB Form Part 1 (Inuktitut; and
- NIRB Form Part 1 (Cover Letter)

<u>2013 Submissions</u>

- City of Iqaluit Response to NWB April 8, 2013 Letter Regarding Application for Water License Renewal
- Lake Geraldine Water Balance Assessment, dated 2013;
- City of Iqaluit Letter to the NIRB requesting Extension for Requested Additional Information, dated August 27, 2013;
- Iqaluit Waste Management Project: *Newsletter #3*, dated 2013;
- Iqaluit Annual Monitoring Report for Water Licence Monitoring Program -2012
- Letter from the City of Iqaluit to NWB regarding the City of Iqaluit Outstanding Items Submission, dated August 30, 2013;
- City of Iqaluit Quality Assurance and Quality Control Plan, dated March 2013
- City of Iqaluit 2007 Water Licence Annual Reports;
- City of Iqaluit 2008 Water Licence Annual Reports; and
- Monthly General Monitoring Reports: June, July, September, October, December 2012.

<u>2014 Submissions</u>

- City of Iqaluit Solid Waste Management Plan, West 40 Landfill Decommissioning Technical Memorandum, dated January 2014
- City of Iqaluit Landfill Operations and Maintenance Manual, dated January 2014; and
- City of Iqaluit Solid Waste Management Plan, dated January 2014.

2015 Submissions

- Cover Letter Regarding Confirmation of Submission and Scope for Type "A" Water Licence No. 3AM-IQA0611, dated March 2, 2015;
- Appendix A – List of appendices considered under the application;
- Appendix B – Supplementary Water Supply Study, dated August 2014;
- Letter from the city of Iqaluit dated November 13, 2015 in response to Environment Canada technical intervention;
- Letter to the City of Iqaluit dated November 13, 2015 in response to Aboriginal Affairs and Northern Development Canada technical intervention; and
- Letter from the City of Iqaluit dated November 13, 2013 in response to DFO technical intervention.

2016 Submissions

- City of Iqaluit's Presentation for the Technical Meeting and Pre-hearing Conference scheduled for its application;
- City of Iqaluit changes to monitoring proposed by the City of Iqaluit;
- Copy of AANDC and EC Inspector's Direction – 4th Quarter Update 2015;
- Copy of Environment Canada Inspector Directions – Dated March 5, 2013
- Scope Clarification of Renewal Application for Water Licence No. 3AM-IQA0612;
- Recommendations Regarding Management Plans Submitted for the City of Iqaluit Water Licence Application (Commitment No. 5;
- City of Iqaluit of the Landfill Fire Emergency Measure Update;
- Addendum to the Landfill Operations and Maintenance Manual to include current sampling program;
- Additional information regarding historical use of lake Geraldine drainage channel;
- Identification of off-site sampling point locations down gradient of the west 40 landfill;
- Response to NWB recommendations Regarding Management Plans submitted for the City of Iqaluit Water Licence Application;
- Proposed Changes to Schedule C of expired licence 3AM-IQA0612 and monitoring program;
- Licence unofficial copy with suggested edits;
- Location of wastewater Treatment Plan outfall in relation to the Ordinary High Tide Mark;
- Copy of Letter from DFO – Lake Geraldine Drainage Channel, Iqaluit, Nunavut;
- Additional Information Regarding Historical use of Lake Geraldine; and
- City of Iqaluit Public Hearing Presentation.

All documentation associated with the Application and the NWB's review of the Application is available from the NWB's FTP site and can be accessed using the following link:

ftp://ftp.nwb-oen.ca/registry/3%20MUNICIPAL/3A/3AM%20-%20Municipality/3AM-IQA0612/2%20ADMIN/4%20HEARINGS/2%20HEARING/

Licensing History for the Undertaking

Licences Issued to the City of Iqaluit

Both the Nunavut Water Board's predecessor, the Northwest Territories Water Board (NWTWB), and the Nunavut Water Board (NWB) have issued water licences to the City of Iqaluit in the past. A summary of the Type "A" and Type "B" Water Licences issued to the City of Iqaluit are available on the NWB's FTP site and consist of the following:

Licence No N5L3-0087

- Issued by the Northwest Territories Water Board to the City of Iqaluit on February 23, 1996; and
- Allowed for the use of water and deposit of waste in support of a Municipal undertaking.

Licence No NWB3IQA9900

- Issued by the Nunavut Water Board to the City of Iqaluit on December 31, 1999 and expired on December 31, 2000; and
- Allowed for the use 1.1 million cubic metres of water annually and the deposit of waste in support of a Municipal undertaking.

Licence No. NWB3IQA0103

- Issued by the Nunavut Water Board on January 1, 2001 and expired on December 31, 2003; and
- Allowed for the use 1.1 million cubic metres of water annually and the deposit of waste in support of a Municipal undertaking.

Licence No. 3AM-IQA0611 Renumbered to 3AM-IQA0612 (when amended to extend the expiry date)

- Issued by the NWB on May 15, 2006 with the expiry date originally set for May 15, 2011;
- Allowed for the use 1.1 million cubic metres of water annually and the deposit of waste in support of a Municipal undertaking; and
- Prior to expiry of the licence, the City applied to the Board for an emergency amendment to extend the term of the licence. The Board granted the emergency amendment on May 13, 2011 and the Minister of INAC approved the amendment on June 17, 2011. This allowed for the expiry date of the Licence to be extended to July 15, 2012.

Type B Licences issued by the NWB to the Project

In addition to the Type "A" Water Licences described above, the NWB has issued two Type "B" licences to the City of Iqaluit, which are as follows:

Licence No. 8BC-TAD0811

- Issued on April 2, 2008 and expired on March 31, 2011; and
- Allowed for the use of water and the deposit of waste in support of the construction of an access road and for quarrying activities at the Trail Area Deposit, located approximately 1.3 kilometres northwest of the Upper Base, on the outskirts of Iqaluit.

Licence No. 8BW-IGD1516

- Issued on May 27, 2015 and expired on May 26, 2016; and
- Allowed for the construction of three (3) water crossings as part of a 4 kilometre long by 8.5 metres wide, access road to the proposed Northwest Iqaluit Granular Deposit and proposed new landfill site.

None of the works, activities, and undertakings captured under these Type "B" Water Licences are included in the scope of the Type "A" Water Licence that is the subject of this decision. The City indicated at the time it applied for Type "B" Water Licence No. 8BW-IDG1516 that it would eventually amalgamate this licence with any Type "A" Water Licence subsequently issued to the City. However, the Board understands that as no work has been completed under Licence No. 8BW-IDG1516 to date, the City has more recently committed to cancelling their obligations under both the newly expired Licence No. 8BW-IDG1516 in addition to the long expired Licence No. 8BC-TAD0811.

Procedural and Regulatory History of the Application

The following listing summarizes key steps in the procedural history of the NWB's processing of this Application.

October 12, 2012

- NWB acknowledged receipt of an Application to replace and amend the City of Iqaluit's expired water licence

October 29, 2012

- NWB acknowledged receipt of the City's Application fee

November 21, 2012

- NWB requested that the City of Iqaluit cancel, withdraw or provide guidance as to whether an amendment application filed with the Board in 2006 should be

considered as part of the renewal and amendment application or whether it should be withdrawn

April 8, 2013

- NWB issued correspondence outlining outstanding deficiencies associated with the Application

July 5, 2013

- NWB and the City of Iqaluit held a teleconference to discuss matters related to requirements to complete the application and other process issues

July 8, 2013

- NWB issued correspondence outlining the commitments made by the parties during the teleconference

July 25, 2013

- City of Iqaluit provided correspondence to the Nunavut Impact Review Board, which outlined the timelines by which the City intended to submit outstanding requirements to the NIRB

September 27, 2013

- City of Iqaluit filed an addendum to the City's water licence application to replace and amend the Expired Licence

October 21, 2013

- The NWB further acknowledged receipt of the application and commenced a preliminary technical review and completeness check with the deadline for submission set for November 8, 2013

November 8, 2013

- NWB received a submission on completeness from Aboriginal Affairs and Northern Development Canada (AANDC)

December 11, 2013

- NWB issued follow-up correspondence to the City of Iqaluit regarding outstanding requirements while informing the City of its commitment to address those requirements

January 31, 2014

- NWB received from the City of Iqaluit copies of some of the outstanding documents required for the application

January to November 2014

- NWB suspended further processing of the application until the Nunavut Impact Review Board assessment process was completed and all outstanding deficiencies with the water licence application were addressed

November 3, 2014

- NIRB issued its Decision indicating that the proposal may proceed to the licensing stage

March 10, 2015

- Following receipt of additional information, NWB issued an acknowledgement of the receipt of additional information and commenced another preliminary technical review and completeness check for the application with the deadline for submission set for March 31, 2015

March 31, 2015

- Environment Canada (as it then was) requested and was granted an extension to the submission deadline

April 15, 2015

- NWB received submissions on completeness from Aboriginal Affairs and Northern Development Canada and Environment Canada on or before April 15, 2015

May 28, 2015

- NWB issued Notice of the Application and commenced full technical review of the Application with the deadline for submission set for July 5, 2015

June 30, 2015

- Environment Canada requested and was granted an extension to the comment deadline

July 10, 2015

- NWB received technical review submissions from, Aboriginal Affairs and Northern Development Canada, the Department of Fisheries and Oceans Canada and Environment Canada on or before the extended deadline for submissions

July 23, 2015

- NWB received correspondence from the City of Iqaluit indicating that the City would respond to interveners' comments on November 13, 2015

August 10, 2015

- NWB issued follow-up correspondence requesting that the City respond to interveners' comments as soon as possible and not delay until November 13, 2015

November 13, 2015

- The City of Iqaluit provided responses to the technical review comments provided by Aboriginal Affairs and Northern Development Canada, the Department of Fisheries and Oceans Canada and Environment Canada

November 27, 2015

- Indigenous and Northern Affairs Canada (formerly AANDC) provided additional comments regarding the City of Iqaluit's response to INAC's information requests

December 4, 2015

- NWB provided notice of the Board's intention to hold a Technical Meeting and Pre-hearing Conference in person in the City of Iqaluit during the week of January 11-15, and distributed for public comments or feedback a copy of the draft agenda for the City of Iqaluit TM-PHC

December 11, 2015

- NWB additional comments from the Department of Fisheries and Oceans Canada related to the City of Iqaluit Application, TM, Community Session and PHC

December 14, 2015

- Indigenous and Northern Affairs Canada provided correspondence, addressed to the City of Iqaluit, regarding INAC's second reply to comments on the City of Iqaluit's water licence
- NWB distributed the final agenda for the Technical Meeting, Community Session, and Pre-Hearing Conference for the City of Iqaluit Water Licence and confirmed the dates of the sessions to be January 13 and 14, 2016

January 13-14, 2016

- NWB held a technical meeting and pre-hearing conference in Iqaluit for the City's water Licence Renewal and Amendment Application

February 2, 2016

- NWB received a copy of the city of Iqaluit proposed changes to monitoring required

February 19, 2016

- NWB issued a Pre-Hearing Conference Decision Report and Notice of the public hearing in English and Inuktitut

March 30, 2016

- NWB received Environment and Climate Change Canada's Intervention in respect of the Application

April 8, 2016

- NWB received INAC's Final Written Submission regarding the Application

April 15, 2016

- NWB distributed the television and radio advertisements for the Public Hearing and also distributed follow up correspondence for the Public Hearing

April 22, 2016

- NWB received a copy of the City of Iqaluit Public Hearing Presentation

All information pertaining to the Amendment Application, including the supporting documents is available on the NWB's FTP site and can be accessed from the links provided above.

SECTION II SUMMARY OF FINAL SUBMISSIONS OF THE PARTIES

City of Iqaluit (the Applicant or the City)

The Applicant proposed the following amendments to the Expired Licence:[6]

a. increase to the Licence term from 5 years to 10 years;
b. changes to some aspects of the scope of the Licence; and
c. changes to the Monitoring Program.

Regarding the maximum annual withdrawal of water from Lake Geraldine, the City indicated that it will request an increase of the maximum annual withdrawal in the future by way of an amendment that would be submitted should the City has identify a suitable supplementary water source.[7]

Regarding the wastewater treatment plant and backup sewage lagoon, the City indicated that there are plans to upgrade the wastewater treatment plant before December 31, 2018. [8]

Regarding the operation and eventual decommissioning of the West 40 Landfill surface water runoff collection system, the City indicated that it is developing a new solid waste management site and will submit this new plan as part of a future amendment to the Licence.[9]

Regarding changes to monitoring programs, the City submitted a number of changes, which are set out in a table attached to the presentation.[10]

Regarding the Landfill Fire Emergency Measures, while outside the scope of the current licencing process, the City submitted that the containment, treatment and discharge of the landfill runoff under the emergency measures will end by October 31, 2016.[11] The City also indicated that the Applicant plans, if required, to request approval of the new pond prior to the end of the emergency measures, by way of an amendment to the Water Licence.

[6] City of Iqaluit, Exhibit 1, NWB Public Hearing Licence No. 3AM-1QA0612, "Water Board Public Hearing May 4-5, 2016", PowerPoint Presentation, (English, French, Inuktitut) filed on April 20, 2016, p. 5 (Exhibit 1).
[7] City of Iqaluit, Exhibit 1, p. 11.
[8] City of Iqaluit, Exhibit 1, p. 12.
[9] City of Iqaluit, Exhibit 1, p. 13.
[10] City of Iqaluit, Exhibit 1, p. 14.
[11] City of Iqaluit, Exhibit 1, p. 16.

In response to INAC's position that the parameters applicable to the marine discharge from the Wastewater Treatment Plant (WWTP) can be administered by an agreement between the Minister of Indigenous and Northern Affairs Canada and the Applicant, the City indicated that they had discussions with INAC and the City is becoming more familiar with the proposed regulatory process. However, the City clarified that, in their view, the marine discharge will not contain industrial wastewater in the foreseeable future. Specifically, the City provided:

> We've been in many discussions with Indigenous and Northern Affairs Canada as well as Environment and Climate Change Canada on this issue, and we feel we have a good understanding of how it would be regulated.
>
> I would like to just clarify something or maybe it's a question to be clarified. As I understand it, an industrial waste is wastewater from an industrial process. If that's the understanding in this room, what that is, the City of Iqaluit does not collect industrial wastewater. There aren't industrial processes occurring right now in Iqaluit. That's not to say it wouldn't happen in the future. There's no, you know, manufacturing industries or that sort of thing. So just -- that's just a point of clarification there.
>
> But in terms of understanding the process, we have been learning it through the course of this licence application process and through the course of the quarterly meetings with both Indigenous and Northern Affairs and Environment and Climate Change Canada.[12]

Indigenous and Northern Affairs Canada (INAC)

INAC's (formerly Aboriginal and Northern Affairs Canada or AANDC) participation in water licensing processes in Nunavut is informed by their mandate under the following Acts and associated regulations: *Department of Indian Affairs and Northern Development Act*,[13] Nunavut Land Claims Agreement, *Nunavut Waters and Nunavut Surface Rights Tribunal Act*,[14] *Territorial Lands Act*,[15] and the *Arctic Waters Pollution Prevention Act*.[16]

INAC recommended that a Type "A" Water Licence be granted for a ten-year term to replace and amend the Expired Licence, subject to the Department's comments and the submission

[12] M. Hamp, City of Iqaluit, NWB Public Hearing File No.3AM-IQA0612, Transcript, May 4, 2016, Volume 1, lines 3 to 22, pg. 137.
[13] R.S.C. 1985, c. I-6.
[14] S.C. 2002, c. 10.
[15] R.S.C. 1985, c. T-7.
[16] R.S.C. 1985, c. A-12.

of an updated Spill Contingency Plan. Below is a summary of the outstanding issues identified by INAC:[17]

1. Monitoring Requirements:
   a. maintain the current testing requirement for Lake Geraldine; and
   b. Update Water Licence Monitoring Program for West 40 Landfill monitoring stations.

2. Disposal of Pond Sludge:
   a. Submission of a disposal plan for sludge from water retention ponds at West 40 Landfill before decommissioning the ponds.

3. Timing of Plan Updates:
   a. Update Spill Contingency Plan before issuing the Licence;
   b. Tighter timelines/deadlines for submission of updated plans.

4. Proposed Modification to the current Licence:
   a. Justification for 15 of the 38 changes proposed to the Expired Licence. (INAC highlights that the City had provided the Expired Licence as part of the Application however many of the requested changes were to remove terms and conditions from the Expired Licence with no justification.[18]

Regarding monitoring requirements, INAC requested that specific information with respect to the location of monitoring stations, the parameters for monitoring, and frequency of monitoring be provided.

Regarding the proposed disposal of pond sludge[19] into the West 40 Landfill, INAC indicated that while it is logical to develop such a plan, it may be problematic for the sediment at the bottom of the pond to be removed during decommissioning of the emergency measures infrastructure which the City was planning for 2016. The pond is located in a ditch and when the berms around the pond are removed, water will likely run through and may entrain contaminated sediments if the sludge has not been properly dealt with. Therefore, INAC recommended that the Applicant be required to submit a plan for the disposal of sediment that has accumulated in the ponds as part of the overall decommissioning of this infrastructure. INAC also noted this would require a plan to be developed in a very abbreviated timeline in order for the work to be done in the fall of 2016.

[17] Indigenous and Northern Affairs Canada, Exhibit 8, NWB Public Hearing Licence No. 3AM-1QA0612, City of Iqaluit Renewal Application for Water Licence #3AM-IQA0612, Nunavut Water Board Public Hearing, pp. 6-9 (Exhibit 8).
[18] Indigenous and Northern Affairs Canada "Final Submission Regarding City of Iqaluit Type A Water Licence Renewal Amendment application for Municipal Undertakings" filed on March 30, 2016, (INAC's Written Submission).
[19] This sludge accumulated when emergency measures infrastructure was put into place to extinguish the landfill fire in 2014.

At the Public Hearing, INAC and the City of Iqaluit came to agreement with respect to several of the City's requested amendments to the Expired Licence.[20]

With respect to INAC's position that an updated Spill Contingency Plan must be filed before the Board considers issuing a Licence, INAC confirmed their satisfaction with the following timing:

> …we would like to confirm for the record that we are satisfied that the Applicant will provide INAC an updated spill contingency plan within 30 days of the end of this public hearing. We understand that, with this schedule, the plan will not be able to be considered by the Board for the licence, but that the plan will be submitted to the Board within 30 days of licence issuance and could then be included as a term in this licence.[21]

Environment and Climate Change Canada (ECCC)

ECCC's (formerly Environment Canada, EC) participates in the water licensing process in the exercise of their jurisdiction under the *Department of the Environment Act*, R.S.C. 1985, c. E-10, *Canadian Environmental Protection Act, 1999*,[22] *Fisheries Act*,[23] *Migratory Birds Convention Act, 1994*[24] and *Species at Risk Act*.[25]

ECCC submitted recommendations on the following topics:[26]

1. Implementation of secondary treatment;
2. Effluent quality criteria for municipal waste water;
3. Management of contaminated sediments from various landfill water management ponds; and
4. Terms and conditions for a Licence (including amendments to the Expired Licence).

With respect to implementation of secondary treatment of sewage effluent, ECCC recommended that the wastewater treatment upgrade design specifications must ensure that

[20] Indigenous and Northern Affairs Canada, Exhibit 10, "Itemization of Suggested Modifications to the Licence, Summary of Discussions with Indigenous and Northern Affairs Canada and the Applicant, City of Iqaluit".
[21] S. Fortier, INAC, NWB Public Hearing File No.: 3AM-IQA0612, Transcript, May 5, Volume 2, p. 160, lines 1-7.
[22] S.C. 1999, c. 33.
[23] R.S.C. 1985, c. F-14.
[24] S.C. 1994, c. 22.
[25] S.C. 2002, c. 29.
[26] ECCC, Exhibits 6 and 7, NWB Public Hearing Licence No. 3AM-1QA0612, "Environment and Climate Change Canada's Final Presentation to the Nunavut Water Board respecting the City of Iqaluit's Municipal Water Licence No. 3AM-IQA0612, Final Public Hearing, Iqaluit, Nunavut, Bradley Summerfield May 4-5, 2016" PowerPoint Presentation, filed on April 20, 2016, p. 5 (Exhibit 7).

discharge is compliant with the *Fisheries Act*.[27] In this regard, ECCC submitted that it is satisfied with the City's progress to investigate treatment system options to improve wastewater quality and recommended that the upgrade design specifications ensure that appropriate effluent quality is achieved such that discharge is compliant with s. 36(3) of the *Fisheries Act*.[28]

While recognizing that the *Wastewater Systems Effluent Regulations*[29] (WSER) do not apply in Nunavut, ECCC recommended that the WSER provide due diligence guidance for *Fisheries Act* compliance.[30] ECCC also recommended that the City should strive to meet or exceed WSER effluent quality standards at the end of the treatment system and rely on the WSER for monitoring of effluent quality criteria.[31]

Regarding the Landfill Fire Emergency Measures, ECCC recognized that the issue is outside the scope of the Application. However, ECCC reminded the City that it has agreed to properly treating and disposing of the discharge that accumulated during the City's emergency efforts to extinguish the landfill fire before the closure of the landfill.[32] However, ECCC noted that the sediments contained in the landfill holding ponds and the fire runoff treatment ponds should be characterized in advance so that appropriate plans for closure can be developed. In this regard ECCC recommended that sediments in water management ponds at the landfill be chemically characterized and the volume estimated in advance of closure planning of the existing landfill.[33]

Regarding specific terms and conditions of the Licence, ECCC recommended that the following changes to the Expired Licence would be appropriate:

a. Update the conditions of Part J: Abandonment and Restoration to include closure and reclamation;
b. Update Schedule C: Monitoring, by adopting the agreed upon monitoring plan changes proposed by the City;
c. Update Part E: Waste Disposal and Waste Management Plans to include details regarding future landfill use enclosure as well as burn box and incinerator use. [34]

ECCC submitted that it has no concern with proposed Licence term of 5-10 years.

[27] ECCC, Exhibit 7, p. 6.
[28] Environment and Climate Change Canada's Intervention to the Nunavut Water Board Respecting the City of Iqaluit Municipal Water Licence 3AM-IQA0612, March 30, 2016 (ECCC's Final Written Submission).
[29] SOR/2013-139 (WSER).
[30] ECCC, Exhibit 7, p. 7.
[31] ECCC's Final Written Submission.
[32] ECCC, Exhibit 7, p. 9.
[33] ECCC's Final Written Submission.
[34] ECCC, Exhibit 7, pp. 11-13.

Fisheries and Oceans Canada (DFO)

DFO is responsible for regulating coastal and inland fisheries as well as administering habitat and serious harm provisions under the Federal *Fisheries Act*.[35] DFO also complies with *Fisheries Protection Policy* and the *Fisheries Productivity Investment Policy*, which set out guidance on the application of fisheries protection and measures to offset serious harm to fish. DFO is also responsible for administering the provisions of the *Species At Risk Act*[36] applicable to aquatic species at risk.

With respect to the Application, DFO indicated that its main focus was on the water withdrawal in Lake Geraldine and the potential negative impact on fish habitat characteristics in that Lake and the outflowing stream.[37] However, DFO indicated that the "uncertainty about the ability of the Lake Geraldine watershed to support much in the way of fish population leads us to believe that this negative alteration may not cause what we refer to as a significant localized effect." [38] Additionally, DFO submits that its conclusion of no significant localized effect is supported by local stakeholders and fisheries managers "…that the watershed is not and has never been of local direct or indirect fisheries concern."[39]

DFO also submitted that the Department and the City have resolved a number of issues concerning the Renewal Application, and the parties come to an agreement with respect to the following:[40]

- A ten-year licence term;
- A maximum annual water volume withdrawal from Lake Geraldine of 1,100,000 cubic meters;
- That the City will continue to provide a compliant fish screen as a precautionary measure on its water intake at Lake Geraldine;
- That the City will evaluate potential effects on fish and fish habitat across watersheds, including Lake Geraldine and future plans for supplementary water supply;
- That the City will retain qualified environmental professionals, including biologists;

[35] R.S.C. 1985, c. F-14.
[36] S.C. 2002, c. 29.
[37] R. Janusz, DFO, NWB Public Hearing File No.3AM-IQA0612, Transcript, May 4, 2016, Volume 1, lines 9-24, pg. 84.
[38] R. Janusz, DFO, NWB Public Hearing File No.3AM-IQA0612, Transcript, May 4, 2016, Volume 1, lines 16-20, pg. 84.
[39] R. Janusz, DFO, NWB Public Hearing File No.3AM-IQA0612, Transcript, May 4, 2016, Volume 1, lines 21-24, pg. 84.
[40] R. Janusz, DFO, NWB Public Hearing File No.3AM-IQA0612, Transcript, May 4, 2016, Volume 1, pp. 88-89.

- That the City will avoid causing serious harm to fish and comply with applicable legislation; and
- That the City will comply with its duty to notify DFO if it has caused or is about to cause serious harm to fish.

SECTION III SUBMISSIONS BY OTHER INTERVENING PARTIES OR MEMBERS OF THE PUBLIC

There were no written submissions provided to the NWB by any other intervening party or members of the public. On the evening of May 4, as part of the in person Public Hearing, the Board hosted a Community Session. Despite Public Notice being published and posted, radio and television advertisements of the event and notifications on social media, no members of the public attended the Community Session.

SECTION IV JURISDICTION OF THE NWB

Under Division 2 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*[41] (NWNSRTA) the NWB has jurisdiction to issue a licence,[42] amend a licence,[43] or in certain circumstances, cancel a licence.[44] In exercising the Board's statutory functions under the Nunavut Land Claims Agreement (NLCA) and the statutory regime governing the Board (the NWNSRTA and the *Nunavut Waters Regulations*), the NWB must be guided by the following objects:

> … to provide for the conservation and utilization of waters in Nunavut, except in a national park, in a manner that will provide the optimum benefit from those waters for the residents of Nunavut in particular and Canadians in general.[45]

In setting the terms and conditions of a licence, the NWB is guided by these objects and the NWB's statutory duty to make *all* reasonable efforts to minimize *any* adverse effects on aquatic ecosystems. Reading several of the Articles of the NLCA together,[46] the NWB relies on the broad definition of "ecosystemic" found in Article 12, Section 12.1.1. of the NLCA, requiring not only the NIRB but also the NWB to ensure that all components of the ecosystem, such as fish and fish habitat, are protected within the parameters of s. 71 of the NWNSRTA.

[41] Sections 42-81 of the NWNSRTA.
[42] See ss. 42, 48, 55, 56, and 70 of the NWNSRTA.
[43] See s. 43(1)(b) of the NWNSRTA.
[44] See s. 43(1)(c) of the NWNSRTA.
[45] See s. 35 of the NWNSRTA.
[46] This approach is consistent with the direction provided in Article 2, section 2.9.1 of the NLCA.

In accordance with Article 13, Section 13.3.6 of the Nunavut Land Claims Agreement and s. 29 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA),[47] the Board has delegated its power to dispose of all matters related to the Application for a Type "A" Water Licence to replace and amend Expired Licence No. 3AM-IQA0612, including the conduct of this public hearing, to a Panel of the Board (which is referred to as Panel P6 or the City of Iqaluit Panel).

As with any applications considered by the NWB, the burden of proof rests with the Applicant, the City of Iqaluit, to demonstrate that the request for a licence should be granted and that the proposed terms and conditions (amendments to the Expired Licence) should be granted. In addition, the NWB Rules of Practice state: "[a]ny party offering evidence before the NWB shall have the burden of introducing sufficient and appropriate evidence to support its position."[48]

SECTION V REQUIREMENTS OF THE NWNSRTA AND THE NLCA

Objects of the NWB and its Relationship to other Bodies

Land Use Planning

On October 2, 2012 the Nunavut Planning Commission (NPC) provided the NWB with confirmation[49] that the undertaking falls outside of the boundaries of the two approved land use plans currently administered by the NPC. However, following the implementation of NuPPAA in July 2015, the NWB received a copy of correspondence[50] from the NPC, dated August 15, 2015, in which it indicated that the undertaking had to be reviewed in accordance with NuPPAA.

Subsequent to the August 15, 2015 correspondence, the NPC issued follow-up correspondence[51] on August 28, 2015 stating that the NIRB had issued a decision in 2014 for the undertaking, and that no additional review was required as no modifications were made to the proposal following the NIRB's initial review. As such, the project proposal falls under section 235(1) of NuPPAA. On this basis, the NWB considered the requisite land use planning requirements of the NLCA to be fulfilled such that the NWB could process the Application.

[47] S.C. 2002, c. 10.
[48] Section 23.1 of the Nunavut Water Board "Rules of Practice and Procedure for Public Hearing" (May 11, 2005).
[49] NPC Determination, City of Iqaluit - Water license renewal, October 5, 2012.
[50] Letter from B. Aglukark, NPC, to M. Hassan, City of Iqaluit, cc'd P. Clow and M. Hamp, City of Iqaluit, Re: NWB 3AM IQA0612 – Type "A" Amendment, August 12, 2015.

[51] Letter from P. Scholz, NPC to ddd cc'd P. Clow, City of Iqaluit, R. Ikkutisluk, NWB, and T.Arko, NIRB, Re: NWB 3AM IQA0612 – Type "A" Amendment, August 28, 2015.

Environmental Assessment

On November 3, 2014 the Nunavut Impact Review Board (NIRB) issued a screening decision under Article 12, Section 12.4.4 (a) of the NLCA.[52] The screening decision confirmed that the Project Proposal (the Application) may be processed by the NWB without a Part 5 or 6 Review as long as the Project Proposal was carried out in accordance with project-specific terms and conditions that were attached to the NIRB's approval.

The following NIRB Screening Decision terms and conditions are relevant to the Board's consideration of the water licence:

> **Water Use**
> 5. The Proponent shall not extract water from any fish-bearing waterbody unless the water intake hose is equipped with a screen of appropriate mesh size to ensure that there is no entrapment of fish. Small lakes or streams should not be used for water withdrawal unless approved by the Nunavut Water Board.
> 6. The Proponent shall not use water, including constructing or disturbing any stream, lakebed or the banks of any definable water course unless approved by the Nunavut Water Board.
>
> **Landfill Operations**
> 13. The Proponent shall dispose of non-hazardous materials only at the landfill and shall limit this disposal to those materials listed as acceptable for disposal. Hazardous materials, materials listed as unacceptable for disposal at the landfill, or materials that contain asbestos, fluorescent tubes or ozone depleting substances are not to be disposed of in the landfill and must be disposed of at an authorized facility, unless otherwise permitted.
>
> 18. The Proponent shall ensure there is no obstruction of natural drainage, flooding or channel diversion from access or other structures or facilities.
>
> **Restoration of Disturbed Areas**
> 32. The Proponent shall ensure that all disturbed areas are restored to a stable or pre-disturbed state to the extent possible upon reclamation and closure of project activities.
>
> **Other**
> 35. Any activity related to this application, and outside the original scope of the project as described in the application and considered within this decision, will be considered a new project and should be submitted to the NIRB for Screening.

[52] NIRB, Screening Decision Report, NIRB File No.: 13UN034, November 3, 2014.

NWB Advice Regarding Marine Areas

As set out under s. 41 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*,[53] the Board may jointly (with the other Institutions of Public Government established under the Nunavut Land Claims Agreement as the Nunavut Marine Council) or individually, as the Board, advise and make recommendations in respect of any marine area to "any department or agency of the Government of Canada or the Government of Nunavut, and those governments shall consider that advice and those recommendations when making any decision that may affect that marine area."

With respect to this Application, there was considerable discussion during both the technical review of the Application and also during the Public Hearing regarding the limits on the Board's jurisdiction to set effluent quality criteria for the Sewage Lagoon Facility and Wastewater Treatment Plant (WWTP) as the parties considered discharges from the WWTP to be discharges into the marine environment. The position of the Federal regulators, as summarized at the Public Hearing by Indigenous and Northern Affairs Canada was as follows:

> It has been communicated to us that the modifications requested by the Applicant to Part B, 12 Items 3 and 4, may be problematic. These items set effluent quality criteria for the wastewater treatment plant. We would like to clarify the Department's opinion with the following three points: Former water licences included criteria relating to the discharge of the wastewater treatment plant effluent; however, the discharge point will be approximately 20 metres above the high-water mark of marine water. Based on our expertise, the Federal interveners are of the view the wastewater discharge at this location will flow into the marine environment, and there is no real likelihood that it would enter and impact inland waters. For that reason, it is our view that this removes the basis for having such criteria in this water licence.
>
> However, because this discharge of wastewater would enter and impact marine waters, this is a matter to be addressed under the Fisheries Act and to be authorized under the Arctic Waters Pollution Prevention Act. Federal departments will be collaborating with the City to work towards compliance with the Fisheries Act and getting proper authorizations under the Arctic Waters Pollution Prevention Act. The Arctic Waters Pollution Prevention Act will require a Federal authorization by Indigenous Affairs as well as a Territorial authorization under the Public Health Act.[54]

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[53] NWNSRTA, S.C. 2002, c. 10.
[54] S. Burgess, NWB Public Hearing File No.: 3AM-IQA0612, Transcript, May 4, Volume 1, pp. 122-123, lines 10-25 and lines 1-10.

The Board accepts the assertion of the City and the Federal parties that the discharge from the Sewage Lagoon Facility and the WWTP constitutes a discharge into the marine environment. Further, recognizing that the jurisdiction of the NWB is limited to "waters" as defined under s. 4 of the NWNSRTA to mean inland waters, the Board also agrees that a water licence is not the appropriate instrument for the establishment of effluent quality criteria for discharges into the marine environment. Consequently, the Board has removed from the Licence those terms and conditions (Part E, Items 3 (a) and (b) in the Expired Licence that purported to regulate effluent quality at the point of discharge into the marine environment.

Although the Board has removed these provisions from the Licence, the Board could, if circumstances warrant, provide advice to the Federal and Territorial agencies responsible for authorizing the marine discharge under the auspices of s. 41 of the NWNSRTA.

Reflecting the NWB's advisory role, the Board recommends that when considering the City's application for the required authorizations under the *Arctic Waters Pollution Prevention Act*, R.S.C. 1985, c. A-12, Indigenous and Northern Affairs Canada (INAC), and the Government of Nunavut (GN) authority responsible for issuing the required authorization under the *Territorial Lands Act*, consider including similar effluent quality criteria as the criteria formerly developed by the Board and included in the Expired Licence. The NWB, in selecting the criteria in the Expired Licence had determined that these criteria were sufficiently protective of water quality in the area and therefore it is the Board's position that these criteria could provide a useful basis for the regulatory authorizations ultimately developed by INAC and GN to authorize the discharges from the SWWTP.

SECTION VI DECISION TO ISSUE

On the basis of the Application, the written materials filed with the Board, and the Public Hearing, the Board has decided to issue Water Licence No. 3AM-IQA1626 (the Licence) subject to the conditions set out below. The Licence authorizes the City of Iqaluit's continued use of water and deposit of waste for a municipal undertaking, but also contains terms and conditions necessary to protect the environment, conserve the water resources, and provide appropriate safeguards in respect of the use of waters in accordance with the Application.

In deciding to grant the Application, the Board is however troubled by the fact that the City of Iqaluit has been operating without the required water licence since July 2012 when the previous Licence No. 3AM-IQA0612 (Amended 3AM-IQA0611) expired. The Board recognizes that there are many competing priorities for funds within the City of Iqaluit, but was concerned about a lack of commitment to compliance with the requirements of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, S.C. 2002, c. 10 (NWNSRTA).

As the Board has noted in past decisions, the ability of the Board, and indeed all participants in Nunavut's integrated regulatory process, including enforcement agencies, to ensure that there is compliance with the objects of the Nunavut Land Claims Agreement (NLCA) can be seriously compromised when situations of pervasive and long-term non-compliance are allowed to continue.

The Board does however, recognize the recent steps and significant financial commitments made by the City of Iqaluit to substantially improve their record of compliance with the NWNSRTA, obligations under the *Fisheries Act*,[55] and future authorization for the marine discharge that will be part of the Indigenous and Northern Affairs Canada process under the *Arctic Waters Pollution Prevention Act*.[56] The Board also notes that further amendments to the water licence are expected in the near future to ensure that there will be sufficient water available to support this rapidly growing community. As part of the Board's consideration of an amendment, the Board will expect the City to provide updates to the Board and participants in the licensing amendment process about the City's progress with respect to meeting outstanding compliance obligations.

Conditions for Issuance of a Licence

Section 57 of the NWNSRTA provides several key legislative requirements that must be satisfied before the NWB may issue a licence.

> The Board may not issue a licence unless the applicant satisfies the Board that
>
> (a) any waste produced by the appurtenant undertaking will be treated and disposed of in a manner that is appropriate for the maintenance of the water quality standards and effluent standards that are prescribed by the regulations or, in the absence of such regulations, that the Board considers acceptable; and
>
> (b) the financial responsibility of the applicant, taking into account the applicant's past performance, is adequate for
>
> (i) the completion of the appurtenant undertaking,
> (ii) such measures as may be required in mitigation of any adverse impact, and
> (iii) the satisfactory maintenance and restoration of the site in the event of any future closing or abandonment of that undertaking (underlining added).

[55] R.S.C. 1985, c. F-14.
[56] R.S.C. 1985, c. A-12.

Financial Responsibility of the Applicant

As outlined under the NWNSRTA, s. 57(b), the NWB considers three aspects of the responsibility of an Applicant to carry out a licensed undertaking:

(i) the financial ability of the Applicant to complete the appurtenant undertaking;

(ii) the ability of the Applicant to undertake measures to adequately monitor for impacts and implement measures to mitigate any impacts; and

(iii) the Applicant's ability to maintain and restore the site during care and maintenance, closure and abandonment.

As a public authority, the Board's inquiry into the financial responsibility of the Applicant is somewhat different than would be the case for other types of corporate or individual water licence applicants. Reflecting this distinction, the Board has focused this inquiry on the second and third elements of the financial responsibility assessment; the ability to undertake measures to adequately monitor and mitigate impacts and the ability of the City to maintain and restore the site during care and maintenance, closure and abandonment.

During the Board's assessment of the extent to which the City has the ability to undertake the required monitoring and mitigation measures, the Board has considered the Applicant's compliance history as an indication of the City's ability to undertake impact monitoring and the mitigation necessary to conduct the undertaking in a manner that is protective of the freshwater environment.

As noted in the Reasons for Decision accompanying the Expired Licence in 2006,[57] the City of Iqaluit has had "regulatory problems" in terms of operating without a valid water licence for various periods commencing in the 1990s and continuing to 2016. In addition, the City has had significant and persistent issues of non-compliance, including discharges into the marine environment contrary to the *Fisheries Act*, R.S.C. 1995, c. F-14,[58] and an application in 2001 by a resident of Iqaluit for an interim injunction to enforce the terms and conditions of the former water licence.[59]

Since 2006 when the Expired Licence was issued, compliance issues have unfortunately continued. In October 2012, Aboriginal Affairs and Northern Development Canada (as it was known then, renamed to Indigenous and Northern Affairs Canada in 2015) and Environment Canada (as it was known then, renamed to Environment and Climate Change

[57] Nunavut Water Board, Reasons for Decision 3AM-IQA0611, May 15, 2006 at pp. 12-16.
[58] *R.* v. *Iqaluit*, 2002 CanLII 53331 (NU CJ).
[59] *P. Crowley* v. *Iqaluit (Municipality of)*, 2001 CanLII 2461 (NU CJ).

Canada in 2015) conducted a joint inspection at the City of Iqaluit's Sewage Lagoon Facility and Wastewater Treatment Plant (WWTP). Laboratory testing of the samples of effluent discharged from the WWTP that were taken during this inspection confirmed that the effluent was a substance deleterious to fish as defined under s. 34(1) of the Federal *Fisheries Act*.

On this basis, in March 2013, Environment Canada issued an Inspector's Direction to the City of Iqaluit pursuant to the Inspector's jurisdiction under s. 38(7.1) of the *Fisheries Act*.[60] The Inspector's Direction required the following:

1. Develop and submit a detailed written report to…Environment Canada Fisheries Act Inspector, no later than July 3, 2013 on the City's plans to address this non-compliance. This plan shall specify the proposed method to manage the Sewage and Wastewater effluent and/or the planned changes to the Sewage and Wastewater Treatment Plant and shall include a detailed chronology of the short and long term progress, measures and activities that have and will be taken and provide dates when each progress measure and activity was initiated and concluded such that it will be compliant with subsection 36(3) of the *Fisheries Act*.

2. Advising…an Environment Canada Fisheries Act Inspector, in writing each calendar quarter starting as of the day hereof of the measures which were taken in the previous calendar quarter until such time that the WWTP will be compliant with subsection 36(3) of the *Fisheries Act*.

In addition, AANDC (now INAC) also issued an Inspector's Direction for the site requiring the following:

- A plan for coming into compliance;
- Filing of the outstanding 2007 and 2008 Annual Reports;
- Submission of a water balance report with assessment of recharge needs;
- QA/QC plan;
- Monthly general Monitoring Reports (dating back to the 2012 Monitoring Program);
- Annual General Monitoring Reports (dating back to the 2012 Monitoring Program);
- Submission of various plans and manuals as part of the Iqaluit Waste Project; and

[60] See Inspector's Direction of C. Didham, Inspector and Fishery Officer, Environmental Enforcement Division, Environment Canada, Enforcement Branch, March 5, 2013 available on the NWB website filed by the City of Iqaluit in fulfillment of a commitment following the Technical Meeting and Pre-hearing Conference for the Application.

- Installation of outdoor monitoring program station signs.[61]

On May 20, 2014, a section of the West 40 landfill caught fire. The City implemented several emergency measures involving the use and storage of water, which were exempted from requiring immediate Board authorization under the emergency measures provisions of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA). However, the City has indicated that the on-going construction, maintenance and reclamation of these Emergency Measures, as well as the authorization to continue to use water and deposit waste associated with these additions to the site will be addressed in future by the City applying for amendments to the scope of the Licence to include this infrastructure.

In addition, on November 3, 2014, the INAC Inspector issued a Letter of Non-Compliance to the City of Iqaluit under s. 90 of the NWNSRTA for using waters and depositing waste for a municipal undertaking without a valid water licence.

Based on the most recent WWTP Compliance Plan Update (4th Quarter 2015),[62] it appears that the City of Iqaluit has made substantial progress on planning for a significant upgrade to the WWTP to be completed by the end of December, 2018 (with commissioning to follow). In addition, INAC's Field Operations in correspondence to the City (copied to the Board)[63] has confirmed that the City is continuing to show "reasonable progress" and diligence in achieving various compliance milestones, including completing the process to obtain a valid Type "A" Water Licence.

While the Board is disappointed to see that the City's compliance problems continued to persist even after the Licence was granted in 2006, the diligence and direction of INAC and ECCC Inspectors as well as concerted efforts by the City since 2013, appear to be yielding genuine results. Although the Board recognizes that the City, as is the case with many municipalities, is operating under considerable fiscal pressure, given the importance of compliance to the health and safety of the community and the protection of the environment, the City's progress must continue and compliance must become a top priority. Based on the evidence provided by the Inspectors for both INAC and ECCC, the Board is, for the first time in more than 20 years, cautiously optimistic that great strides are being made to improve environmental performance and bring the City into full compliance. To this end, the Board

[61] Letter from J. Hack, Water Resources Officer, INAC to K. Kharatyan, NWB, January 29, 2016 available on the NWB website as filed by INAC in fulfillment of a commitment following the Technical Meeting and Pre-hearing Conference for the Application.
[62] Document entitled "AANDC and EC Inspector's Direction, 4th Quarterly Update 2015, City of Iqaluit" and available on the NWB website as filed by the City of Iqaluit in fulfillment of a commitment following the Technical Meeting and Pre-hearing Conference for the Application.
[63] Letter from J. Hack, Water Resources Officer, INAC to K. Kharatyan, NWB, January 29, 2016 available on the NWB website as filed by INAC in fulfillment of a commitment following the Technical Meeting and Pre-hearing Conference for the Application

would appreciate being kept informed by all the parties as the City's plans for compliance continue to progress over the course of the current Licence.

Compensation of Existing or Other Users

The NWNSRTA requires that the NWB be satisfied that compensation of existing or other water users affected by the Application has been or will be paid.[64] To ensure that all parties with the potential to bring a water compensation claim have been notified of their rights under the NWNSRTA, the NWB provides, in the Notice of Application, an invitation to parties with water user compensation issues to advise the NWB regarding such issues. Notice of the Application in accordance with s. 55 of the NWNSRTA was issued by the Board on May 28, 2015 and the NWB confirms that no representations regarding compensation were made to the NWB.

Issuance of a Licence

As stated above and pursuant to s. 42(1) of the NWNSRTA, the NWB has decided to issue Water Licence 3AM-IQA1626 subject to the terms and conditions set out in this decision. In issuing the Licence, the NWB is satisfied that the Application contained the required information and is in the proper form having regard to the requirements of the NWNSRTA[65] and associated regulations.[66]

Applications in Relation to the Licences

Overall, the NWB is satisfied that the requirements of s. 48 of the NWNSRTA were met by the Applicant. The City of Iqaluit filed an Application which complied with the NWB's Rules, and was accompanied by the fees required by regulation including the application fee and water use fees. Further, the City has also provided the necessary application and supplementary information required to evaluate whether a Licence to replace and amend the Expired Licence should be granted and also to assess whether the amendments to the Expired Licence requested by the Applicant are reasonable and consistent with the objects of the Board as established under the NLCA and the NWNSRTA.

Application to Amend or Application for Future Modifications

In relation to future applications to amend or modify activities proposed by the City of Iqaluit and associated reclamation and remediation measures that may become necessary, the NWB reminds the City of Iqaluit that it must comply with all requirements of the NLCA,[67] the

[64] See ss. 58-60 of the NWNSRTA.
[65] See s. 48 of the NWNSRTA.
[66] *Nunavut Waters Regulations*, SOR/2013-69, April 18, 2013.
[67] See Article 12, Clause 12.4.3 (b) of the NLCA.

Nunavut Planning and Project Assessment Act,[68] and the NWNSRTA.[69] In particular, the Board notes that the scope of the authorized water uses or deposits of waste is defined as provided by the City in the Application and as set out in Part A of the Licence, and any requested changes to that scope may require processing as an amendment to the Licence.

Cancellation or Expiry of the Licence

As identified above, the NWB reminds the City that the provisions of s. 46 of the NWNSRTA states: "[t]he expiry or cancellation of a licence does not relieve the holder from any obligations imposed by the licence."

The Applicant is also reminded that pursuant to the NWB's authority under s. 43(1)(c)(iii) of the NWNSRTA, the NWB may, on application by a licensee, or on its own motion, cancel a licence at any time that the NWB considers the cancellation to be in the public interest.

Term of Licence

Section 45 of the NWNSRTA (in force as of the date of this decision) provides that the term of a licence or any renewal shall not exceed twenty-five years. The Applicant initially requested a 25-year term for the Licence; however, during the Technical Meeting and Pre-Hearing Conference, the Applicant requested that the term be changed to 10 years. Although in the past, the City of Iqaluit's compliance history and delays in ensuring that an active water licence was in force, meant the Board was hesitant to issue a licence for a term exceeding 5 years, for this Application the Board recognizes that the City has taken tangible and verifiable steps on the path to compliance. In particular, the Board notes that the City has made a significant commitment to improving their Waste Treatment Facilities and practices associated with the undertaking, and has made great strides to achieve compliance in the longer term. Consequently, the Board remains cautiously optimistic that the City will meet these commitments and this justifies the issuance of a longer term Licence that will enable the City to focus on complying with the terms and conditions in the Licence rather than on efforts to renew the Licence for shorter terms.

Given these circumstances, the NWB is satisfied that a ten-year term is appropriate.

[68] S.C. 2013, c. 14 (NuPPAA).
[69] See s. 43 of the NWNSRTA.

SECTION VII WATER LICENCE 3AM-IQ1626 TERMS AND CONDITIONS

The Licence does not take effect until approval of the Minister is given or deemed to have been given pursuant to s. 56 of the NWNSRTA.[70] As indicated in Section VI, the Panel has decided to issue a Licence, subject to the conditions contained herein.

To provide context and clarity, the NWB has provided the discussion and comments about specific terms and conditions that follow. The NWB has not, however, provided specific comments for those licence terms and conditions that are clear in their wording and intent on the face of the Licence.

Part A: Scope, Definitions and Enforcement

Scope

The scope of activities, works, and undertakings included under Licence No. 3AM-IQA1626 issued to the City of Iqaluit for a Municipal undertaking, as classified under schedule 1, Item 3, of the *Regulations*,[71] (the Licence) is as follows:

i. Use, management, and protection of the Lake Geraldine drainage basin and associated infrastructure;
ii. Management and protection of Waters surrounding the West 40 Landfill site;
iii. Management, collection, and monitoring of leachate from the West 40 Landfill site and adjacent Sludge Management Facility;
iv. Management of improved drainage works at the West 40 Landfill site;
v. Management, operation, and eventual closure and reclamation of the current West 40 Landfill site and associated solid waste disposal facilities;
vi. Upgrades, operation, maintenance, monitoring, and eventual closure and reclamation of a Wastewater Treatment Plant (WWTP);
vii. Operation, maintenance, monitoring, and eventual closure and reclamation of a Sludge Management Facility;
viii. Operation, maintenance, monitoring and eventual closure and reclamation of a Sewage Lagoon Facility;
ix. Implementation of contingency measures for the Wastewater and Landfill management facilities; and
x. Implementation of changes to the monitoring requirements including frequency, parameters, and stations being monitored.

[70] Section 56 of the NWNSRTA states:

> The issuance, amendment, renewal and cancellation of a type A licence, and if a public hearing is held, a Type B licence are subject to the approval of the Minister.

Under s. 56(2.2) if the Minister does not issue a decision within 45 days of receiving the Licence from the Board, (or within 90 days if the Minister has extended the decision-making period by an additional 45 days) the Minister is deemed to have approved the Licence.

[71] SOR/2013-69.

The above scope resulted from several changes requested by the Licensee and granted by the Board during the licensing process for the Application. Key items removed from the scope that the Licensee indicated would potentially be captured as part of a future amendment to the Licence, included the following:

1. Construction, operation, and eventual decommissioning of a new Solid Waste Management Facility (SWMF), to be located approximately 7.5 km northwest of the City Centre;
2. Supplementation of Lake Geraldine water supply with water withdrawn from the Apex River; and
3. Use, management, and eventual decommissioning of the collection ponds used during the landfill firefighting exercise.

Further, in Licence No. 3AM-IQA1626, the Board removed several items from the scope of the Expired Licence based on comments and recommendations provided by the Applicant and intervening parties or to reflect updated licence terms and conditions and address aspects of the project scope that are no longer applicable to the undertaking. On this basis, the following items included in the scope of the Expired Licence were removed from the scope of the Licence:

- Raising of the Lake Geraldine dam by 2.0 metres to meet over-winter storage capacity;
- Extension of the two berms adjacent to the Lake Geraldine dam and construction of a new berm to the south of the Lake Geraldine dam;
- Landfill expansion into the northern adjacent site in the West 40 Landfill site; and
- Upgrades, maintenance, operation and monitoring of the Sewage Lagoon.

It should be noted that since the Expired Licence was issued in 2006, the NWB has, in some cases updated, added, amended, and removed some of the terms and conditions that are generally applicable to this type of undertaking. The Licence has been amended to reflect these general revisions. Wherever the Board has chosen to make changes to key items within the Expired Licence the Board has highlighted these changes and provided discussion.

Definitions

Several minor changes have been made in the Licence to reflect changes to the definitions contained in the Expired Licence. These changes are primarily to capture the amended scope for the undertaking as well as to include general updates and address relevant comments and recommendations provided by intervening parties and the Licensee during the review process.

Enforcement

To ensure that the Licensee complies with the terms and conditions of the Licence, Inspectors, designated and empowered by the Minister[72] of Indigenous Affairs and Northern Affairs Canada (INAC), may inspect or examine works, activities, and undertakings associated with the use of waters and/or the deposit of waste for the purposes of exercising their powers in accordance with the NWNSRTA. The Licensee should note that compliance with the terms and conditions of this Licence does not necessarily absolve it from the responsibility to comply with all other applicable legislation, guidelines, and directives.

The Board has made only minor changes to the terms and conditions relevant to the enforcement provisions of the Expired Licence. In the Licence, the key change the Board has made to the Expired Licence terms and conditions related to enforcement is the removal of Part A, Item 3 (d), which require an Inspector to submit annual reports for the undertaking. The Board's rationale for removing this condition from the Licence is that the Board cannot purport to limit or direct an Inspector's discretion and flexibility in carrying out his/her duties and functions. In addition, the Board recognizes that this section was unique to only the Expired Licence and is not consistent with the Board's approach to other licences. In the Board's view, removal of this term and condition from the Licence ensures consistency in the Board's reporting requirements across similar types of undertakings and minimizes potential interference with respect to the Inspector's discretion and flexibility in carrying out his/her duties.

Compliance

The Board also points out to the City of Iqaluit that the Licence states that "Compliance with the terms and conditions of this Licence does not absolve the licensee from responsibility for compliance with all applicable legislation, guidelines and directives." In this respect, the Board notes that although the regulatory process governing the City's outflow into the marine environment is outside the NWB's jurisdiction, the Board still expects, having identified these additional compliance requirements during the water licensing process, that the City will be sure to seek the required permits, approvals and authorizations from regulatory authorities applicable to the outflow.

[72] Sections 85-88 of the NWNSRTA.

Part B: General Conditions

Part B of the Licence addresses many of the general terms and conditions that apply to the undertaking, such as annual report submission, protocols for handling documents related to the licence, posting of signage at sites associated with the undertaking, and more.

Changes made to this section of the Licence centre on removal and addition of terms and conditions to ensure that relevant Licence requirements are consistent with the scope of the undertaking and licences issued for similar types of undertakings.

Part C: Conditions Applying to Security

The term and condition related to security from the Expired Licence has been brought forward, unchanged, into the Licence.

Part D: Conditions Applying to the Use of Water and Water Management Plans

Section 11 of the NWNSRTA states "… no person shall use, or permit the use of, water in Nunavut except in accordance with the conditions of a licence."

Part D of the Licence focuses on water use and the related management plans. The Licensee did not request any changes to the water use requirements for the undertaking, therefore, only minor changes were made to this section of the Licence primarily to update the conditions to reflect current NWB requirements.

As under the Expired Licence, the Licensee requested the use of up to 1,100,000 cubic metres of water annually from the Lake Geraldine Reservoir. The Board has authorized the continued use of this volume under the Licence. The Board notes, however, that information provided in the Application suggests that the Lake Geraldine Reservoir may not be capable of satisfying the City's freshwater demand for the entire ten-year term of the Licence (given the growth projections for the City and the associated increased demand for water). Consequently, the City anticipates having to apply for an amendment to the Licence in the near future that will include, among other items, augmenting the water withdrawn from the Lake Geraldine Reservoir with freshwater withdrawn from the Apex River (or other alternative source).

To ensure that the current amount of water use authorized under the Licence does not negatively impact freshwater resources, the Board has included several terms and conditions under Part D of the Licence including those carried over from the Expired Licence that will continue to apply to the use and management of freshwater.

Notably, in keeping with DFO's recommendations, the Board has retained requirements in the Licence for the use of DFO–compliant fish screens. Also the requirements for continuation of Dam Safety Inspections (DSI) and Dam Safety Reviews (DSR) of the Lake Geraldine Reservoir, with only slight modifications to the frequency of the inspections, reviews and the timing for report submission following inspection have been retained. The frequency of DSI's and DSR's are now linked to the *Canadian Dam Association (CDA) - Dam Safety Guidelines.*[73] The timeline for submission of inspection reports and the Licensee's responses to addressing issues in the inspections reports have been changed from sixty (60) days, following completion of a DSI or DSR, to submission as part of the Licensee's Annual Report, following inspections. Terms and conditions addressing the requirements as related to DSI's and DSR's are included under Part D, Item 4.

Another notable change made to this section of the Licence relates to the inclusion of terms and conditions requiring the Licensee to evaluate the potential effects on freshwater including fish and fish habitat, associated with any plans to augment the Lake Geraldine Reservoir, taking into consideration DFO's recommendations. The Board notes that while supplementation of the Lake Geraldine Reservoir is not part of the scope of the Licence, it is important that the Licensee be reminded of the need to address this requirement as part of any future application to supplement the Lake Geraldine Reservoir. Conditions related to this requirement are included under Part D, Item 9 of the Licence.

Part E: Conditions Applying to the Deposit of Waste and Waste Management Plans

Part E of both the Expired Licence and the Licence focus on terms and conditions relevant to Waste Management and the associated plans. The Board has retained, as well as amended many of the terms and conditions under Part E of the Expired Licence, in the Licence. Some of the significant terms and conditions that have been amended are as follows.

Part E, Item 3, of the Expired Licence

Part E, Item 3 of the Expired Licence included discharge criteria and limits for Effluent generated by the Sewage Lagoon Facility, Wastewater Treatment Plant, and Runoff Water from construction areas and sites impacted by the undertaking. Changes made to conditions associated with this part of the Expired Licence under the Licence include removal of the regulated discharge criteria and limits included under Part E, Items 3(a) and 3(b) of the Expired Licence. As the Board's jurisdiction for these discharges is quite limited (as these are largely regulated under the *Fisheries Act* and the *Arctic Waters Pollution Prevention Act*, these discharge criteria and limits have been replaced by including additional monitoring

[73] Canadian Dam Association, *Dam Safety Guidelines 2007* (2013 Edition).

requirements in Schedule I of the Licence for both the Sewage Lagoon Facility and Wastewater Treatment Plant.

The NWB's main rationale for removing regulated Effluent quality parameters for the Sewage Lagoon Facility and the Wastewater Treatment Plant from the Licence is based on the recognition that the effluent final discharge points for both facilities are located in the marine environment, Koojesse Inlet, which is outside the NWB's jurisdiction in terms of establishing discharge criteria for a deposit of waste to fresh water. The removal of the effluent quality parameters is supported by both Environment and Climate Change Canada (ECCC) and Indigenous and Northern Affairs Canada (INAC). ECCC in its technical review comments and presentation at the Public Hearing stated that while the NWB had in past licences included criteria with limits for the effluent discharges coming from these facilities, ECCC noted that the outfall is about 20 metres above the tidal High Water Mark and is discharging into the marine environment. Therefore, ECCC observed that it may not be appropriate for the NWB to include regulatory limits in the Licence for these two facilities, given the point of discharge. ECCC, however, recommended that specified effluent criteria be considered as performance objectives by the City and that the NWB include regular monitoring requirements for these facilities in the Licence. Additional details related to the monitoring requirements for the discharge from these facilities are included under Schedule I of these Reasons for Decision.

With respect to the effluent criteria for runoff water associated with construction activities, Part E, Item 3(c) of the Expired Licence, the condition has been carried over into the Licence and is included under Part E, Item 4. The NWB has retained the regulated parameters for runoff water associated with construction activities in the Licence because there is an expectation that the Licensee will be carrying out upgrades to the Wastewater Treatment Plant in the coming years that is likely to generate runoff water, and it also likely that the general ongoing maintenance at site may generate runoff water that the Licensee must ensure meets the specified effluent discharge criteria in order to protect freshwater quality at the site.

Part E, Item 8 of the Expired Licence

Part E, Item 8 of the Expired Licence required the Licensee to undertake Dam Safety Inspections (DSI) of the Sewage Lagoon Facility at specific times of the year and at specific frequencies. This term and condition has been amended in the Licence under Part E, Item 10, in order to allow the Licensee to undertake DSIs of the Wastewater Treatment Facilities in accordance with the frequency and reporting requirements under the most recent version of the Canadian Dam Association, *Dam Safety Guidelines*.[74] .

[74] Canadian Dam Association, *Dam Safety Guidelines 2007* (2013 Edition).

Part F: Conditions Applying to Construction

Consistent with the approach taken for other parts of the Licence, the Board has amended, updated, removed, and added, as required, terms and conditions to Part F of the Expired Licence to reflect the construction that has taken place at the site already and the anticipated construction of the Upgraded Wastewater Treatment Plant.

Specifically, the Board has added the requirement that the Licensee submit for the NWB's review, for-construction design drawings and plans for the upgrades to the Wastewater Treatment Plant at least thirty (30) days prior to the commencement of construction activities. In addition, the Board has amended the terms and conditions of the Licence related to approval of the construction report and as-built drawings under the Expired Licence. Requirements have been included under Part F, Item 1 of the Licence noting that the NWB will be accepting these documents, but not approving such documents.

Other notable changes the Board has made to this section of the Licence include the following:

- Terms and conditions that have been added/amended under the Licence:
  - *Part F, Item 14 of the Expired Licence*: This condition, which required the Licensee to submit to the Board for review final design drawings for upgrades to the Wastewater Treatment Plant (WWTP) within ten (10) days of the Licence effective date, has been superseded by an all-encompassing condition under Part F, Item 1 of the Licence

- Terms and Conditions in this Part of the Expired Licence that have been removed from the Licence:
  - *Part F, Item 9 of the Expired Licence*: Conditions related to conducting Dam Safety Review for Lake Geraldine Raw Water Storage Upgrade II have been amended upon request of the Licensee for consistency with the Canadian Dam Association, *Dam Safety Guidelines*. The amended condition is now included under Part D, Item 4 of the Licence.
  - *Part F, Item 11 of the Expired Licence*: This condition required submission, for Board approval, of Final Design for the West 40 Landfill Expansion. As the expansion has been completed, the NWB has removed this condition from the Licence.
  - *Part F, Item 12 of the Expired Licence*: This condition required submission of Final Design Drawings for the Sludge Management Facility. As this requirement has been met, the Board has removed it from the Licence.

- *Part F, Item 13 of the Expired Licence*: This condition required the Licensee to submit to the Board for approval Final Design Drawings for the rehabilitation of the west berm of the Sewage Lagoon. As the Licensee has satisfied this requirement, it has been removed from the Licence.

Part G: Conditions Applying to Modifications

This section of the Licence is intended to address minor or limited changes that do not fundamentally change the nature and scope of the undertaking and that may be carried out by the Licensee without seeking an amendment to the Licence. As this section tends to be very general and consistent across all Type "A" licences, the Board has made only minor updates and edits to the Licence to reflect some updates to the Board's approach to modifications and to reflect recent changes to Nunavut's regulatory processes applicable to modifications.

The provisions of Part G, Item 1 allow for a Licensee to carry out certain types of "modifications" (as defined in the Licence) without consent from the Board. However, pursuant to Article 11, Section 11.5.9A and Article 12, Section 12.4.3 of the Nunavut Land Claims Agreement (NLCA) and ss. 76 and 141 of the *Nunavut Planning and Project Assessment Act* (NuPPAA),[75] a proposed modification submitted under this Licence may require processing by the Nunavut Planning Commission (NPC) and a screening determination by the Nunavut Impact Review Board (NIRB). It is therefore the responsibility of the Licensee to notify and consult with the NPC and the NIRB to ensure the requirements of Articles 11 and 12 of the NLCA and the applicable requirements of NuPPAA are met prior to submitting a notification of modification to the NWB under the Licence.

Further, the Applicant is required to obtain permission from the NWB for modifications that do not meet the definition of modifications or the criteria of Part G, Item 1. Without written consent from the NWB, the Licensee is not allowed to carry out any modifications. Changes that do not meet the definition of modification under the Licence or the requirements of Part G may be considered to be amendments to the Licence and could be subject to a Type "A" water licence amendment process, including a public hearing as may be required under the NWNSRTA.

Part H: Conditions Applying to Contingency Planning

Two previously approved spill contingency plans were authorized for implementation under the Expired Licence. They included a general plan entitled *City of Iqaluit Spill Contingency Plan*, updated 2004, and a specific plan entitled *Sewage Lift Station Spill Contingency Plan*, dated 2003. As the two plans underwent no updates in the years following implementation,

[75] S.C. 2013, c. 14.

both INAC and the NWB expressed concerns about the validity of some of the information contained in the plans. In response, the City had initially proposed to update the plans within 180 days following issuance of the Licence. However, prior to and during the Public Hearing for the Application, INAC objected to the timeline as proposed by the City.

In response to INAC's objections, the City proposed to amalgamate, update, and submit a copy of the amalgamated and updated Spill Contingency Plan to INAC within thirty (30) days following the date of the Public Hearing.[76] The City also committed to providing the NWB with a copy of the same plan within thirty (30) days from the date of issuance of the Licence. However, recognizing that there may be a delay of up to 90 days between the NWB issuing the Licence and the date on which the Licence is approved by the Minister and takes effect, the NWB has decided that the timeline for submission of the amalgamated and updated Spill Contingency Plan required under the Licence should be thirty (30) days following the effective date of the licence (approval of the Minister) rather than the date the NWB issues the Licence to the Minister for her consideration and approval. The requirement for submission of the updated Spill Contingency Plan is included under Part H, Item 1 of the Licence. The updated plan must address general spill contingency planning requirements for all aspects of the undertaking, including spill contingency planning requirements for the sewage lift station.

To ensure that the Licence fully reflects the Applicant's commitment to amalgamate all spill contingency planning into the updated Spill Contingency Plan, the Board has removed the requirement for submission of a separate Sewage Lift Station Spill Contingency Plan from the Licence (this requirement was previously required in Part H, Item 2 of the Expired Licence).

Part I: Conditions Applying to Monitoring

With respect to the monitoring requirements under the Licence, the NWB's jurisdiction is very broad and the NWB may include conditions in the licence related to monitoring programs to be undertaken.[77] In general, most of the monitoring requirements under the Expired Licence have been carried forward to the Licence. However, changes to the monitoring program have been made to address required updates to plans, scope changes, and relevant recommendations provided by the interveners and the Licence.

The general changes made to this section of the Licence are not discussed specifically in this document as these changes and updates from the terms and conditions of the Expired Licence

[76] This agreement was confirmed by INAC at the close of the Public Hearing, see S. Fortier, INAC, NWB Public Hearing File No.: 3AM-IQA0612, Transcript, May 5, Volume 2, pp. 159-160, lines 24-26 and lines 1-6.
[77] See s. 70(1)(c) of the NWNSTRA.

are considered routine and do not warrant detailed discussion. Details on specific changes made to address plans required under this section of the licence are provided in the Management Plans, Manuals and Reports section of this document.

Specific changes made to the monitoring program are included under the discussions for "Schedule I", which was previously referred to as Schedule C under the Expired Licence, and changes relevant to submission of monitoring plans are included under discussions related to the Management Plans, Manuals and Reports section of this document.

Part J: Conditions Applying to Closure and Reclamation

For the Closure and Reclamation Part of the Licence, which was formerly referred to as "Abandonment and Restoration" in the Expired Licence, the NWB has made some changes to reflect that the Applicant has already met some of the terms and conditions prior to or during the licensing process, and having satisfied these terms and conditions, the Board considered it appropriate to remove these terms and conditions.

For the purposes of the Licence, the term "Closure and Reclamation" has replaced "Abandonment and Restoration" which was the term formerly used for this part of the Expired Licence. This change reflects ECCC's recommendation that it is more appropriate to use the term "closure", to denote everything from a planned permanent decommissioning of an undertaking to an unplanned abandonment of an undertaking, whereas abandonment is a much narrower scope than the term "closure". ECCC also noted that the term "closure" is the term currently used in relevant guidelines.

Schedules A, B and I

Schedules A, B, and I have been included in the Licence to provide additional context, details and guidance with respect to the specific requirements of Parts A, B and I respectively of the Licence. Additionally, the schedules help to provide the Board and the Licensee with some flexibility for addressing reasonable changes to administrative details that, in the Board's view, do not require an amendment to the Licence. The following sections outline the schedules included in the Licence.

Schedule A

As in the Expired Licence, the Licence includes Schedule A, Definitions, that provides the meaning of terms as defined in the Licence. The function of this Schedule is to support consistent interpretation and application of key terms of the Licence. As the majority of the terms defined in the Licence have remained the same as those included in Schedule A of the Expired Licence, the NWB has made only minor changes to Schedule A to ensure that the definitions are up-to-date and continue to be applicable to the undertaking in the current circumstances.

Schedule B

Schedule B applies to general and specific annual reporting requirements for the undertaking. Similar to Schedule A, only minor changes were made to Schedule B in the Licence. These minor changes were required to ensure that all requirements are up-to-date and consistent with the undertaking in the current circumstances.

The requirement under schedule B, which are linked to Part B, Item 1 of the Licence, stipulates that a report detailing the use of water and the deposit of waste activities, that must be submitted to the Board for review prior to the 31st of March, annually. The Board provides public access to the information provided in Annual Reports submitted by licensees through its ftp site as well as upon requests from interested parties.

The NWB has included on its FTP site, a standardized form for annual reporting that licensees can use to submit reporting information, supplemented by other relevant information.

Schedule I

Schedule I of the Licence, was previously Schedule C under the Expired Licence. This Schedule has been renamed to make it clear that it is linked to Part I of the Licence and the Conditions Applying to Monitoring. This Schedule includes updates or changes to the monitoring requirements, taking into consideration the Licensee's requests, intervener's recommendations, the Board' Mandate and the scope of the undertaking. The Board has made four main types of changes under Schedule I:

- Changes to Regulated Parameters
- Changes to Monitoring Stations
- Changes to Type of Monitored Parameters
- Changes to Monitoring and Reporting Frequency and Responsibilities

Changes to Regulated Parameters

As stated under the section of these Reasons reviewing changes to Part E, under the Expired Licence, Part E, Items 3a, 3b, and 3c, the Board had imposed requirements for monitoring effluent discharged from the Sewage Lagoon Facility, Wastewater Treatment Plant, and surface runoff water from construction activities, respectively. During the application process for this Licence, the issue was raised regarding the extent of the NWB's jurisdiction to regulate the effluent which eventually discharges into the marine environment from the Sewage Lagoon and Wastewater Treatment Plant. As discussed in detail in the section of the decision subtitled NWB Advice Regarding Marine Areas the Board has accepted the view of the INAC and ECCC that because the final point of discharge is the marine environment and not freshwater, it is appropriate for the Board to remove effluent criteria for the Sewage Lagoon Facility and the Wastewater Treatment Plant from the list of regulated

parameters in the Licence. ECCC, however, indicated that although the parameters for the Effluent may not constitute Effluent limits, it may still be advisable to include these parameters in the Licence for monitoring purposes so that the Board and parties can continue to assess whether the wastewater treatment performance objectives are being met.

While the City did not explicitly request the removal of regulated parameters from the licence, the NWB has considered the recommendations made by intervening parties and weighed the overall potential effects to the freshwater environment in its decision and considers it appropriate to remove the regulated parameters for the Sewage Lagoon Facility and Wastewater Treatment Plant from the Licence. The Board has however retained the regulated parameters and associated effluent quality limits related to runoff water linked to construction activities, given the expected construction activities associated with upgrades to the Wastewater Treatment Plant in the near future.

Changes to Monitoring Stations

On the topic of monitoring stations associated with the Expired Licence, the City requested both removal and addition of specific stations from the monitoring program requirements of the Expired Licence, which are as follows:

Monitoring Station	Description	Request
IQA-01(#):	Based on Part I, Item 4	Removal (Inactive)
IQA-03	Sewage Lagoon Influent	
IQA-07	Surface water entering west 40 landfill	
IQA-08#	Based on Part E17, F10 and I4	
IQA-09	Contaminated soil accepted at the landfill	
IQA-08A	Up-gradient of West 40 Landfill	Addition
IQA-08B	Down-Gradient of West 40 Landfill	

The Applicant's rationale for requesting the removal of IQA-01(#) is that the data captured at this station is already included in other Licence requirements while the basis for requesting removal of station IQA-03 is the assertion that all surface runoff water from the Sewage Lagoon Facility is eventually collected in berms prior to being released into the marine environment. For the removal request associated with IQA-08#, the Licensee indicated that two additional stations, IQA-08A and IQA-08B should be added to address relevant concerns raised by INAC that there would be a data gap if the monitoring at IQA-08# was removed. The proposed locations for IQA-08A and IQA-08B are up-gradient and down gradient of the West 40 Landfill Facility, respectively.

The Board has seriously considered the Licensee's requested changes to monitoring stations, and the rationale provided, while considering interveners' comments and recommendations, and has decided to grant the Applicant's requests to remove or add the monitoring stations as requested. It should be noted that for the stations that have been removed from the updated monitoring program, the Board has labelled those stations "Inactive" in the table listing the monitoring stations so that parties referencing past monitoring reports will be able to link the historical information to monitoring station locations under previous licences, including the Expired Licence.

Changes to Type of Monitored Parameters

The City also requested changes to the parameters being monitored under the Expired Licence to exclude chlorinated alkenes and LC_{50} bioassay testing. In response, both intervening parties, INAC and ECCC, generally supported the Applicant's request. However, in addition ECCC recommended that research be conducted on the topic of chlorinated alkenes and that the LC_{50} test be replaced with acute lethality testing EPS1/RM/50 after the WWTP is constructed and commissioned. After considering the Applicant's request and the Intervener's comments and recommendations, the Board has included the changes to parameters as requested by the City within the new Licence.

Apart from the parameters changes made for the Wastewater Treatment Facilities, the Board has added Polychlorinated Biphenyls (PCBs) and Benzene, Toluene, Ethylbenzene and Xylene (BTEX) to monitoring requirements for the Solid Waste Facility.

Changes to Monitoring, Reporting Responsibilities and Frequency

Under the Expired Licence, the Board had included specific monitoring responsibilities for the INAC (formerly AANDC) Inspector to carry out on an annual basis. Based on the Board's discretion and submissions from INAC, these responsibilities have been removed from the Licence.

With respect to monitoring and reporting frequency, the Applicant requested several changes, which the Interveners agreed to and which the Board has granted as reflected in new Schedule I of the Licence.

Management Plans, Manuals and Reports

Throughout the review of the Application, Interveners, the Board, and the Applicant have considered and commented to various extents on the following management plans, which have been received either under the Expired Licence, with the Application or are requirements under the Licence:

1. Lake Geraldine Water Balance Assessment
2. Wastewater Treatment Plan Operations and Maintenance Manual

3. Sewage Sludge Manage Composting Pilot Project Report
4. Solid Waste Management Plan
5. Landfill Operations and Maintenance Manual, January 2014
6. Sewage Lagoon Operations and maintenance manual
7. West 40 Drainage Management Review
8. General Spill Contingency Plan and Sewage Lift Station Spill Contingency Plan
9. Monitoring Program
10. Quality Assurance/Quality Control Plan
11. Solid Waste Management Plan West 40 Landfill Decommissioning Technical Memorandum, January 2014
12. Final Abandonment and Restoration Plan West 40 Landfill; and
13. Water Treatment Plant Operation and Maintenance Manual

In respect of the Board's handling and review of plans received under the Licence, it should be noted that there are two different approaches for handling plans required under the Licence. For some plans, the Board merely "accepts" the plans as received. For plans that are accepted by the Board, the Board generally posts the plan on the NWB public registry, but does not invite or receive technical review or other forms of comment in respect of the plan. In contrast, for plans that are "approved" by the Board, comments are typically invited on these plans and the Board reviews the plan and considers whether to approve such plans or not. These plans, as approved are integral to the Licensee's compliance with the conditions of the Licence.

The Licensee should be aware that the Board may alter or modify a plan for the purpose of achieving legislative objectives, and that the plans approved by the Board are considered a part of the Licence.

The following subsections summarize the Board's specific requirements and/treatment of particular management plans or documents.

Lake Geraldine Water Balance Assessment

Part B, Items 3(a) and 3(b) of the Expired Licence, required the Licensee to submit for information, one year prior to expiry of the Licence, a complete water balance for Lake Geraldine along with an assessment of the recharge needs and long-term water demand. To satisfy this requirement, on August 20, 2013 the Licensee submitted a document entitled *Lake Geraldine Water Balance Assessment*, dated August 20, 2013. The document was reviewed by intervening parties and the Board during the licensing process; however, it has not been either approved or accepted with the issuance of the Licence because much of its content is expected to be the subject of further evaluation under any future application submission with respect to augment the City's potable water supply.

Wastewater Treatment Plant Operations and Maintenance Manual, January 2014

Part E, Item 6 of the Expired Licence required the Licensee to submit to the Board for approval, an operation and maintenance manual for the Wastewater Treatment Facilities. The Licensee submitted on November 13, 2012, a manual entitled *Operation and Maintenance Manual for the Iqaluit Wastewater Treatment Plant Conversion and Expansion – Phase 1, Iqaluit, Nunavut*, dated 2006. Following receipt and review of the document, the Board informed the City that the form of the document was not consistent with the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (GNWT 1996), and that the manual should be revised and resubmitted to the Board upon revision of the manual to be in compliance.

During the Board's review of the Application, the City committed to providing an updated version of the manual by December 21, 2018, following commissioning of the Wastewater Treatment Plant. In recognition of this commitment, the Board has carried over and included requirements under Part E, Item 7 of the Licence that will require the City to submit an Operation and Maintenance Manual on or prior to December 21, 2018.

Iqaluit Sewage Sludge Management Composing Pilot Project Report

Part E, Item 7 of the Expired Licence required the Licensee to submit a final assessment report for the sludge management pilot project. On November 13, 2012 the Licensee submitted a document entitled *Iqaluit Sewage Sludge Management Composting Pilot Project Report*, dated March 31, 2009, as part of the documents to renew the licence. As the assessment report was to generally assess the effectiveness of the City's sludge treatment process, which is determined to be generally effective overall, this requirement has been removed in the Licence.

Solid Waste Management Plan

Part E, Item 10 of the Expired Licence required the Licensee to submit to the Board for review, a long-term Solid Waste Management Plan. As part of the Application, the City submitted a document entitled *City of Iqaluit Solid Waste Management Plan*, dated January 2014. During the licensing process, the Applicant requested that this plan be removed from the Licence. However, INAC recommended that the plan be updated by December 2018 to reflect expected changes in solid waste management, as the West 40 Landfill is expected to reach capacity by that time. The Board is in agreement with INAC that the plan should be updated and resubmitted given that the construction of a new landfill facility is not considered to be within the scope of the Licence. The requirement for submission of the updated Solid Waste Management Plan for the Board's review is included under Part E, Item 9 of the Licence.

Solid Waste Operations and Maintenance Manual

Part E, Item 11 of the Expired Licence authorized the implementation of a previously approved Solid Waste Facility Operation and Maintenance Manual, dated 2005. As part of

the documents included with the Application, the Applicant submitted a manual entitled *City of Iqaluit, Landfill Operations and Maintenance Manual*, dated January 2014. Interveners' comments on the Manual suggest that it should be updated to address leachate management, sampling, open burning requirements and other concerns. The Board has included requirements under Part E, Item 12 of the Licence that require the City, within sixty (60) days from the Minister's approval of the Licence (effective date of the Licence), to submit to the Board for approval an Operations and Maintenance Manual for the Landfill Facility

Sewage Lagoon Operations and Maintenance Manual

The Expired Licence did not include requirements for submission of an Operation and Maintenance (O&M) Manual specifically for the Sewage Lagoon Facility. During the review process for the Application, INAC requested that an Operations and Maintenance Manual be provided for the Sewage Lagoon Facility. The Board agrees with INAC's submission and has included a term or condition that would require the City to file an O&M Manual for that Facility under Part E, Item 6 of the Licence. Further, once the Wastewater Treatment Plant is upgraded and commissioned, the O&M Manual for the Sewage Lagoon Facility is to be incorporated into the O&M Manual for the Upgraded Wastewater Treatment Pant as set out under Part E, Item 7.

West 40 Drainage Management Review

The Licensee submitted on November 13, 2012, the document entitled *West 40 Landfill Drainage Management Review*, dated September 16, 2011. The document, which addresses the collection, monitoring, and control of runoff water from the West 40 landfill site and adjacent sludge management facility, was not necessarily a requirement under the Expired Licence. Given the comments received from intervening parties and the importance of the information contained in the report regarding the management of effluent water quality, the Board has included requirements under Part E, Item 14 of the Licence for the Licensee to submit to the Board for review, an updated version of the document by December 31, 2017.

General Spill Contingency Plan and Sewage Lift Station Spill Contingency Plan;

Part H, Items 1 and 2 of the Expired Licence authorized the City to implement a general Spill Contingency Plan, dated 2004, and a specific Spill Contingency Plan for the Sewage Lift Station, dated 2003. The Licensee did not include any updated spill contingency plans as part of its Application. Based on discussions carried out and commitments made during the licensing process, the Board has included under Part H, Item 1, the requirements for the Licensee to submit to the Board for approval within thirty (30) days of the effective date of the Licence, an amalgamated and updated Spill Contingency Plan that would replace all plans that were previously authorized for use under the Expired Licence.

Monitoring Program

Part I, Item 4 of the Expired Licence required the Licensee to submit a Monitoring Program for the Water Supply, Wastewater Treatment Plant, and Solid Waste Management Facilities

to the Board for approval. The City submitted as part of the Application the Plan entitled *City of Iqaluit Water Licence Monitoring Program*, dated June 2008. Prior to submission of the program as part of the Application, the same monitoring program had previously been submitted to the Board. However, due to various program deficiencies, the program was never approved by the Board. During the review of this Application, the City committed to updating the plan 180 days following issuance of the Licence. However, INAC recommended that the Program be submitted to the Board for approval within sixty (60) days following issuance of the Licence. The Board agrees that as the implementation of an approved monitoring program has been an outstanding requirement for a number of years, it is reasonable for the Board to expect a revised and compliant Monitoring Program be provided as soon as possible, and the six (6) months requested by the City to file this vital information is too long. Consequently, the Board has included requirements under Part I, Item 2 of the Licence that would require the City to submit an updated Monitoring Program to the Board for approval within sixty (60) days of the effective date of the Licence.

Quality Assurance/Quality Control Plan, March 2013;

Part I, Item 7 of the Expired Licence required the Licensee to submit a Quality Assurance/Quality Control (QA/QC) Plan to the Board for approval. In the Application, the City submitted the plan entitled *Quality Assurance / Quality Control Plan (QA/QC),* dated March 2013. The Applicant also committed to updating the QA/QC Plan within 180 days following issuance of the Licence. INAC in its comments on the QA/QC Plan recommended that it be updated sixty (60) days following issuance of the licence. The Board has modified the conditions in the Licence applicable to the QA/QC Plan to reflect that it is no longer Board practice to approve QA/QC Plans. Instead of approving the QA/QC Plan, the Board now reviews the Plan along with a letter of acceptability from an accredited laboratory. On this basis, the Board has included requirements under Part I, Item 7 of the Licence for the QA/QC Plan, along with an acceptance letter from an Analyst of an accredited laboratory, to be submitted for the Board's review within sixty (60) days of the effective date of the Licence.

Solid Waste Management Plan West 40 Landfill Decommissioning Technical Memorandum, January 2014

As part of its Application, the City submitted the Plan entitled *Iqaluit Solid Waste Management Plan West 40 Landfill Decommissioning Technical Memorandum*, dated January 2014, which the Board has accepted with the issuance of the Licence under Part J, Item 1 of the Licence.

Final Abandonment and Restoration Plan West 40 Landfill

Based on discussions among the parties and a commitment made by the Applicant during the Board's review of the Application, the Board has included requirements for the City to submit a Final Abandonment and Restoration Plan for the West 40 Landfill to the Board for

approval at least one (1) year prior to the expiry of the Licence. Conditions related to this requirement are included under Part J, Item 2, of the Licence.

Water Treatment Plant Operation and Maintenance Manual

The City submitted prior to, and as part of its Application, a manual entitled *Process Operation and Maintenance Manual for City of Iqaluit Water Treatment Plant*, dated 2004. In response to the initial submission of the Manual the Board had recommended that the Manual be revised to reflect relevant aspects of the format included in the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (GNWT 1996). During the processing of this Application, the City requested that the Manual be removed from any future licence issued by the Board as the water treatment plant should be considered outside of the scope of the Water Licence. INAC, the only Intervener to comment on this issue agreed with the Applicant that the requirement could be removed.

The Board, however, disagrees with the Applicant's position that the Manual is not within the scope of the Licence in that many aspects of the operation of the Potable Water Treatment Plant involve the use of water and/or the deposit of waste, and as such falls directly under the Board's mandate. The Board has therefore included conditions to address this requirement under Part D, Item 2 of the Licence, which requires the City to submit an updated O & M Manual for the Potable Water Treatment Plant (of reduced scope) within sixty (60) days of the effective date of the Licence.

APPENDIX A - Agendas for Public Hearing and Community Session

PUBLIC HEARING **AGENDA**

CITY OF IQALUIT (LICENCE 3AM-IQA0612)

VENUE: SAINT JUDE'S ANGLICAN PARISH HALL, IQALUIT, NUNAVUT

May 4 - 5, 2016 (9:00 a.m. – 5:00 p.m., ET, Including Intermissions)

1. Opening Prayer
2. Opening Remarks by the Chairperson, which shall include the purpose of the Hearing and the scope of matters, which will be considered by the Board
3. Introduction of the Board Members and staff
4. Identification and introduction of the Parties
5. Introduction of the Elders and their role in the Hearing
6. Introduction and identification of the persons, associations, agencies, etc., who have not submitted interventions but who have expressed a desire to speak at the Hearing
7. Identification of any Motions or any objections
8. Presentation by the Applicant
9. Questioning of the Applicant by Parties respecting the Applicant's presentation
10. Questioning by the Board staff and Panel Members
11. Presentation by Interveners
12. Questioning of Interveners by Parties
13. Questioning by the Board staff and Panel Members
14. Presentation by any other persons, associations, agencies, etc. who have advised the Chairperson that they wish to speak
15. Questioning of other persons, associations, agencies, etc. by Parties
16. Questions by the Board staff and Panel Members
17. Upon completion of presentations by all Parties, the Board will give the Applicant the opportunity to reply. Then all Parties will have the opportunity to make final closing statements taking into account matters raised at the Hearing
18. Closing remarks by the Chairperson; and
19. Closing Prayer

AGENDA: Community Session

CITY OF IQALUIT (LICENCE 3AM-IQA0612)

VENUE: SAINT JUDE'S ANGLICAN PARISH HALL, IQALUIT, NUNAVUT

May 4, 2016 (7:00 p.m. - 10:00 p.m., ET, Including Intermissions)

1. Opening Prayer
2. Opening Remarks by the Chair
3. Presentation by the Nunavut Water Board (NWB) – Type "A" water licensing process for the Application (15 minutes)
4. Questions and/or comments from community members and other participants
5. Presentation by the City of Iqaluit regarding the Renewal-Amendment Application before the Board for Type "A" Water Licence 3AM-IQA0612 (20 Minutes)
6. Question and/or comments from community members and other participants
7. Presentation from each intervening party pertaining to its mandate and role(s) in the water licensing process as well as an overview of their findings pertaining to their technical review of the Application (15 Minutes/Intervener)
8. Questions and/or comments from community members and other participants
9. Closing Remarks
10. Closing Prayer

APPENDIX B - Exhibit List

Exhibit	Exhibit Description	Date	From
1	Hard Copy PowerPoint Presentation Water Board Public Hearing May-5, 2016 Presentation of the Applicant (Inuktitut, English and French)	May 4, 2016	City of Iqaluit
2	Hard Copy Table 1: Changes to Schedule C and Monitoring Program (Inuktitut)	May 4, 2016	City of Iqaluit
3	Hard Copy Table 1: Changes to Schedule C and Monitoring Program (French)	May 4, 2016	City of Iqaluit
4	Hard Copy Table 1: Changes to Schedule C and Monitoring Program (English)	May 4, 2016	City of Iqaluit
5	Hard Copy PowerPoint Presentation Iqaluit Water Licence Renewal Presentation to the Nunavut Water Public Hearing, Iqaluit NU May 4-5, 2016 (English)	May 4, 2016	Fisheries and Oceans Canada
6	Hard Copy Power Point Presentation Environment and Climate Change Canada's Final Presentation to the City of Iqaluit's Municipal Water Licence 3AM-IQA0612 (English/French)	May 4, 2016	Environment and Climate Change Canada
7	Hard Copy Power Point Presentation Environment and Climate Change Canada's Final Presentation to the City of Iqaluit's Municipal Water Licence 3AM-IQA0612 (English/Inuktitut)	May 4, 2016	Environment and Climate Change Canada

Exhibit	Exhibit Description	Date	From
8	Hard Copy Power Point Presentation Indigenous and Northern Affairs Canada City of Iqaluit Renewal Application for Water Licence #3AM-IQA0611 Nunavut Water Board Public Hearing Iqaluit (English)	May 4, 2016	Indigenous and Northern Affairs Canada
9	Hard Copy Final Submission to the Nunavut Water Board Regarding City of Iqaluit Type A Water Licence Renewal Application for Municipal Undertakings March 30, 2016 Executive Summary (English, Inuktitut and French)	May 4, 2016	Indigenous and Northern Affairs Canada
10	Electronic Form Only Itemization of Suggested Modifications to the Licence Summary of Discussions with Indigenous and Northern Affairs Canada and the Applicant, City of Iqaluit (English)	May 4, 2016	Indigenous and Northern Affairs Canada

APPENDIX C - List of Acronyms

AANDC	Aboriginal Affairs and Northern Development Canada	ᑲᓇᑕᒥ ᓄᓇᕗᑦᑲᑦᑐᑦᑕᓂᕆᔨᑦ ᐅᑭᐅᖅᑕᖅᑐᒥᓗ ᐱᓕᕆᓂᐊᓕᕆᓂᕆᔨᑦ
EC	Environment Canada	ᑲᓇᑕᒥ ᐊᓕᑎᓂᕆᔨᑦ
ECCC	Environment and Climate Change Canada (former EC)	ᑲᓇᑕᒥ ᐊᓕᑎᓂᕆᔨᑦ ᐊᒻᒪᓗ ᓯᓚᑦ ᐊᓯᔪᖅᑮᓂᐊᓕᕆᓂᕆᔨᑦ (ᑕᒃᑯᐊᖓᔪᒥᑉᓂᑦ EC-ᑯᑦ)
GN	Government of Nunavut	ᓄᓇᕗᑦ ᓄᓕᒫᖓ
INAC	Indigenous and Northern Affairs Canada (former AANDC)	ᑲᓇᑕᒥ ᓄᓇᖅᑲᑦᑐᑦᑕᓂᕆᔨᑦ ᐅᑭᐅᖅᑕᖅᑐᒥᓗ ᐱᓕᕆᓂᐊᓕᕆᓂᕆᔨᑦ (ᑕᒃᑯᐊᖓᔪᒥᑉᓂᑦAANDC-ᑯᑦ)
IR	Information Request	ᑐᓴᖅᑎᑕᐅᕈᐊᕆᑲᓐᓂᕐᒪᔪᑦ
NIRB	Nunavut Impact Review Board	ᓄᓇᕗᒥ ᐊᓕᑎᓂᕆᔨᓴᑯᑦ ᑲᑎᒪᔨᖏᑦ
NLCA	Nunavut Land Claims Agreement	ᓄᓇᕗᓱᒥ ᓄᓇᑦᓂᔭᑦ ᐊᖏᑭᕈᑎᑦ
NPC	Nunavut Planning Commission	ᓄᓇᕗᓱᒥ <ᖁᓚᐃᔨᑦ
NWB	Nunavut Water Board	ᓄᓇᕗᒥ ᐃᒪᓕᕆᔨᑦ ᑲᑎᒪᔨᖏᑦ
PHC	Pre Hearing Conference	ᐃᓄᕈᐊᑎᓪᓗᐊ ᐃᓄᐃᑦ ᑲᑎᒪᑎᑕᐅᓂᐊᓵᖁᓂᖏᓐᓂᒃ ᑲᑎᒪᓂᖅ
TDS	Total Dissolved Solids	ᓯᑎᐊᕐᓂᑦ ᐊᐅᒃᓯᒪᔪᑦ ᑲᑎᓪᓗᑎᑦ

APPENDIX D - List of Submissions and Correspondence

Application Submissions:

***March 2015 Submission*s**

Cover Letter Regarding Confirmation of Submission and Scope for Type "A" Water Licence 3AM-IQA0611

Appendix A – List of documents submitted as part of the initial submission for the application

Appendix B – Supplementary Water Supply Study

Appendix C – Letter to the City of Iqaluit from Aboriginal Affairs and Northern Development Canada pertaining to monitoring requirement in the expired licence

2014 Submissions

City of Iqaluit Landfill Operations and Maintenance Manual, dated January 2014

City of Iqaluit Solid Waste Management Plan, dated January 2014

Iqaluit Solid Waste Management Plan, West 40 Landfill Decommissioning Technical Memorandum, dated January 2014

***2013 Submission*s**

Cover Letter: City of Iqaluit Outstanding Items Submission

2012 Annual Monitoring Report

2007, 2008 Annual Report

Monthly General Monitoring Reports: June, July, September, October, December (2012)

Lake Geraldine Water Balance Assessment (2013)

Iqaluit Supplementary Water Supply Sampling Parameters (2013)

Iqaluit Waste Management Project: Newsletter #3 (2013)

Quality Assurance and Quality Control Plan (2013)

City of Iqaluit Renewal Application Addendum (Letter). This item describes Terms and Conditions associated with the Amendment No. 1 Application withdrawn by the City of Iqaluit (2006) that the City is proposing to be included in the Application Renewal (2012).

2012 Submissions

Cover Letter

Cover Letter (Updated Appendices)

Executive Summary (English)

Executive Summary (Inuktitut)

Application for Water Licence Renewal; and

Application Appendices (contents as described):

Appendix A: General

- A-1: Topographic map/satellite image (5m contours)
- A-2: Water Licence Inspection Reports (2008, Jul 2009, Oct 2009, 2010, 2011, 2012)
- A-3: City of Iqaluit Spill Contingency Plan (2004)

- A-4: Alternate Monitoring Plan (2008)
- A-5: Current Monitoring Program Tests Dates (2012) Appendix A Page 2
- A-6: Monitoring Program Test Results (April 2012, July 2012, September 2012)
- A-7: Spill Reports (2005, 2006, 2007, 2008, 2009, 2010, 2011)
- A-8: Allangua Road Culvert Installation
- A-9: Water Licence Reports (2009, 2010, 2011)
- A-10: Audited Financial Statements (2011)
- A-11: Compliance Assessment (2012)

Appendix B: Water Use

- B-1: Picture of Water Source Sign
- B-2: Lake Geraldine Dam Expansion Drawings (2006)
- B-3: Water Treatment Plant Drawings (2003)
- B-4: Water Treatment Plant Operation & Maintenance Manual (2004)
- B-5: Underwater Dive Report (2010)
- B-6: Watershed Mapping and Monitoring for Northern Community Impact Assessment
- B-7: Lake Geraldine Dam - Dam Safety Review (2006)
- B-8: Lake Geraldine Dam - Dam Safety Inspections (2009, 2010, 2011, 2012)
- B-9: Lake Geraldine Dam - Permanent Record File (2011)

Appendix C: Wastewater:

- C-1: Picture of Lagoon Identification
- C-2: Sewage Lagoon Drawing (1988)
- C-3: Wastewater Treatment Plant Phase 1 Drawings (2005)
- C-4: Lift station No. 1 - As-Built Drawings (2007)
- C-5: Lift Station No. 2 - As-Built Drawings (2011)
- C-6: Sludge Management Operation & Maintenance Manual (2006)
- C-7: Wastewater Treatment Plant Operation & Maintenance Manual (2006)
- C-8: Sewage Lagoon West Berm Rehabilitation Reports and Drawings (2006)
- C-9: Iqaluit Wastewater Treatment Plant Technical Overview of 2005 Secondary Sewage Treatment Plant Design (2011)
- C-10: Sewage Lagoon Dam Safety Inspections (2006, 2009, 2011)
- C-11: Sewage Lagoon Permanent Record File (2012)
- C-12: Sewage Lagoon Dam Safety Review Requirement Investigation (2012)

Appendix D: Solid Waste

- D-1: Picture of Landfill Sign
- D-2: Landfill Facility Expansion Drawings (2001)
- D-3: Landfill Drawings (2006)
- D-4: Landfill Berm Repair Drawings (2011)
- D-5: Solid Waste Facility Operations & Maintenance Manual (2005)
- D-6: Landfill Water Management Improvements Report (2009)

- D-7: West 40 Landfill Drainage Management Review (2011)
- D-8: Iqaluit Sewage Sludge Management Composting Pilot Project Report (2009)
- D-9: Iqaluit Waste Management Project Terms of Reference (2010)

Additional File Submissions & Correspondence:

1. Email from Robin Ikkutisluk, Licence Administrator Assistant, NWB to Megan Leach, Director of Engineering and Sustainability, City of Iqaluit; Re: Acknowledgement of Renewal Water Licence Application, dated **October 29, 2012.**

2. Letter from Robin Ikkutisluk, Licence Administrator Assistant, NWB to Megan Leach, Director of Engineering and Sustainability, City of Iqaluit; Re: Acknowledgement and Receipt of Application Fee Renewal Water Licence, dated **October 29, 2012.**

3. Email from Robin Ikkutisluk, Licence Administrator Assistant, NWB, to Megan Leach, Director of Engineering and Sustainability, City of Iqaluit, Guide6 Electronic Documentation, dated **November 20, 2012.**

4. Email from Robin Ikkutisluk, Licence Administrator Assistant, NWB to Megan Leach, Director of Engineering and Sustainability; Re: City of Iqaluit Application for Amendment request withdrawal, dated **November 21, 2012.**

5. Letter from Sean Joseph, Technical Advisor, NWB to John Hussey, Chief Administrator Officer, City of Iqaluit; Re: Application for Renewal Water Licence, dated **April 8, 2013.**

6. Letter from John Hussey, Chief Administrative Officer, City of Iqaluit to Sean Joseph, Technical Advisor, NWB; Re: Response to April 8, 2013; Re: Letter regarding Application for Water License Renewal, dated **April 30, 2013.**

7. Letter from Sean Joseph, Technical Advisor, NWB to John Hussey, Chief Administrative Officer; Re: City of Iqaluit's Water Licence Renewal Application Addendum Requirements, dated **July 8, 2013.**

8. Letter from John Hussey, Chief Administrative Officer, City of Iqaluit to Jaswir Dhillon, Technical Advisor, NIRB; Re: Request for Additional Information Required for the City of Iqaluit's Water Licence Renewal Project Proposal, dated **July 25, 2013.**

9. Letter from John Hussey, Chief Administrative Officer, City of Iqaluit to Sean Joseph, Technical Advisor, NWB; Re: City of Iqaluit Renewal Application Addendum, dated **September 27, 2013.**

10. Letter from Phyllis Beaulieu, Manager of Licensing, NWB to John Hussey, Chief Administrative Officer, City of Iqaluit; Re: Renewal Amendment Application City of Iqaluit's Type "A" Water Licence, dated **October 21, 2013.**

11. Letter from David Abernethy, Regional Coordinator, AANDC to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Completeness Assessment, dated **November 8, 2013.**

12. Letter from Phyllis Beaulieu, Manager of Licensing, NWB to John Hussey, Chief Administrative Officer, City of Iqaluit; Re: Renewal Amendment Application City of Iqaluit's Type "A" Water Licence, dated **December 11, 2013.**

13. Email from Damien Cote, Executive Director, NWB to Erik Allain, Manager of Field Operations, AANDC; Re: Renewal Amendment Application, dated **January 11, 2014.**

14. Email from Erik Allain, Manager of Field Operations, AANDC to Damien Cote, Executive Director, NWB; Re: Renewal Amendment Application, dated **January 13, 2014.**

15. Email from Damien Cote, Executive Director, NWB to Erik Allain, Manager of Field Operations, AANDC, Re: Renewal Amendment Application, dated **January 13, 2014.**

16. Email from Megan Leach, Director of Engineering and Sustainability, City of Iqaluit to Robin Ikkutisluk, Licence Administrator Assistant and Phyllis Beaulieu, Manager of Licensing, NWB; Re: Outstanding Solid Waste Management Submissions, dated **January 31, 2014.**

17. Email from Robin Ikkutisluk, Licence Administrator Assistant, NWB to John Hussey, Chief Administration Officer, City of Iqaluit, and Meagan Leach, Director of Engineering and Sustainability; Re: City of Iqaluit Renewal Application Submission of Reports, dated **February 19, 2014.**

18. Email from Megan Leach, Director of Engineering and Sustainability to Robin Ikkutisluk, Licence Administrator Assistant, NWB; Re: City of Iqaluit Renewal Application Submission of Reports, dated **February 19, 2014.**

19. Email from Richard J. Sparham Project Officer, City of Iqaluit to Sean Joseph, Technical Advisor, NWB; Re: City of Iqaluit's Type "A" Water Licence Renewal and Amendment Project Proposal, dated **September 17, 2014.**

20. Letter from Elizabeth Copland, Chairperson NIRB to the Honourable Bernard Valcourt, Minister of AANDC; Re: Screening Decision for the City of Iqaluit's Application for Water Licence Renewal Project Proposal, dated **November 3, 2014.**

21. Letter from Robert Savard, Water Resources Officer, AANDC to Paul Clow, Project Officer, City of Iqaluit; Re: Appendix C Re-evaluating Water Monitoring Letter November 14, 2014, dated **December 5, 2014.**

22. Submission from Concentric Associates International Incorporated to NWB Licensing; Re: Lake Geraldine Dam Safety Review Iqaluit Nunavut Final Report, dated **February 5, 2015.**

23. Letter from John Mabberi-Mudonyi, Acting Chief Administration Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licencing, NWB; Re: Confirmation of Submissions and Scope for Type "A" Water Licence Renewal Amendment Application, dated **March 2, 2015.**

24. Email from Michael Mohammed, Environment Canada to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Accessing documents for 3AM-IQA0612 City of Iqaluit Type "A" Water Licence Renewal Amendment Application, dated **March 31, 2015.**

25. Letter from Sarah Forte, Waste Water Management Coordinator AANDC to Phyllis Beaulieu, Manager of Licensing, NWB; Re: AANDC Completeness Assessment of an Application to Amend and Renew Water Licence 3AM-IQA0612 City of Iqaluit Municipal Undertaking, dated **March 31, 2015**.

26. Email from Robin Ikkutisluk, Licence Administrator Assistant, NWB to John Price, and Michael Mohammed, Environment Canada; Re: Extension Request City of Iqaluit Type "A" Renewal and Amendment Water Licence Application, dated **April 1, 2015.**

27. Letter from John Price, Environment Assessment Officer, EC to Phyllis Beaulieu, Manager of Licensing, NWB; Re: 3AM-IQA0612 City of Iqaluit Type "A" Water Licence Renewal and Amendment Application, dated **April 15, 2015.**

28. Letter from Ben Kogvik, Acting Executive Director, NWB to Muhamud Hassan, Chief Administrative Officer, and Meagan Leach, Director of Engineering and Sustainability, City of Iqaluit; Re: Licence No. 3AM0IQA0612 Type "A" Notice of Renewal Amendment Application and Commencement to Technical Review Period for City of Iqaluit Municipal Water Licence, dated **May 28, 2015.**

29. Email from Robin Ikkutisluk, Licensing Administrator Assistant, NWB; to Michael Hanssen, City of Iqaluit; Re: Notice of Application and Commencement of Technical Review Period City of Iqaluit, dated **May 28, 2015.**

30. NWB Notice to Local Organizations Request to Post Notices from Robin Ikkutisluk, Licensing Administrator Assistant, NWB; English and Inuktitut, dated **May 28, 2015.**

31. Email from Jaida Ohokannoak, Manager, Technical Administration NIRB to Robin Ikkutisluk, Licensing Administrator Assistant, NWB; Re: NIRB 13UN034 - NWB Licence No. 3AM-IQA0612 City of Iqaluit Type "A" Renewal Amendment Application, dated **June 5, 2015.**

32. Email from Phyllis Beaulieu, Manager of Licensing, NWB to Meagan Leach, Director of Engineering and Sustainability, City of Iqaluit; Re: Request for deadline Extension – Re: 150528 Notice of Application and Commencement of Technical Review Period, dated **June 30, 2015.**

33. Email from Michael Mohammed, Environment Canada, to Robin Ikkutisluk, Licensing Administrator Assistant, NWB; Request for deadline extension - Re:150528 Notice of Application and Commencement of Technical Review Period, dated **June 30, 2015.**

34. Email from Meagan Leach, Director of Engineering and Sustainability, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Request for deadline Extension - Re: 150528 Notice of Application and Commencement of Technical Review Period City of Iqaluit, dated **July 2, 2015.**

35. Email from Phyllis Beaulieu, Manager of Licensing, NWB to Meagan Leach, Director of Engineering and Sustainability, City of Iqaluit: Re: Extension to Deadline Completeness Review, dated **July 2, 2015.**

36. Letter from Sarah Forte, Water Management Coordinator, AANDC to Robin Ikkutisluk, Licensing Administrator Assistant, NWB; Re: AANDC Review of the City of Iqaluit's

Type "A" Amendment and Renewal Water Licence Application 3AM-IQA0612 Municipal Undertaking, dated **July 10, 2015.**

37. Letter from Richard Janusz Senior Fisheries Protection Biologist, DFO to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Licence No. 3AM-IQA0612 Type "A" Notice of Renewal Amendment Application and Commencement of Technical Review Period for City of Iqaluit Municipal Water Licence, dated **July 10, 2015.**

38. Letter from John Price, Environment Assessment Officer, EC to Phyllis Beaulieu, Manager of Licensing, NWB; Re: 3AM-IQA0612 Notice of Application and Commencement of Technical Review Period City of Iqaluit with Comment Table, dated **July 10, 2015.**

39. Email from Paul Crow Project Officer, City of Iqaluit to Sean Joseph, Sr. Technical Advisor, NWB; Re: City of Iqaluit Response to Comment Period Water Licence 3AM-IQA0612, dated **July 23, 2015.**

40. Letter from Robin Ikkutisluk, Acting Manager of Licensing, NWB; to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit; Re: 3AM-IQA0612 Previous Licence No. 3AM-IQA0611 Type "A" Amendment Renewal Application by the City of Iqaluit for a Municipal Undertaking, dated **August 10, 2015.**

41. Email from Robin Ikkutisluk, Acting Manager of Licensing, NWB to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit; Re: Type "A" Amendment Renewal Application by the City of Iqaluit for Municipal Undertaking, dated **August 10, 2015.**

42. Letter from Peter Scholz, Senior Planner, NPC, to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit; Re: NWB 3AM-IQA0612 Type "A" Amendment, dated **August 28, 2015.**

43. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: City of Iqaluit's Response to 150710 3AM-IQA0612 EC Response to City of Iqaluit Comment Table, dated **November 13, 2015.**

44. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: City of Iqaluit's Response to 150331 3AM-IQA0612 Completeness Assessment AANDC Review, dated **November 13, 2015.**

45. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: City of Iqaluit's Response to Stakeholders Submission 150415 3AM-IQA0612 EC Letter of Comment, dated **November 13, 2015.**

46. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: City of Iqaluit's Response to 150710 3AM-IQA0612 DFO Comment to NWB on Completeness, dated **November 13, 2015.**

47. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: City of Iqaluit's Response to Stakeholders Submission 150710 3AM-IQA0612 AANDC Technical Comments, dated **November 13, 2015.**

48. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: City of Iqaluit's Response to 131106 3AM-IQA0612 Completeness Assessment AANDC Review, dated **November 13, 2015.**

49. Email from Phyllis Beaulieu, Manager of Licensing, NWB to Paul Clow Project Officer, City of Iqaluit; Re: 3AM-IQA0612 Acknowledgement of Submissions, dated **November 16, 2015.**

50. Email from Phyllis Beaulieu, Manager of Licensing, NWB to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit, Matthew Hamp, Director of Public Works and Engineering City of Iqaluit and Paul Clow Project Officer, City of Iqaluit; Re: 3AM-IQA0612 TM & PHC Correspondence, dated **November 26, 2015.**

51. Letter from Stephanie Autut, Executive Director, NWB to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit; Re: Water Licence No. 3AM-IQA0612 or Licence No. 3AM-IQA0611 Type "A" Renewal Amendment Application by the City of Iqaluit for a Municipal Undertaking, dated **November 26, 2015.**

52. Letter from Sean Joseph, Senior Technical Advisor, NWB to City of Iqaluit distribution; Re: Draft Agenda TM/PHC Draft Agendas, dated **November 26, 2015.**

53. Letter from Sarah Forte, Water Management Coordinator AANDC to Matthew Hamp, Director of Public Works and Engineering, City of Iqaluit; Re: First reply to City of Iqaluit's response to AANDC's comments regarding its renewal application for water licence 3AM-IQA, dated **November 27, 2015.**

54. Email from Robin Ikkutisluk, Licensing Administrator, NWB to Bradley Summerfield, AANDC; Re: City of Iqaluit Water Licence Renewal Application Documents, dated **December 1, 2015.**

55. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Draft Agenda Technical Meeting and Pre-Hearing Conference, dated **December 3, 2015.**

56. Email from Sean Joseph, Senior Technical Advisor, NWB to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit, Paul Clow, Project Officer, City of Iqaluit, Matthew Hamp, Director of Public Works and Engineering City of Iqaluit; Re: Draft Agenda Technical Meeting and Pre-Hearing Conference, dated **December 4, 2015.**

57. Letter from Phyllis Beaulieu, Manager of Licensing, NWB to Muhamud Hassan, Chief Administrative Officer, City of Iqaluit; Re: Draft Agenda Technical Meeting and Pre-Hearing Conference, dated **December 4, 2015.**

58. Email from Sean Joseph, Senior Technical Advisor, NWB; to Matthew Hamp Director of Public Works and Engineering City of Iqaluit; Re: Samples of Presentation, dated **December 4, 2015.**

59. Email from to Matthew Hamp, Director of Public Works and Engineering City of Iqaluit, to Sean Joseph, Senior Technical Advisor, NWB; Re: Samples of Presentations, dated **December 8, 2015.**

60. Email from Sean Joseph, Senior Technical Advisor NWB to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Samples of Presentations, dated **December 9, 2015.**

61. Email from Sarah-Lacey McMillan, EC, to Licensing; Re: 151126 3AM-IQA0612 TM & PHC Correspondence, dated **December 9, 2015.**

62. Email from Richard Janusz, Senior Fisheries Protection Biologist, DFO to Licensing, NWB; Re: 151126 3AM-IQA0612 TM & PHC Correspondence, dated **December 11, 2015.**

63. Letter from Sarah Forte, Water Management Coordinator AANDC to Matthew Hamp, Director of Public Works and Engineering City of Iqaluit: Re: Second reply to City of Iqaluit's response to AANDC's comments regarding its renewal application water licence 3AM-IQA with Comment table tracking, dated **December 14, 2015.**

64. Email from Phyllis Beaulieu, Manager of Licensing, NWB to Matthew Hamp, Director of Public Works and Engineering, City of Iqaluit; Re: Request Confirmation on Attendance at TM/PHC, dated **December 14, 2015.**

65. Email from Matthew Hamp, Director of Public Works and Engineering, City of Iqaluit to Phyllis Beaulieu, Manager of Licensing, NWB; Re: Request Confirmation on Attendance at TM/PHC, dated **December 14, 2015.**

66. Email from Phyllis Beaulieu, Manager of Licensing, NWB to Matthew Hamp, Director of Public Works and Engineering City of Iqaluit, Paul Clow, Project Officer, City of Iqaluit, Muhamud Hassan, Chief Administrative Officer, City of Iqaluit; Re: Final TM/PHC Agenda, dated **December 14, 2015.**

67. Letter from Phyllis Beaulieu, Manager of Licensing, NWB; Re: Agenda TM Community Session PHC, dated **December 14, 2015.**

68. Radio Announcement to City of Iqaluit, from Ida Porter, Licensing Administrative Assistant, NWB; Re: Radio Announcement TM/PHC, dated **January 5, 2016.**

69. Submission from INAC to Licensing NWB; Re: INAC presentation for technical meeting English, French, Inuktitut, dated **January 7, 2016.**

70. Submission from DFO to Licensing NWB; Re: DFO presentation for technical meeting English, French, Inuktitut, dated **January 7, 2016.**

71. Submission from ECCC to Licensing NWB; Re: ECCC presentation for technical meeting English, French, Inuktitut, dated **January 7, 2016.**

72. Radio Announcement to City of Iqaluit, from Ida Porter, Licensing Administrative Assistant, NWB; Re: Radio Announcement TM/PHC, dated **January 7, 2016.**

73. Submission from NWB letter to City of Iqaluit distribution; Re: Community Session Presentation, dated **January 11, 2016.**

74. Submission from City of Iqaluit to NWB Licensing, Re: City of Iqaluit Water Board TM/PHC final English, French, Inuktitut, dated **January 12, 2016.**

75. Submission from NWB Licensing, to City of Iqaluit distribution; Re: TM Community Session PHC Final Agenda Inuktitut, dated **January 12, 2016.**

76. Letter from Curtis Didham, Inspector and Fishery Officer, EC, to City of Iqaluit, and John Hussey, Chief Administration Officer, dated March 5, 2013; Re: Fisheries Act Inspector's Direction with AANDC and EC Inspector's Direction 4th Quarterly Update 2015, dated **January 22, 2016.**

77. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Scope Clarification of Renewal Application for Water Licence 3AM-IQA0612, dated **January 22, 2016.**

78. Email from Robin Ikkutisluk, Licence Administrator Assistant, NWB to Paul Clow Project Officer, City of Iqaluit; Re: Nunavut Water Board response to commitments No. 5 City of Iqaluit with Table, dated **January 25, 2016.**

79. Letter from Sean Joseph, Senior Technical Advisor, NWB City of Iqaluit; Re: NWBs Response to Commitments No. 5, dated **January 25, 2016.**

80. Letter from Justin Hack, Water Resource Officer, INAC to Karen Kharatyan, Manager of Licensing, NWB; Re: A Summary of Compliance with the INAC Inspector's Direction, City of Iqaluit, dated **January 29, 2016.**

81. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Update Compliance History Inspectors Direction, dated **January 29, 2016.**

82. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Landfill Fire Emergency Measures Update, dated **January 29, 2016.**

83. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Prepare an addendum to the Landfill Operations and Maintenance Manual to include the current sampling program, dated **February 5, 2016.**

84. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Additional information regarding historical use of Lake Geraldine drainage channel, dated **February 5, 2016.**

85. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Identification of off-site sampling point locations down gradient of the West 40 Landfill, dated **February 5, 2016.**

86. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Response to NWB Recommendations Regarding Management Plans Submitted for the City of Iqaluit Water Licence Application, dated **February 5, 2016.**

87. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Changes to Schedule C of expired licence 3AM-IQA0612 and the Monitoring Program, dated **February 5, 2016.**

88. Email from Paul Clow, Project Officer, City of Iqaluit to Sean Joseph, Senior Technical Advisor, and Karen Kharatyan, Acting Manager of Licensing, NWB; Re: Submission February 17, 2016, dated **February 11, 2016.**

89. Email from Karen Kharatyan, Acting Manager of Licensing, NWB to Paul Clow, Project Officer, City of Iqaluit; Re: Submission February 12, 2016 dated **February 17, 2016.**

90. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Changes to the Conditions to expired Water Licence 3AM-IQA0611, dated **February 19, 2016.**

91. Letter from Muhamud Hassan, Chief Administrative Officer, City of Iqaluit to Karen Kharatyan, Manager of Licensing, NWB; Re: Location of Wastewater Treatment Plant Outfall in relation to the Ordinary High Tide Mark, dated **February 19, 2016.**

92. Letter from Stephanie Autut, Executive Director, NWB to City of Iqaluit Distribution; Re: Type "A" Water Licence No. 3AM-IQA0612 Pre-Hearing Conference Decision Regarding an Application for Renewal and Amendment, dated **February 19, 2016.**

93. NWB Notice of Public Hearing English and Inuktitut to City of Iqaluit distribution, dated **February 19, 2016.**

94. Letter from Zoya Martin, Aquatic Science Biologist, DFO to Paul Clow, Project Officer, City of Iqaluit, and Staff at the City of Iqaluit, Nunavut; Re: Lake Geraldine Drainage Channel Iqaluit Nunavut, dated **February 22, 2016.**

95. Letter from Muhamud Hassan, Chief Administrative Officer to Karen Kharatyan, Manager of Licensing, NWB; Re: Additional information regarding historical use of Lake Geraldine drainage channel, dated **February 23, 2016.**

96. Letter from Bradley Summerfield, Environmental Assessment Coordinator EC to Sean Joseph, Senior Technical Advisor, NWB; Re: 3AM-IQA0612 City of Iqaluit Water Licence Renewal Application, dated **March 30, 2016.**

97. Submission from ECCC's to NWB Licensing; Re: ECCC's Intervention Respecting the City of Iqaluit Municipal Water Licence 3AM-IQA0612, dated **March 30 2016.**

98. Submission from INAC to NWB Licensing; Re: Final Submission Regarding City of Iqaluit Type "A" Water Licence Renewal Amendment Application for Municipal Undertakings, dated **March 30, 2016.**

99. Submission from ECCC, to NWB Licensing; Re: Executive Summary English and French, dated **March 31, 2016.**

100. Email from Robin Ikkutisluk, Licensing Administrator Assistant, NWB to Anne Wilson, EC and Distro Iqaluit, ECCC; Re: Submission of Changes to Monitoring Program City of Iqaluit Type "A" Renewal Water Licence, dated **April 1, 2016.**

101. Letter from Stephanie Autut, Executive Director, NWB to Matthew Hamp, Director of Public Works and Engineering City of Iqaluit, Paul Clow, Project Officer, City of Iqaluit; Re: Follow Correspondence Including Agenda, dated **April 15, 2016.**

102. Radio Announcement to City of Iqaluit Public Hearing Announcement, from Ida Porter, Licensing Administrative Assistant, NWB, dated **April 15, 2016.**

103. TV Ad to City of Iqaluit TM PHC Public Hearing Announcement, from Ida Porter, Licensing Administrative Assistant, NWB, dated **April 15, 2016.**

104. Submission from ECCC to NWB Licensing, NWB; Re: ECCC Final Presentation English and Inuktitut, dated **April 20, 2016.**

105. Submission from INAC to Licensing Department, NWB; Re: INAC Final Community Presentation and Technical Final Presentation, dated **April 20, 2016.**

106. Submission from City of Iqaluit, to Licensing Department NWB; Re: City of Iqaluit Water Board Public Hearing Presentation Final, dated **April 22, 2016.**

107. Submission from DFO to Licensing Department NWB; Re: DFO Detailed Written Submission Iqaluit Water Licence Renewal May 4 to 5 2016, dated **April 22, 2016.**

108. Email from Ida Porter, Licensing Administrative Assistant, NWB to City of Iqaluit Distribution; Re: 3AM-IQA0612 Public Hearing Confirmation on Attendance and list of attendees, dated **April 26, 2016.**

109. Email from Anne Wilson, EC to Ida Porter, Licensing Administrative Assistant, NWB; Re: EC Public Hearing Confirmation on attendance and list of attendees, dated **April 27, 2016.**

110. Letter form Thomas Hoggarth, Acting Regional Manager, Regulatory Reviews, DFO to Karen Kharatyan, Manager of Licensing, NWB; Re: DFO 14 HCAA 01381 letter to NWB Iqaluit water licence renewal, dated **April 28, 2016.**

111. Submission from DFO to NWB Licensing; Re: DFO Iqaluit Public Hearing Presentation May 4 to 5 2016, dated **April 28, 2016.**

112. Email from Richard Janusz, DFO to Ida Porter, Licensing Administrative Assistant, NWB; Re: DFO Public Hearing Confirmation on attendance and list of attendees, dated **April 28, 2016.**

113. Letter from Stephanie Autut, Executive Director, NWB to Matthew Hamp, Director of Public Works and Engineering City of Iqaluit, Paul Clow, Project Officer, City of Iqaluit; Re: Inuktitut Follow Correspondence Including Agenda, dated **April 28, 2016.**

114. Email from Scott Burgees, P Geo Acting Manager Water Resources Division, INAC, to Ida Porter, Licensing Administrative Assistant, NWB; Re: INAC Public Hearing Confirmation on attendance and list of attendees dated, **April 28, 2016.**

115. Submission from Ida Porter, Licensing Administrative Assistant, NWB to City of Iqaluit; Inuktitut Radio Announce PH, dated **April 28, 2016**.
116. Submission from NWB Licensing, to City of Iqaluit, Inuktitut TV Ad announcement PH, dated **April 28, 2016.**

117. Letter from Stephanie Autut, Executive Director, NWB to Matthew Hamp, Director of Public Works and Engineering City of Iqaluit, Paul Clow, Project Officer, City of Iqaluit; Re: French Follow Correspondence Including Agenda, dated **April 29, 2016.**

118. Submission from INAC to NWB Licensing; Re: INAC final community presentation French and Inuktitut and INAC final public presentation Inuktitut, dated **April 29, 2016.**

119. Email from Paul Clow, Project Officer City of Iqaluit to Ida Porter, Licensing Administrative Assistant, NWB; Re: Public Hearing City of Iqaluit list of attendees, dated **April 29, 2016.**

120. Radio Announcement (French) from Ida Porter, Licensing Administrative Assistant, NWB; Re: City of Iqaluit Public Hearing Announcement, dated **April 29, 2016.**

APPENDIX E - Sign-in Sheets – List of Participants in the Public Hearing

Public Hearings — Day 1

Wednesday, May 4, 5, 2016 3AM-IQA0612 — Morning

Name	Last Name	Organization	Phone Number	Email Address
Stephanie	Autut	NWB		
Dave	Hohnstein	NWB		
Ben	Kogvik	NWB		
Ida	Porter	NWB		
Sean	Joseph	NWB		
Lootie	Toomasie	NWB Board		
Makabe	Nartok	NWB Board		
Theresa	Meadows	NWB Legal		
Caroline	Shuman	Court Reporter		
Norman	Mike	NWB Board		
Elaina	Cooper	155		
Felai	Uniyssaraq	Inuirvik		
Justin	Hache	INAC		
Jonathan	Mosher	INAC		
Edith	Baragar	INAC		
Sarah	Forlei	INAC		
SCOTT	BURGESS	INAC		
MATTHEW	HAMP	City of Iqaluit		
RICHARD	SPARHAM	City of Iqaluit		
PAUL	CLOW	City of Iqaluit		
Amanda	Wingerter	INAC		
Anne	Wilson	ECCC		
Bradley	Summerfeld	ECCC		
~~DIANNE~~ CURTIS	DIDHAM	ECCC		

Public Hearing
Wednesday, May 4, 2016
3AM-IQA0612

Day 1 Morning Session

Name	Last Name	Organization	Phone Number	Email Address
Lisa P	Bachelliez	INAC	867-975-4568	
George	Metuq	ISS	979-1012	
Daniel	Cuerrier	Cuerrier & Assoc.	979-1330	cuerrier@gmail.com
Mary	Hunt	TuKiliK Translator		
		Afternoon		
Paul S	Clow	City of Iqaluit	867-979-6363	p.clow@city.iqaluit.nu.ca
DAVID	LYCON	Stantec	604-551-2863	david.lycon@stantec.com
Daniel	Cuerrier	Cuerrier + Asso	979-1330	
RICHARD	SPARHAM	CITY OF IQALUIT	867-979-6363	r.sparham@city.iqaluit.nu.ca
George	Mehn	ISS		
Elaina	Cooper	ISS	979-1012	
Amanda	Wingerter	INAC	975-3877	Amanda.Wingerter@aandc.gc.ca
Lisa	Bachelliez	INAC	975-4568	LisaBachelliez@aandc-gc.ca
Jonathon	Mesher	INAC		
Sarah	Forte	INAC		
SCOTT	BURGESS	INAC		
MATTHEW	HAMP	City of Iqaluit		
Anne	Wilson	ECCC		
Brad	Summerfield	ECC		
CURTIS	DRUMM	ECCC		
Andrea	Markey	INAC	975-4554	Andrea.Markey@aandc.gc.ca
Xiaohong	Yang	INAC	975-4584	Xiaohong.Yang@aandc.gc.ca
Stephanie	Autut	NWB ED		
Dave	Hohnstein	NWB DTS		
Jason	Hack	INAC		

Public Hearing
Wednesday May 4, 2016
3AM - IQA 0612

Day 1
Afternoon

Name	Last Name	Organization	Phone Number	Email Address
EDITH	BARAGAR	INAC		
Ben	KOGVIK	NWB ~~Board~~		
Ida	Porter	NWB		
Norman	Mike	NWB Board		
Lootie	Toomasie	NWB Board		
Theresa	Meadows	NWB Legal		
Caroline	Schuman	Court Dicta		
Mary	Hunt	Tukilik Translator		
Makabe	Nartok	NWB Board		
Sean	Joseph	NWB T.A		
CHRISTIANNE	LAFFERTY	INAC		
William	Autut	Public		willautut@gmail.com
Michael	Setuchand	INAC		
RICHARD	JANUSZ	DFO		richard.janusz@

Public Hearing
Wednesday, May 4, 2016
3AM-IQA 0612

Day 1
Evening

Name	Last Name	Organization	Phone Number	Email Address
Stephanie	Autut	NWB ED		
Dave	Hohnstein	NWB DTS		
Sean	Joseph	NWB		
Ben	Kogvik	NWB		
Ida	Porter	NWB		
Theresa	Meadows	NWB Legal		
Caroline	Schuman	Court Dicta		
Mary	Hunt	Tuk'ilik Translator		
Lootie	Toomasie	NWB Board		
Makabe	Nartok	NWB Board		
Norman	Mike	NWB Acting Chair		
Sarah	Forté	INAC		
Paul	Clerow	City of Iqaluit		
RICHARD	JANUSZ	DFO		
Bradley	Summerfield	ECCC		
Anne	Lyploom	"		
SCOTT	BURGESS	INAC		
DAVID	LYCON	STANTEC		
MATTHEW	HAMP	City of Iqaluit		
RICHARD ~~SPARHA~~	SPARHAM	City of Iqaluit		
Fiona	Cooper	ISS	979-1012	
Daniel	Guertin	Guertin & Asso	979-1330	
[illegible]	Metty	ISS		
CURTIS	DELANEY	ECCC		
SONIA	ARABES	NWB		

City of Iqaluit Water Licence Renewal Application
St. Jude's Anglican Parish Hall - Iqaluit, NU
May 4-5, 2016 Public Hearing

May 4, 2016
Evening

Registration Form

NO.	First Name	Last Name	Organization Representing	Address	Phone	Fax	E-mail
1	Justin [redacted]	Huck	INAC				
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City of Iqaluit Water Licence Renewal Application
St. Jude's Anglican Parish Hall - Iqaluit, NU
May 4-5, 2016 Public Hearing

May 5, 2016
Morning

Registration Form

IO.	First Name	Last Name	Organization Representing	Address	Phone	Fax	E-mail
1	GEO	[illegible]	IGC				
2	JANUSZ	LYCON	STANTEC				
3	RICHARD	JANUSZ	DFO				richard.janusz2@dfo-mpo.gc.ca
4	MATTHEW	HAMP	City of Iqaluit				
5	SCOTT	BURGESS	INAC				
6	[illegible]	[illegible]	INAC				
7							
8	[illegible]	[illegible]	CURRENT LASSO				
9	Sarah	Forté	INAC				
10	CURTIS	DEDHAM	ECC				
11	ANNE	WILSON	"				
12	BRADLEY	SUMMERFIELD	"				
13	PAUL	CLOW	City of Iqaluit				
14	STEPHANIE	AUTUT	NWB EO				
15	JUSTIN	HUCK	INAC.				
16	DAVE	HOHNSTEIN	NWB DTS				
17	SEAN	JOSEPH	NWB				
18	BEN	KOGVIK	NWB				
19	IDA	PORTER	NWB				
20	NORMAN	MIKE	NWB Board				
21	MAKABE	NARTOK	NWB Board				
22	LOOTIE	TOOMASIE	NWB Board				
23	MARY	HUNT	TUKILIK Translator				
24	CAROLINE	SCHUMAN	Court Dicta				
25	ELAINA	COOPER	ISS				
26							
27							
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Appendix C INAC SAMPLING GUIDE

QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

GUIDELINES

FOR USE BY CLASS "A" LICENSEES IN MEETING SNP REQUIREMENTS

AND FOR SUBMISSION OF A QA/QC PLAN

JULY 1996

DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS CANADA
WATER RESOURCES DIVISION
AND THE
NORTHWEST TERRITORIES WATER BOARD

Table of Contents

1.0 Introduction and Definitions

In order to assist Licensees in completing their Quality Assurance and Quality Control (QA/QC) Plan, the following guidelines are provided, which indicates the minimum information that should be included.

These Guidelines are divided into three sections:

1) Field Sampling
2) Lab Analysis
3) Reporting Requirements

It is recognized that there may be different interpretations as to what is covered by "Quality Assurance/Control" due to the fact that certain Licensees have their own laboratories, while others only use commercial laboratories. For licence purposes, "Quality Assurance" and "Quality Control" refer to the following:

Quality Assurance: is the system of activities designed to better ensure that quality control is done effectively; while

Quality Control: is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy and reliability.

2.0 Field Sampling

2.1 Sample Collection

2.1.1 Location

A QA/QC plan must identify the locations of all sampling stations and the markers used to identify the stations. If the Surveillance Network Program (SNP) of the Water Licence does not specify sampling locations, locations should be chosen with help from an Inspector.

Buoys and landmarks identify sampling stations in tailings ponds and lakes, while sign post positioning usually marks stream sample stations. Stations should be used repeatedly, with the same personnel and techniques to reduce operational error. The use of Global Positioning System (GPS) to identify Latitude and Longitude for sampling stations is recommended.

2.1.2 Sampling Equipment

The Plan must include a detailed section on the equipment used for sampling, the rationale behind the choices of equipment, and descriptions of how the equipment is maintained and calibrated. Equipment and bottles should be selected so that they do not contaminate or otherwise alter the concentrations of parameters of interest.

Sampling devices, sample bottles and filtration devices should be constructed of non-metallic material. Most samples are now collected in containers constructed of high density polyethylene plastic. However, there are some exceptions, when testing for oil and grease or phenols glass containers are to be used. When conducting a fish bioassay, plastic drums are used while hydrocarbon based containers are not to be used for the collection of organic samples.

This section should also identify whether new or used bottles are used for each sample analysis. New bottles are preferred,

but sample containers may be used repeatedly with proper handling measures.

If old bottles are used, a detailed description should be included, noting how they are maintained, stored and cleaned. Usually, this will closely resemble the product manufacturer's instructions. An example of how bottles should be cleaned is outlined below:

- Rinse well with hot tap water for one minute or more.
- Empty bottle and add 30% HNO_3 to approximately 1/3 container capacity. Shake well for three to four minutes.
- Rinse vigorously with hot tap water for two minutes.
- Rinse thoroughly three times with tap water and three times with distilled water.
- Store with 0.2% HNO_3 for a minimum of one week.
- Rinse again with distilled water at least three times.

Bottles that are to be used for bacteria testing should be acid washed or autoclaved if possible.

Note: Additional information on bottle washing is also available from Water Resources Division.

2.1.3 Sampling Methods

This Section will include details on methods for sample collection and the equipment that is to be used for each station.

In lakes and ponds, regular sample bottles are used the majority of the time, but Van Dorn samples are often utilized. The sample or the sample bottle is usually lowered to mid

depth and washed three times before collecting the sample on the fourth submersion. Approximately 2% of the sample container capacity should remain to provide for mixing, preservative addition and thermal expansion.

Stream water sampling is usually done by plunging a sample bottle toward the current and allowing it to fill. Once again, the bottle should be rinsed three times before filling and room should be left for preservative addition and mixing.

A glass bottle should be used when sampling for oil and grease with the sample being collected during the first submersion and not rinsed three times first.

This section should also describe how often field blanks and replicate samples will be collected. Field blanks are samples of distilled/deionized water that are to be treated in exactly the same manner as the other samples. Blanks should therefore be taken to the field and handled and preserved as part of the sample program. They indicate when a sample may be contaminated and are indicative of general sample integrity. Replicate samples (duplicates and triplicates) are two or three samples collected from the same station at the same time. They help to ensure sample precision at the laboratory.

2.2 Sample Handling

2.2.1 Preservation

After collection, most samples must be preserved in order to prevent chemical or biochemical changes to the sample. The QA/QC plan must describe how samples from each station are to be preserved.

Preservation is generally done by the addition of certain chemicals into the bottle immediately after the sample is collected. **Table 1** is a general guide to preservatives and their appropriate concentrations. The QA/QC plan should contain more detailed information on the concentrations and amount of preservatives that will be used.

2.2.2 Sample Identification

The plan should include a description of the system used to identify samples. The system must provide positive sample identification and ensure that the identification is maintained. It is advisable to keep a logbook of samples that have already been delivered.

The identification can be maintained by marking the bottle itself or a label, with a water resistant, non-smear felt pen. The information should be clear to persons uninvolved in the sampling and may include such details as company name, sample area, SNP number, time and date.

2.2.3 Transportation

The section on transportation will describe how sample integrity will be ensured from the time of collection to completion of delivery. Delivery to the lab should be done as soon as possible after the samples have been collected.

Usually, samples are sealed and stored upright in a box with other samples to provide a snug, immobile storage space during transfer. Any samples that require refrigeration for preservation should be kept cool during transport.

3.0 Lab Analysis

Because certain Class "A" Licensees have their own analytical laboratory and others rely on commercial laboratories, this section of the Guidelines is divided accordingly.

3.1 Outside Laboratories

3.1.1 Lab Accreditation

The Licensee will identify in the plan the name of the commercial laboratory that will be conducting the analyses. A letter must be provided from the commercial lab indicating that they are accredited to conduct analyses on each of the required sampling parameters. Ideally, the lab should be accredited by the Canadian Associated for Environmental Analytical Laboratories (C.A.E.A.L.) and should provide a certificate stating parameters for which they are accredited.

3.1.2 Detection Limits

Detection limits for the commercial lab should be identified for all parameters and should be reported when any SNP data is submitted.

3.1.3 Methodology

Descriptions should be included for any methods of analysis used that are not outlined in "Standard Methods for the Examination of Water and Wastewater".

3.2 In House Laboratories

3.2.1 Identification of Analytical Laboratory/Detection Limits

Licensees using in-house labs shall identify their detection limits for all parameters and report them when any SNP data is submitted. The Licensee shall also identify the commercial lab they use to check for quality control.

3.2.2 For Overall Analytical Methods, Precision and Accuracy

The plan must describe how the Licensee will ensure precision and accuracy in their analytical methods. This includes what action will be taken if any sample results are found to be outside the appropriate ranges.

All analyses should be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" or by other approved methods. In addition, the lab should analyze standard reference material for each parameter measured. For each parameter (group) to be measured, a complete description of the sampling procedure must be documented and adhered to.

If any sample results are outside the appropriate QA/QC ranges, attempts should be made to correct the problem and the sample shall be immediately re-analyzed. If any analysis indicates a violation of a licence condition, an Inspector shall be notified of the violation, any corrective action taken, and the results of retests.

3.2.3 Accuracy Requirements

The plan should document how the Licensee will go about

ensuring accuracy in the laboratory. Accuracy is the measurement of how closely a value approximates a standard, or true value. The Licensee should identify the frequency at which certified or reference standards will be analyzed during each sampling period.

3.2.4 Precision Requirements

Precision is a measure of the closeness or repeatability of a set of values. This section will describe how and when replicate samples are taken to ensure lab precision. It is recommended that the Licensee take triplicates at one SNP station during each sampling period. If daily sampling is required at only one station, a duplicate sample should be taken each time, with a triplicate sample taken one a week.

3.2.5 Methodology

Descriptions should be included of any methods of analysis that are not taken from "Standard Methods for the Examination of Waste and Wastewater." Standard methods should be referenced.

4.0 Reporting Requirements

4.1 General Submission

The QA/QC plan will contain a section outlining what information will be reported in the monthly SNP reports. Any control charts or graphs which display the precision and accuracy of the methods used to analyze the samples should be submitted with the report. This includes warning and control limits used to determine acceptability of the data.

4.2 Outside Laboratories

The Licensee shall outline the number of replicate samples that will be collected and submitted with each SNP report. It is recommended that one set of duplicates or triplicates from an assigned SNP site, as well as the results from field blanks, be submitted with each required SNP report. This would serve as an internal/external check for the Licensee and the commercial lab.

4.3 In-House Laboratories

The Licensee shall outline the number of results from replicate samples that will be included with each required SNP report. It is recommended that two duplicate sets be collected per month at an assigned SNP site, with one set being sent to a commercial lab while the other is to be analyzed by the Licensee's lab. Analytical results from both labs should be submitted with each required SNP report. This would serve as an external check for the lab. Any results from a commercial lab should be presented on the lab's letterhead.

FOR FURTHER INFORMATION, CONTACT THE WATER RESOURCES DIVISION AT:

Box 1500
Yellowknife, NWT
X1A 2R3
(867) 669-2654 Phone
(867) 669-2716 Fax

Appendix 1
Table 1: General Summary of Special Sampling or Handling Techniques

Determination	Container	Minimum Sample Size (ml)	Preservation	Maximum Storage Recommended
BOD	Sterile polyethylene	1000	Refrigerate 4°C	24 hours
Conductivity	Polyethylene	500	Refrigerate 4°C	28 days
Total Cyanide	Polyethylene	500	Add NaOH to raise pH>12 refrigerate in dark	24 hours
Hardness	Polyethylene	100	Add Conc. HNO_3 to lower pH<2 OR (*) unpreserved	6 months
Metals, General	Polyethylene	250	For dissolved metals filter immediately, add Conc. $HN0_3$ to pH<2	6 months
Mercury	Glass (rinsed with 1 + 1 HNO_3)	500	Add Conc. HNO_3 or pH<2 or H_2SO_4 + 1 ml of 5% $K_2Cr_2O_7$, refrigerate 4°C	28 days
Nitrogen:				
Ammonia	Polyethylene	500	Analyze as soon as possible or add H_2S0_4 to pH<2, refrigerate OR (*) unpreserved	7 days
Nitrate	Polyethylene	100	Analyze as soon as possible or refrigerate	48 hours
Oil and Grease	Glass or wide-mouth calibrated	1000	Add H_2S0_4 to pH<2, refrigerate	28 days
pH	Polyethylene	--	Analyze immediately	2 hours
Suspended Solids	Polyethylene	--	Refrigerate	7 days
Temperature	Polyethylene	--	Analyze immediately	0
Turbidity	Polyethylene	--	Analyze same day; store in dark up to 24 hours, refrigerate	24 hours
Bacteria	Polyethylene (sterilized)	--	None: Keep cool	6 - 48 hours

(*) Unpreserved = check with lab that will be analyzing the samples

Appendix 2

References:

Gilbert, Andrew (1993). "Echo Bay Mines Ltd. Environmental Laboratory Quality Assurance Plan".

Soniassy, R. (1980). "A Guide for the Collection of Water and Effluent Samples"; pp 1-16; INAC

"Standard Methods for the Examination of Water and Wastewater" (1989); AHPA, AWWA and WPCF, 17th edition.

Water Resources Division, Indian and Northern Affairs Canada (1990). "Generic Quality Assurance (QA) Plan Guidelines for Use by the Licensees in Meeting SNP Requirements for Submission of a QA Plan"; INAC.

Appendix D PERMANENT LOG BOOK

A Permanent Log Book (PLB) shall be provided for every dam structure that meets the requirements set forth by the Dam Safety Guidelines (DSG). The log book shall contain notations or records of the following items:

- Changes to normal operation
- Unusual events or conditions
- Inspection activity
- Weather conditions and trends
- Unusual maintenance activity
- Test of any control equipment

The PLB is to be updated in accordance with these instructions. All updates should be completed either on the same day as the event noted or within 24 hours of the event. The PLB should be updated by the person that undertakes the particular inspection.

For the Iqaluit WWTP Sewage Lagoon, the only control equipment is the control valve and access structure at the outlet to the lagoon. These components should be inspected for proper operation during the regularly scheduled inspections on a bi-annual basis. All site inspection checklists completed shall be contained in this section and maintained in chronological order.

Date	Update Description	Action Required	Name & Signature
Feb 10 2005	DSI Conducted by Concentric	Nothing Immediate; report will be added to the PRF in Tab 6	
Jun 30 2005	Regular Inspection by Plant Foreman	None	
Aug 06 2005	Unscheduled Inspection by Plant Foreman due to unusual amount of rainfall over the previous 24 hours	No obvious problems. Continue to monitor, another inspection will be done tomorrow.	

City of Iqaluit – Sewage Lagoon
Monitoring and Maintenance Checklist

Created: Feb 2019
Version 1.0

A) Weekly Inspection: **Concerns:**

1. Visual inspection of berms No Yes
2. Visual inspection of accompanying drainage ditches No Yes
3. Visual inspection of truck discharge structures No Yes
4. Visual inspection of outlet structures No Yes
5. Verify lagoon water levels & 1-meter freeboard No Yes
6. Colour of lagoon: _____ No Yes

Concerns:_____

_____

_____

A) Monthly Inspection: **Concerns:**

1. Visual inspection of lagoon signage No Yes
2. Sample and record effluents during periods of flow No Yes
3. Remove floating debris and vegetation No Yes

Concerns:_____

_____

_____

A) Annual Inspection: **Concerns:**

1. Complete a sludge survey (as required) No Yes
2. Clear drainage ditches and culverts and repair as necessary No Yes
3. Assess berms and site for erosion and repair as necessary. No Yes

Concerns:_____

_____

_____

Signature of Inspector: _____ Weekly Monthly Annually

Name of Inspector: _____ Date of Inspection: _____

Appendix E LABORATORY SAMPLING REQUIREMENTS

A list of the minimum testing requirements for the Iqaluit WWTP Sewage Lagoon are provided below. All test samples should be sent to and evaluated by an accredited and approved laboratory. Testing results should be reported every year.

The testing requirements below should be reviewed and updated at each update/renewal of the City's Water License. The table below shall log when each update was completed to ensure that the most current Water License testing requirements are being executed. Confirmation that the testing requirements meet the most current Water license shall be completed prior to any sampling/testing being completed.

Sampling Requirement Log Book

Date	Current Water License	Updates to Testing	Name & Signature
Jan 2020	3AM-IQA1626/TYPE – A (June 17, 2016 – June 16, 2026)	None	Nunami Stantec

The following tables are taken directly from the current Water license, which illustrate the required testing parameters and frequency for the Iqaluit WWTP Sewage Lagoon. If further clarification is required, consult the complete Water License in Appendix B (ensure that Water License is up-to-date).

Sampling requirements for the Iqaluit WWTP Sewage Lagoon are identified in yellow in Table 1 and Table 2 below:

Table 1 – Water Quality Parameters

Test Groups	Analytical Parameters	Units
Routine (R)	Alkalinity, Acidity, Chloride, Carbonate, Bicarbonate, Total Hardness, Hydroxide, Sulphate, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Organic Carbon (TOC), Total Inorganic Carbon (TIC)	mg/L
	pH (field and lab)	pH units
	Oxidation-Reduction Potential (ORP) (field)	mV
	Conductivity (field and lab)	uS/cm
	Temperature (field)	°C
	Turbidity	NTU
Effluent (E)	Total Suspended Solids (TSS)	mg/L
	Temperature (field)	°C
	Conductivity (field and lab)	uS/cm
	pH (field and lab)	pH units
Acute Lethality (AL)	Based on Environment Canada's *Procedure for pH Stabilization During the Testing of Acute Lethality of Wastewater Effluent to Rainbow Trout* (EPS 1/RM/50, March 2008), if single concentration test fails and un-ionized ammonia concentration is less than or equal to 1.25 mg/L	"Pass" / "Fail"
ICP- Metals Scan (Total)	Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Sn, Ag, Sr, Tl, Ti, U, V, Zn, Hg	mg/L
Nutrients (N)	Ammonia-N, Nitrate-N, Nitrite-N	mg N/L
	Total Phosphorus, Orthophosphate	mg/L
Biological (B)	Biochemical Oxygen Demand	mg/L
	Total and Fecal Coliform	CFU/100 mL
Potable Water (PW)	Fecal Coliform	CFU/100 mL
	ICP Metals (Total and dissolved)	mg/L
	Total Suspended Solids –TSS	mg/L
Flow (F)	Volume	m^3
Landfill Specific (LS)	Polychlorinated Biphenyls (PCBs) Benzene, Toluene, Ethylbenzene and Xylene (BTEX)	mg/L

Table 2[1] - Water Quality Monitoring Criteria

Station ID	Description	Status	Parameter	Testing / Measurement Frequency	Reporting Frequency
IQA-01	Lake Geraldine Reservoir – Raw Water	Active	R, PW	Monthly	Biannually
			F	Monthly	
IQA-01(#)	Based on Part I, Item 4 of Expired Licence	Inactive	N/A	N/A	N/A
IQA-02	Sewage Lagoon – Effluent Discharge Point	Active	B, N, E, ICP	Once prior to discharge; once during discharge; and once prior to the completion of discharge	Annually
			F	During decant	
IQA-03	Sewage Lagoon – Influent	Inactive	N/A	N/A	N/A
IQA-04	Wastewater Treatment Plant - Effluent	Active	B, N, E, ICP	Quarterly – Prior to commissioning of the WWTP	Annually
			B, N, E, ICP	Monthly – Following commissioning of the WWTP	
			AL	Annually – following commissioning of the WWTP	
			F	During Discharge	
IQA-05	Wastewater Treatment Plant - Influent	Active	B, E, N, ICP	Biannually – Prior to commissioning of the WWTP	Annually
				No testing requirements following commissioning of the WWTP	N/A
IQA-06	Sludge – From WWTP	Active	B, E, N, ICP	Quarterly	Annually
IQA-07	Surface Water entering West 40 Landfill – Based on Part E, Item 4 of the Expired Licence	Inactive	N/A	N/A	N/A

Appendix F DAM SAFETY REVIEWS & INSPECTIONS

Copies of all Dam Safety Inspections (DSI's) and Dam Safety Reviews (DSR's) conducted on the Iqaluit WWTP Sewage Lagoon shall be contained in this section. The documents should be placed in chronological order for ease of reference.

New documents that are added to this section should be noted in the annual updates page at the beginning of the O&M manual, in the Permanent Log Book for the associated site inspection, and in the DSR/DSI register listed below.

Date	Document	Completed By
Feb 2002	Dam Safety Review	Trow
Oct 2002	Dam Safety Inspection	Trow
Feb 2005	Dam Safety Inspection	Concentric
Aug 2006	Dam Safety Inspection	Concentric
Oct 2009	Dam Safety Inspection	Concentric
Sep 2011	Dam Safety Inspection	Concentric
Jun 2012	Dam Safety Review Investigation	Concentric

TOWN OF IQALUIT
DAM SAFETY REVIEW FOR
LAKE GERALDINE DAM
&
SEWAGE LAGOON

Trow Consulting Engineers Ltd.

P.O. Box 6
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Fax: (613)-225-7337

Executive Summary

The Town Of Iqaluit retained Trow Consulting Engineers Ltd., (Trow), in October 2001, to prepare a Dam Safety Review (DSR) for the Lake Geraldine Dam, and for the sewage lagoon dikes.

The DSR for both retaining structures was conducted in October and November 2001, in accordance with Dam Safety Guidelines, prepared by the Canadian Dam Association.

As a result of the DSR, the following conclusions and recommendations have been made regarding Lake Geraldine Dam:

As a result of the DSR, the following conclusions and recommendations have been made regarding the sewage lagoon dikes:

1. Introduction

The Town Of Iqaluit was mandated to commission an inspection report of the Lake Geraldine Dam, and the sewage lagoon embankment structures (dikes). The report was to be in accordance with the Canadian Dam Association publication, Dam Safety Guidelines, published in January, 1999.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, that involves completion of checklist items in accordance with the Dam Safety Guidelines.

It is expected that in the interval between DSR's, a Dam Safety Inspection (DSI) would be performed on a yearly basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns.

The DSR is therefore a benchmark that is established for both new and existing dams which should be updated at specified milestones. Under the current guidelines, a DSR is required for these structures simply because no previous DSR exists.

2. HISTORY & BACKGROUND

In the following chronological summary, record documents have been referenced. After each reference, a number appears in parenthesis. That number corresponds to tabulated record document numbers in Section 4, where details are provided on the document source.

Lake Geraldine Dam:

The town of Iqaluit derives its water supply from Lake Geraldine, which is retained by a structure consisting of two sections; one a cast in place concrete gravity dam incorporating a spillway section, the other a cast in place concrete cut-off wall and embankment. Both concrete structures are founded on rock, and engage rock at their abutments.

Lake Geraldine is a natural body of water in an irregularly shaped basin. It is fed by rainfall and snow/ice melt. The total watershed area is approximately 385 hectares.

In the late 1950's, the demand for a reliable year round source of water resulted in the construction of a cast in place concrete gravity dam, and a section of earth berm with a central cast in place concrete cut off wall. The project was designed and built by the Department Of National Defense. According to the literature, the original construction took place circa 1958.

Since that time, as the Town has grown and water demands have risen, the dam has been raised three times to increase the storage capacity. The first height increase of 0.3m reportedly took place in 1979. The second construction took place in 1985, and increased the height of the spillway structure by 1.15m. The third alteration was done in 1995, and increased the height of the spillway structure by a further 1.5m.

The 1995 alteration included an extensive rock anchoring program for the gravity dam portion.

In the time span of the available historical data, which extends back to 1984, there have been only a few notable events relating to the safety and serviceability of the dam structures.

- In November 1984 joint and patch repairs were made to localized areas on the upstream side of the spillway structure by diving contractors.
- In June 1990 an inspection report (3) of the structure by diving contractors was made following construction blasting. The 1984 repair areas were also assessed.
- In June 1990 a visual inspection report (4) was prepared for the Town by an engineering consultant, as a result of the construction blast. No significant damage was noted.
- In July 1990 a dam inspection and stability report (5,6) was conducted for the Town by an engineering consultant. Recommendations were made regarding repair of leaking joints, and provisions to increase stability should the dam be raised in the future.

- In September 1990, a diving contractor performed crack repairs and prepared an inspection report (7). Repair material used was oakum.

- In October 1997 a visual inspection report (10) was prepared for the Town by an engineering consultant. Leaking cracks were identified, however, these were not viewed as being structurally significant. It was recommended that leaking cracks be chemically grouted.

- In June 1998, a study (11) was prepared for the Department Of Public Works by an engineering consultant to assess the hydrological impact of a dam failure on a proposed downstream hospital site.

Sewage Lagoon:

The existing lagoon is located to the west of the town, south of the FOL barracks, on the tidal plain at the head of Koojesse Inlet. The lagoon was constructed at this location circa 1978.

The sewage lagoon was formed by the construction of two dikes that connected the shoreline to a natural island formation. The man-made structures form the east and west boundaries of the lagoon; the north and south boundaries therefore utilize the natural topography.

The original area and capacity of the lagoon are reported in the literature to be approximately 17,000 square meters and 32,000 cubic meters, respectively.

In 1981, a partial wash out occurred during high tide, which was subsequently repaired. The repair reportedly washed out again that same year. Subsequent upgrades in 1983 increased the capacity of the lagoon to approximately 56,0000 meters.

According to the literature, the lagoon was the subject of investigative studies in 1983 and 1984, which proposed various upgrades, including the following:

- Lining of exterior slopes with filter cloth and rip-rap.
- Construction of an overflow (spillway) in the west dike.
- Construction of a positive outlet control.
- Installation of an impermeable liner on the interior slopes.

In June 1991, a breach of the west dike caused a major effluent spill into Koojesse Inlet.

A preliminary engineering report (12) from July 1991 indicates that the spillway and impermeable liner upgrades had not been done, and that as-built drawings for any upgrades could not be located. The 1991 report recommended specific repairs and improvement for the dike reconstruction area. These included erosion protection (filter cloth and rip-rap) on the upstream and downstream sides, section conformity (2H:1V and 3H:1V on the upstream and downstream sides respectively), and construction of a spillway section.

In a December 1991 supplementary report (13), concerns over material suitability prompted the recommendation to further flatten slopes to 3H:1V and 4H:1V on the upstream and downstream sides, respectively.

In December 1997, significant seepage developed on the west dike. Recommendations were made in a February 1998 engineering report (16) to increase monitoring, to develop a spill preparedness plan, and to maintain the lagoon at its lowest possible level.

The current retention volume is approximately 25,000 m^3.

In June 1998, a Spill Contingency Plan (17) was prepared for the Town by an engineering consultant which included a Sewage Lagoon Preparedness Plan.

In that document, it is stated that the potential exists for further uncontrolled sewage releases due to dike failure.

3. Scope Of Work & Methodology

The level of detail required for a DSR is influenced by several factors as follows:

- Importance of structure
- Complexity of structure
- Consequences of failure
- Completeness, continuity, and availability of record documentation
- Current condition

Reasonably extensive documentation exists for both the Lake Geraldine Dam and the sewage lagoon dikes, however, as this is the first DSR and benchmark document for any subsequent inspection, we have included a complete review of the required tasks.

A summary of our methodology to complete the work is presented below:

1. Acquire and assemble chronological documentation, including but not limited to:

   - Design Documents
   - Repair Specifications
   - Past Condition Assessment Reports
   - Records of Alteration

   The bulk of the record documents were retrieved from the Town records.

2. Review all available record documentation.

3. Perform a site inspection to assess the current condition of the structures. No invasive work was performed; the condition assessment was visual in nature.

4. Interview maintenance and management personnel as required and appropriate.

5. Execute the DSR checklist of items.

6. Prepare the draft DSR report, complete with site surveys, photographs, structural sections, and field notes as required and appropriate. Submit to and discuss with the Town Engineer.

7. Submit the final DSR report.

4. Relevant Record Documents

The following documentation has been utilized in the preparation of this report. Other record documentation was provided but not directly applicable to the DSR.

TABLE I
RELEVANT RECORD DOCUMENTATION
LAKE GERALDINE DAM

No.	Date	Description	Author
1	August 1984	Lake Geraldine Water Supply Study	OMM
2	January 1985	Water Supply Improvements	OMM
3	June 1990	General Diving Report	Arctic Divers
4	June 1990	Dam Inspection for Blast Damage	Hardy BBT
5	July 1990	Dam Inspection & Leakage Repair	Acres
6	July 1990	Dam Stability	Acres
7	Sept. 1990	Diving Report	Arctic Divers
8	Feb. 1995	Lake Geraldine Storage Study	OMM
9	June 1995	Lake Geraldine Storage Design Dwgs. & Specifications	OMM
10	October 1997	Dam Inspection	Trow
11	June 1998	Dam Failure Study	EBA

TABLE II
RELEVANT RECORD DOCUMENTATION
SEWAGE LAGOON

No.	Date	Description	Author
12	July 1991	Preliminary Engineering Report on Repairs to Iqaluit Sewage Lagoon	UMA
13	Dec. 1991	Supplement to Preliminary Engineering Report on Repairs to Iqaluit Sewage Lagoon	UMA
14	Dec. 1992	Performance Evaluation for Sewage Lagoon 1990 to 1992	UMA
15	May 1995	Geotechnical Evaluation Proposed Sewage Lagoon	Agra
16	Feb. 1998	Iqaluit Sewage Lagoon Investigation Final Report	FSC
17	June 1998	Municipality of Iqaluit Spill Contingency Plan	Dillon

5. Commentary On Dam Safety Review Requirements

According to Dam Safety Guidelines, the document applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity. Both the Lake Geraldine dam and the sewage lagoon dikes exceed these minimums.

The Dam Safety Guidelines document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The document requires a systematic checklist review, which includes the following items. For each item, the applicable Section number from the Dam Safety Guidelines is shown in parenthesis.

1. Dam Classification (1)
2. Site Inspection (2)
3. Design & Construction Review: (2)
   - 3.1. Earthquakes (5)
   - 3.2. Floods (6)
   - 3.3. Discharge Facilities (7)
   - 3.4. Geotechnical Considerations (8)
   - 3.5. Concrete Structures (9)
   - 3.6. Reservoir & Environment (10)
   - 3.7. Construction (11)
4. Operation & Testing (2,3)
5. Maintenance (2,3)
6. Surveillance & Monitoring (2,3)
7. Emergency Preparedness (2,4)
8. Compliance With Previous Reviews (2)

6. Lake Geraldine Dam DSR

DAM CLASSIFICATION (DSG SECTION 2.2.1)

Based on our knowledge of the Dam Safety Guidelines, and the dam structure itself, the Lake Geraldine Dam has a consequence category of "High" for both the Life Safety and Socioeconomic, Financial and Environmental categories. Under the guidelines, it is therefore required to have a Dam Safety Review every seven (7) years.

SITE INSPECTION (DSG SECTION 2.2.2)

A visual site inspection of the dam structures was performed in October 2001. The inspection was non-invasive in nature, and did not include an underwater assessment. A photographic and video record of our inspection was made, and appends this report.

A summary of observed conditions is as follows:

- The visible portions of the concrete structures are generally in good condition with no evidence of concrete durability issues. A few localized areas exhibited spalling due to embedded formwork remnants.
- Several actively seeping cracks were observed. These cracks are generally vertical in orientation and hairline in width, as would be expected for shrinkage (non-structural) cracking. The location and extent of shrinkage cracking has not changed significantly since the 1997 inspection.
- There was no evidence of distress or overstressing of any portion of the visible structure.
- The rate of leakage through the control joint south of the spillway section has not changed significantly since the 1997 inspection.
- Minor corrosion of the 1985 spillway extension frame.

Based on our review of the record documentation, it is our understanding that the elevation of the top of the concrete cut-off wall in the embankment portion of the dam is at least equal to the elevation of the top of the concrete gravity dam portion of the dam. We have in part based the Dam Safety Review on this condition.

DESIGN & CONSTRUCTION REVIEW (DSG SECTION 2.2.3)

This section constitutes the bulk of the Dam Safety Review process. We have followed the format in the DSG document for convenience and clarity.

Earthquakes (DSG Section 5)

According to the DSG, dams shall be evaluated to withstand a Maximum Design Earthquake (MDE) without release of the reservoir. For a High Consequence Category, the DSG requires evaluation at 50% - 100% of the Maximum Credible Earthquake (MCE). To paraphrase the DSG, the MCE is defined as the largest reasonably conceivable earthquake that appears possible under the presently known tectonic framework.

Concrete Gravity Dam Portion

For the concrete portions of the dam, two sections were assessed; the spillway section and the gravity dam itself. For each section, the worst case was assessed, which corresponded to the maximum retained height.

Our analysis has based the MCE on statistical seismic data in the National Building Code (NBC) 1997, specifically zonal velocities and accelerations for the Iqaluit area. The calculation involves deriving a resultant force proportional to the mass of the structure, and includes an allowance for the inertial effect of the retained water. We have used 100% of the calculated MCE as our Maximum Design Earthquake. That value is 68 kN per meter width of the gravity dam section, and 73 kN per meter width of the spillway section.

The MDE loads were applied in combination with other loads in accordance with Section 9.4, Load Combinations, Concrete Structures.

In the load combination case involving the MDE, the overall contribution of seismic loads is less than 10%, and is not considered significant compared to uplift and hydrostatic forces. This is consistent with previous reviews and design notes, which do not consider seismic forces.

Embankment Dam Portion

Floods (DSG Section 6)

According to the DSG, dams shall be evaluated to safely pass an Inflow Design Flood (IDF), which is based on Consequence Category and the Probable Maximum Flood (PMF). The PMF is an estimate of the most severe "reasonably possible" flood at a particular location and time of year. For a High Consequence Category, the DSG requires an IDF with an annual exceedence probability between 1/1000 and the PMF. For this review, we have used the PMF as a conservative estimate of the IDF. The PMF was based on a regression analysis for the nearby Sylvia Grinnel River.

Based on our analysis, the spillway structure, in its current configuration, can safely pass the estimated Inflow Design Flood.

Discharge Facilities (DSG Section 7)

Section 7 of the DSG has a broad applicability that includes flow control equipment, instrumentation, and emergency backup equipment, which are relevant to more complex structures. In the case of the Lake Geraldine Dam, the applicability really only involves the spillway section.

According to the DSG, discharge facilities shall be capable of passing an Inflow Design Flood (IDF) without adversely affecting the freeboard. Freeboard is defined as the vertical distance between the water surface elevation and the lowest elevation of the top of the containment structure.

The freeboard should satisfy the requirements of section 7.2, Freeboard. That section indicates that sufficient freeboard be provided such that the percentage of overtopping waves during extreme flood or wind conditions is limited to an amount that would not lead to dam failure.

The Lake Geraldine Dam essentially has only one effective discharge facility, that being the spillway section. Normal water levels are at or slightly below the spillway discharge elevation, which yields a freeboard of approximately 0.9m (3 feet).

Based on our analysis, the spillway is capable of passing an Inflow Design Flood. Wave action overtopping the gravity structure is not considered significant given the relatively small fetch of the lake.

Section 7 also requires consideration of the following for discharge facilities:

- Resistance to erosion
- Adequate energy dissipation
- Capability to pass floating debris

At this time, there are no concerns with the above items.

Geotechnical Considerations (DSG Section 8)

Section 8 of the DSG presents Geotechnical considerations for proposed dams, as well as for several configurations of existing dams.

Concrete Gravity Dam Portion

Not applicable.

Embankment Dam Portion

Concrete Structures (DSG Section 9)

Section 9 of the DSG applies to concrete structures founded on strong, competent rock. Based on our review of the record data, and the dam performance over the last 43 years, it is believed that the foundations are indeed competent rock, and that invasive conformation and/or assessment is not warranted at this time.

Our assessment follows the format of Section 9 as follows:

Section 9.2 – Condition Of Structures And Site

The structure was visually inspected on site as described above. At the time of our visit, we did not observe any conditions that would adversely affect the structural adequacy and/or performance.

Observations that are considered minor at this time include:

- Several shrinkage cracks, actively seeping at a low rate.
- One joint leak estimated at 2-4 liters per minute, south of the spillway section.
- A few areas of spalling and delamination, due to embedded formwork.
- Corrosion of the 1985 spillway extension frame.

No general concrete deterioration problems were noted.

Section 9.3 – Loads

Loads used in our assessment of structural stability were in conformance with this sub-section, with the exception that Temperature (T) and backfill/silt deposit loads (S) were not considered applicable. A summary of loads considered is as follows:

- D Dead loads of permanent structures
- H, H_F Maximum normal and flood headwater levels, respectively
- U Internal (uplift) water pressure
- I Thrust created by an ice sheet
- Q Maximum design earthquake

Section 9.4 – Load Combinations

Load combinations used in our assessment of structural stability were in conformance with this sub-section, with the exception that the "Unusual Loading"

case was not considered applicable. A summary of load combinations considered is as follows:

- Usual D+H+I+U
- Flood D+H_F+U
- Earthquake D+H+Q+U_Q

Section 9.5 – Design And Analysis

A static and seismic analysis was performed on the dam using the above loads and combinations, and considering the following:

- Sliding
- Overturning
- Overstressing

Based on our analysis, and site inspection, the dam structure is deemed adequate to resist the above effects. The minimum factor of safety for overturning and sliding were calculated to be 1.33 and 1.72, respectively.

Typically, we would require minimum factors of safety for overturning and sliding of 1.5 and 2.0, respectively, for an existing structure.

Although the calculated values are slightly below our usual norms of acceptance, it is our opinion that the stability of the dam is adequate and would satisfy minimum factors of safety under more sophisticated analysis, for the following reasons:

1. The calculated factors are for the worst case load combination at the spillway section, which is the weakest link of the structure. The section was analyzed as if it was a stand-alone structure. In reality, the spillway section is relatively narrow in elevation, and directly engages the wing walls of the gravity section at each end. Given these boundary conditions, we believe the factor of safety would be similar to the 1.6 calculated for the gravity section.

2. The sliding calculation does not take into account the resistance offered by the rock anchors, which is significant, and would likely result in a factor of safety against sliding well in excess of 2.0.

Copies of our sliding and overturning calculations append the report.

Section 9.6 – Performance Indicators

The DSG recommends that the assessment of concrete dams include the following performance indicators:

- Position of resultant force
- Normal stresses at the heel and toe
- Sliding factors
- Observed conditions, based on records of permanent monitoring equipment such as joint meters, plumb lines, monument displacement, piezometric pressures, extensometers, and accelograms.

We have determined that the resultant force for the "Usual" load case is within the middle third of the section, as required. Normal stresses are also within acceptable limits.

Expressions to determine sliding factors are not considered applicable due to the rock anchor retrofit program of 1995. To our knowledge, no permanent monitoring instrumentation exists at or remote from the site.

Section 9.7 – Acceptance Criteria

This sub-section presents commonly accepted values for sliding factors. As mentioned above, the expressions for sliding factors are not considered applicable due to the rock anchor retrofit program of 1995. Concrete strength factors are within acceptable limits.

Reservoir & Environment (DSG Section 10)

According to the DSG, the following conditions should be assessed as they relate to the reservoir and environment:

a) The stability of slopes around the reservoir rim.
b) Detrimental affects of groundwater, reservoir water, soil, etc., on dam safety.
c) Silt deposition affecting discharge facilities or dam stability.
d) Hazards to local ecology.
e) Reservoir drawdown capability.
f) Reservoir debris and ice should not present an unacceptable risk to dam safety.

Based on our review and inspection, the only significant items are e) and f). Items a), b), c), and d) are not a concern at this time.

Regarding item e), the reservoir does not have rapid drawdown capability. Section 10.5 of the DSG indicates a requirement for rapid drawdown for those dams subject to severe damage by earthquake, or where a high potential for internal erosion exists. In our opinion, these risk factors do not apply, and rapid drawdown is not required.

Regarding item f), we have allowed for ice thrust in our stability analysis. We note that the ice thrust loads may be reduced by partial drawdown of the reservoir before major ice loads are developed. Debris has historically not been a problem, however, it should be cleared periodically from the upstream face to allow underwater inspections.

Trow

Construction (DSG Section 11)

This section applies to new construction and therefore is not applicable.

OPERATION & TESTING (DSG SECTION 2.2.4)

The applicable reference section of the DSG is Section 3: Operation, Maintenance, and Surveillance.

Our interpretation of this section of the DSG requires some clarification on the meaning and intent of the words "operation" and "testing". In this section of the DSG, "testing" generally refers to the testing of equipment required to operate discharge facilities. In the case of the Lake Geraldine Dam, the primary discharge facility is the spillway section, and as such, no equipment exists. Therefore, there is no testing requirement.

The word "operation" in the DSG is associated with the premise that "the operation of a dam shall not violate any important design assumptions that could impair the safety of the dam." From this premise, and our review of Section 3.2 of the DSG, it would appear that this section really applies to more complex dams with operable flow control equipment, ice rakes, trash racks, penstocks, etc. Simply stated, the Lake Geraldine Dam is not really "operable".

Notwithstanding these interpretations, there should be some basic operational procedures for ice management and cleaning of upstream debris that would form part of the OMS Manual (see below).

Other applicable requirements of Section 3 are described below.

In the DSR checklist of required items, the DSG indicate that a Permanent Record File (PRF) suitable for transfer to the regulatory agency be maintained as an ongoing historical reference. The file should contain the following:

- OMS Manual (see below)
- Permanent Log Book (see below)
- History and photographic record
- As-Built Drawings
- Performance reports
- All design data
- Records of all inspections and DSR's

Based on our review and correspondence, a PRF does not exist, however, most of the raw data is readily available.

The DSG indicate that a dam Operation, Maintenance, and Surveillance (OMS) Manual shall be provided for every dam structure. The manual may be quite involved depending on the complexity of the dam. For the Lake Geraldine Dam, an acceptable manual would likely be relatively simple and concise. The manual should contain information and procedures that

include the following:

- General description, history, location, access, etc.
- Chain of operational responsibilities
- Requirements for training of involved staff
- Responsibility and mechanism for review and update, including DSR input
- Requirements for operation, maintenance and surveillance as per Sections 3.2, 3.3, and 3.4 of the DSG (See below)

Based on our review and correspondence, an OMS Manual does not exist.

The DSG indicate that a Permanent Logbook shall be provided for every dam structure. The logbook should contain notations or records of the following:

- Changes to normal operation
- Unusual events or conditions
- Inspection activity
- Weather conditions and trends
- Unusual maintenance activities
- Tests of any control equipment

Based on our review and correspondence, a Permanent Logbook does not exist.

MAINTENANCE (DSG SECTION 2.2.5)

The applicable reference section of the DSG is Section 3: Operation, Maintenance, and Surveillance.

Maintenance Procedures (MPS) as described in Section 3.3 of the DSG are intended to ensure that the structures are maintained in a safe and serviceable condition.

No formal Maintenance Procedures exist. These should form part of the OMS Manual.

SURVEILLANCE & MONITORING (DSG SECTION 2.2.6)

The applicable reference section of the DSG is Section 3: Operation, Maintenance, and Surveillance.

Surveillance Procedures (SPS) as described in Section 3.4 of the DSG are intended to ensure adequate inspection and monitoring. Applicable considerations are as follows:

a) Procedures or requirements for routine visual inspection by staff, including inspection records.
b) Procedures for implementation of any required action as a result of a routine inspection.
c) Procedures or requirements for more detailed regular inspections, such as underwater assessments.

d) Procedures or requirements for special inspections due to extreme events or unusual observations.

No formal Surveillance Procedures exist. These should form part of the OMS Manual.

EMERGENCY PREPAREDNESS (DSG SECTION 2.2.7)

Section 4 of the DSG involves Emergency Preparedness. The primary requirement is that an Emergency Preparedness Plan (EPP) exists. An EPP should describe the actions to be taken by the owner and operator in the event of an emergency. The EPP should include the following:

- Emergency identification and evaluation
- Preventative action
- Notification procedure and flowchart
- Response during darkness, adverse weather, etc.
- Available resources and their allocation
- Inundation maps, based on an Inundation Study

Based on our review and correspondence, no formal Emergency Preparedness Plan exists.

COMPLIANCE WITH PREVIOUS REVIEWS (DSG SECTION 2.2.8)

No previous Dam Safety Review documents exist at this time.

7. Sewage Lagoon DSR

DAM CLASSIFICATION (DSG SECTION 2.2.1)

Based on our knowledge of the Dam Safety Guidelines, and the lagoon embankment structures, the sewage lagoon has a consequence category of "Low" for Life Safety, and "High" for Socioeconomic, Financial and Environmental categories. Under the guidelines, it is therefore required to have a Dam Safety Review every seven (7) to ten (10) years.

SITE INSPECTION (DSG SECTION 2.2.2)

A visual site inspection of the embankment dikes was performed in October 2001. The inspection was non-invasive in nature, and did not include an underwater assessment. A photographic and video record of our inspection was made, and appends this report.

A summary of observed conditions is as follows:

DESIGN & CONSTRUCTION REVIEW (DSG SECTION 2.2.3)

This section constitutes the bulk of the Dam Safety Review process. We have followed the format in the DSG document for convenience and clarity.

Earthquakes (DSG Section 5)

Floods (DSG Section 6)

Discharge Facilities (DSG Section 7)

Section 7 of the DSG has a broad applicability that includes flow control equipment, instrumentation, and emergency backup equipment, which are relevant to more complex structures. In the case of the sewage lagoon, the applicability really only involves the spillway section.

Normal water levels are approximately _____ below the spillway discharge elevation, which yields a freeboard of approximately _____.

Based on our analysis, the spillway is capable of passing an Inflow Design Flood. Wave action overtopping the structure is not considered significant.

Section 7 also requires consideration of the following for discharge facilities:

- Resistance to erosion
- Adequate energy dissipation
- Capability to pass floating debris

At this time, we have the following concerns with the above items.

Geotechnical Considerations (DSG Section 8)

Section 8 of the DSG presents Geotechnical considerations for proposed dams, as well as for several configurations of existing dams.

Concrete Structures (DSG Section 9)

This section is not applicable.

Reservoir & Environment (DSG Section 10)

According to the DSG, the following conditions should be assessed as they relate to the reservoir and environment:

a) The stability of slopes around the reservoir rim.
b) Detrimental affects of groundwater, reservoir water, soil, etc., on dam safety.
c) Silt deposition affecting discharge facilities or dam stability.
d) Hazards to local ecology.
e) Reservoir drawdown capability.
f) Reservoir debris and ice should not present an unacceptable risk to dam safety.

Based on our review and inspection, the only significant items are ____. Items _____ are not considered a concern at this time.

Construction (DSG Section 11)

This section applies to new construction and therefore is not applicable.

OPERATION & TESTING (DSG SECTION 2.2.4)

The applicable reference section of the DSG is Section 3: Operation, Maintenance, and Surveillance.

As per the rationale for the Lake Geraldine Dam, there is no testing requirement for the lagoon. It is also not considered "operable".

The following items are considered a requirement, and were described in detail in Section 7, above.

- Permanent Record File (PRF)
- Dam Operation, Maintenance, and Surveillance (OMS) Manual
- Permanent Logbook

MAINTENANCE (DSG SECTION 2.2.5)

The applicable reference section of the DSG is Section 3: Operation, Maintenance, and Surveillance.

Maintenance Procedures (MPS) as described in Section 3.3 of the DSG are intended to ensure that the structures are maintained in a safe and serviceable condition.

No formal Maintenance Procedures exist. These should form part of the OMS Manual.

SURVEILLANCE & MONITORING (DSG SECTION 2.2.6)

The applicable reference section of the DSG is Section 3: Operation, Maintenance, and Surveillance.

Surveillance Procedures (SPS) as described in Section 3.4 of the DSG are intended to ensure adequate inspection and monitoring. Applicable considerations are as follows:

a) Procedures or requirements for routine visual inspection by staff, including inspection records.
b) Procedures for implementation of any required action as a result of a routine inspection.
c) Procedures or requirements for more detailed regular inspections, such as underwater assessments.
d) Procedures or requirements for special inspections due to extreme events or unusual observations.

No formal Surveillance Procedures exist. These would should part of the OMS Manual.

EMERGENCY PREPAREDNESS (DSG SECTION 2.2.7)

Section 4 of the DSG involves Emergency Preparedness. The primary requirement is that an Emergency Preparedness Plan (EPP) exists. An EPP should describe the actions to be taken by the owner and operator in the event of an emergency. The EPP should include the following:

- Emergency identification and evaluation
- Preventative action
- Notification procedure and flowchart
- Response during darkness, adverse weather, etc.
- Available resources and their allocation
- Inundation maps, based on an Inundation Study

A Sewage Lagoon Preparedness Plan was prepared in 1998. The plan is contained in Appendix B of the Spill Contingency Plan that forms part of the record documentation we reviewed. It is believed that this document, with some modification, would be adequately as an EPP.

COMPLIANCE WITH PREVIOUS REVIEWS (DSG SECTION 2.2.8)

No previous Dam Safety Review documents exist at this time.

8. Summary

Based on our inspection, review, and analyses, we summarize the results of the DSR as follows:

Lake Geraldine Dam

1. In accordance with Section 1 of the DSG, the dam has been classified as having a High Consequence Category.

2. The dam is in a safe and serviceable condition at this time, with no significant changes in visible condition compared to the last (1997) inspection.

3. The dam is in general compliance with the required design and performance standards of the DSG, Sections 5 through 11, where applicable and appropriate for the structure, as discussed above. Safety improvements are therefore not recommended at this time.

4. The dam is in non-compliance with the requirements of Sections 3 and 4 of the DSG. The following documents do not exist at this time:

    - Permanent File
    - OMS Manual
    - Logbook
    - Emergency Preparedness Plan

5. Based on the available record documentation, the submerged portion of the dam has not been assessed since 1990.

Sewage Lagoon

9. Recommendations & Required Action

Lake Geraldine Dam

1. The structures should have a Dam Safety Inspection (DSI) conducted in 2002, preferably by mid-October of that year. This is essentially a yearly non-invasive review comprising a visual inspection to identify any changes in condition, or any observed concerns. The summary written report generated would form a permanent record document to be included in the Permanent Record File.

2. An underwater inspection of the submerged structures should be done in 2002. This inspection should be coordinated with, and be under the direction of, the DSI recommended in Item 1, above. Underwater inspections should be carried out with at least the same frequency as Dam Safety Reviews, i.e. every seven years.

3. The dam is in non-compliance with the requirements of Sections 3 and 4 of the DSG. The following documents need to be developed and maintained.

   - Permanent File
   - OMS Manual
   - Logbook
   - Emergency Preparedness Plan

   In terms of time to compliance, we do not believe it is necessary, or realistic, to produce completed documents forthwith, however, it is our opinion that an understanding to proceed be demonstrated as soon as practically possible so as to show intent. We would certainly expect full compliance be achieved well before the next DSR in seven years time. A timeline of two years to full compliance would be reasonable. Regulatory agencies may well impose timelines for compliance upon review of the DSR.

Sewage Lagoon

We would be pleased to discuss this report with you at your convenience.

Yours truly,

Trow Consulting Engineers Ltd.

Prepared By:

Allan Murray, P.Eng.,
Manager,
Special Projects Group

Prepared By:

Andy Schell, P.Eng.,
Manager,
Sudbury Branch

APPENDIX 1
SITE PHOTOGRAPHS
LAKE GERALDINE DAM

APPENDIX 2
SITE PHOTOGRAPHS
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DAMAGE PATH

APPENDIX 3
SUMMARY STABILITY CALCULATIONS
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LAKE GERALDINE DAM
SEWAGE LAGOON

CONCENTRIC

Concentric Associates International

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

February 16, 2005
REPORT

Produced For:
THE CITY OF IQALUIT, NUNAVUT

Produced By:
CONCENTRIC ASSOCIATES INTERNATIONAL

Concentric Project Reference Number:
04-1166

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

CONTENTS

1. EXECUTIVE SUMMARY

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon. The scope of work for the assignment has been undertaken in accordance with Concentric's proposal 04-1166, dated November 19, 2004.

The site inspection and reporting were conducted on February 9, 10 and 11, 2005, by Allan Murray, P.Eng., of Concentric. Snow and ice cover did not allow adequate assessment of the structures. It is strongly recommended that the next DSI be conducted prior to October 2005.

OBSERVATIONS:

- No significant changes in condition were observed since the previous DSI
- City of Iqaluit Engineering staff reported no maintenance/repair works since the last DSI was conducted in 2002.

RECOMMENDATIONS:

1. Preparation of the required Operation & Safety Manual, Emergency Preparedness Plan, Logbook, and Permanent File, remains delinquent, despite initial identification for compliance in 2001, and repeated non-compliance in 2002, 2003, and 2004. Steps should be taken to address this issue in 2005, as continued non-compliance negates the purpose, and validity, of the entire process, that began in 2001 with the Dam Safety Review (DSR).

2. Undertake the next DSI prior to October 2005.

3. Based on record documents and discussion with the City of Iqaluit Engineering Department, the lagoon may be in service for perhaps another two (2) or three (3) years. If this is indeed the case, best practices would seem the best approach for ongoing safety and serviceability of the berms. Unfortunately, the safety/stability recommendations from the 2003 geotechnical report (discussed herein) have not been implemented. This work should have been undertaken in 2004. It is strongly recommended that the recommended measures (adequate protection against overtopping, and adequate erosion protection installed on downstream portions of the berms) be implemented in 2005. Design and analysis would be required prior to construction.

4. If the sewage lagoon is to remain in service significantly longer than indicated in item 1, above, it is strongly recommended that the lagoon be either redesigned and rebuilt; or, that an impervious liner be installed with erosion measures applied to downstream faces of berms. Either option will likely require a new DSR.

2. INTRODUCTION

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon located in Iqaluit, Nunavut.

This assignment and the scope of work described herein has been undertaken in accordance with Concentric's proposal 04-1166, dated November 19, 2004.

The site visit and reporting were conducted on February 9, 10 and 11, 2005.

Allan Murray, P.Eng., of Concentric, met with the following personnel at the City of Iqaluit:

- Brad Sokach, Director of Engineering, City of Iqaluit
- Geoff Baker, Project Manager, City of Iqaluit Department of Engineering

This report summarizes our terms of reference for the assignment, observations, conclusions and recommended action.

3. BACKGROUND

The Canadian Dam Safety Guidelines (DSG) requires that all structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals.

A DSR is a comprehensive, formal review process that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The sewage lagoon requires a DSR every ten (10) years. The DSR for the sewage lagoon was conducted in 2001.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection only to identify any changes in condition, or any observed concerns.

A detailed historical perspective may be referenced in the DSR on file with the City of Iqaluit.

4. SCOPE OF SERVICES

Our directive has been to undertake a Dam Safety Inspection (DSI) in accordance with the DSG, for the sewage lagoon. The inspection consisted of an on-site visual assessment, notation of any significant changes in condition since the last available DSI, preparation of a written report in a format compatible with the DSR, and a photographic record.

The following is a summary of the scope of work for this assignment. The DSI report is the primary deliverable, and has been prepared in accordance with the DSG document.

- Review available record documentation, to be provided by the City
- Review, in particular, reports and/or repairs/upgrades conducted since the 2001 DSR
- Interview and/or solicit input from maintenance personnel and City Administration regarding operating performance, concerns, incidents, repairs, and any notable concerns
- Conduct a visual on-site assessment of the sewage lagoon
- Prepare a photographic record documenting general and representative conditions
- Identify, characterize, and risk-assess any actual or potential concerns
- Prepare a written report summarizing our observations, items of concern, and recommendations
- Indicate any recommended repairs
- Prioritize action items
- Submit final documents in electronic format and hard copy

Limitations

At the time of the inspections, visual acuity of the site was difficult due to snow and ice accumulation. Snow and ice cover did not allow adequate assessment of the structure. It is strongly recommended that the next DSI be conducted prior to October 2005.

5. SUMMARY OF PREVIOUS DSI'S

The following is a summary of observations and recommendations made from the previous DSI's:

January 7, 2003 (2002) DSI

A DSI was conducted by Trow Consulting Engineers (Report MA15882A, dated January 7, 2003) in October 2002. The DSI was termed "...an interim step prior to the implementation of remedial measures..." recommended in the 2001 DSR.

The DSI noted no significant changes since the 2001 DSR, but highlighted the seepage concerns of the east berm and the threat of overtopping in the spring.

The DSI reiterated the recommendations of the 2001 DSR, as follows:

- There is inadequate information concerning the as-built conditions of the berms
- The berms are not considered safe in their current condition and are non-compliant with the design and performance standards of the DSG.
- Remedial measures include three (3) options - an impermeable liner; buttressing the berms; and building a new lagoon.

Not stated in the 2002 DSI, but recommended in the 2001 DSR, were the following additional requirements, which are believed to be still outstanding:

- Complete the remaining outstanding non-compliance requirements of Section Nos. 3 and 4 of the DSG, as follows:
  - Permanent file
  - Operation, Maintenance and Surveillance Manual
  - Logbook
  - Emergency Preparedness Plan

2003 DSI

Based on our discussions with the City of Iqaluit Engineering Department, there is no 2003 DSI on file. However, a geotechnical investigation was conducted by Trow Associates Inc. (Report OTGE00016794A, dated October 8, 2003) in 2003.

The scope of the geotechnical investigation was to undertake a topographic survey of the lagoon and conduct a slope stability analysis of the berms. A separate hydrologic report is referenced, but was not provided to us. It would appear that the geotechnical investigation was attempting to address some of the as-built issues discussed in the 2002 DSI.

Salient points from the geotechnical investigation include:

- Adequate (satisfying the Dan Safety Guidelines) factors of safety exist for steady state seepage and rapid drawdown scenarios
- The berm slopes should remain stable provided they are protected against overtopping and adequate erosion protection is installed on downstream faces
- Catastrophic failure is unlikely with the above provisos, however, localized failures or seeps are expected until such time as the lagoon is lined with an impervious material, or rebuilt

The report also notes that it is Trow's understanding that the lagoon will remain operational for perhaps four (4) more years, (2007) until the new sewage treatment plant is complete.

6. COMMENTARY ON DAM SAFETY GUIDELINES

The Canadian Dam Association publication, Dam Safety Guidelines (DSG), governs the nature and frequency of inspection and review activities for structures which fall under its umbrella criteria.

The DSG applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their "consequence category", that is, the consequence of dam failure in terms of life safety, and socio-economic impact. The category assigned may range from very low to very high. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The frequency of DSR's varies depending on consequence category. For structures where significant life safety and/or socio-economic consequence exist, the DSR is usually conducted every five (5) to ten (10) years. The sewage lagoon requires a DSR every ten (10) years. The initial DSR for the sewage lagoon was conducted in 2001; therefore, the sewage lagoon is due for an updated DSR in 2011. If significant alterations to the structure take place before this date, an updated DSR would be required.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection (DSI) would be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns. The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.

7. OBSERVATIONS

Sewage Lagoon

The sewage lagoon was accessed on foot. The review was hampered by considerable accumulation of snow and ice. Based on our limited visual assessment we have the following comments:

- Seepage was not observed downstream of the east berm. Seepage was observed in previous inspections by others.
- The majority of the lagoon was frozen, with small areas of open effluent near the inflow.
- Considerable constant flow was observed at the outflow.
- No evidence of repair/maintenance/upgrade work was evident

Overall, the condition of the structure has not changed significantly since the previous DSI.

We note that the safety (berm stability) issues identified in the 2001 DSR and 2002 DSI have had a solution proposed in the 2003 geotechnical report.

Unfortunately, the recommended measures to ensure safety and stability have not been implemented.

8. RECOMMENDATIONS

The following actions are recommended:

1. Preparation of the required Operation & Safety Manual, Emergency Preparedness Plan, Logbook, and Permanent File, remains delinquent, despite initial identification for compliance in 2001, and repeated non-compliance in 2002, 2003, and 2004. Steps should be taken to address this issue in 2005, as continued non-compliance negates the purpose, and validity, of the entire process, that began in 2001 with the Dam Safety Review (DSR).

2. Undertake the next DSI prior to October 2005.

3. Based on record documents and discussion with the City of Iqaluit Engineering Department, the lagoon may be in service for perhaps another two (2) or three (3) years. If this is indeed the case, best practices would seem the best approach for ongoing safety and serviceability of the berms. Unfortunately, the safety/stability recommendations from the 2003 geotechnical report (discussed above) have not been implemented. This work should have been undertaken in 2004. It is strongly recommended that the recommended measures (adequate protection against overtopping, and adequate erosion protection installed on downstream portions of the berms) be implemented in 2005. Design and analysis would be required prior to construction.

4. If the sewage lagoon is to remain in service significantly longer than indicated in item 1, above, it is strongly recommended that the lagoon be either redesigned and rebuilt; or, that an impervious liner be installed with erosion measures applied to downstream faces of berms. Either option will likely require a new DSR.

We would be pleased to discuss this report with you.

Should there be any questions, please contact the undersigned.

Yours truly,

Concentric Associates International Inc.,

Allan D. Murray, P.Eng.,
Project Manager

APPENDIX A
Photographs

CONCENTRIC

Concentric Associates International Incorporated

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

August 31, 2006
REPORT

Produced For:
THE CITY OF IQALUIT, NUNAVUT

Produced By:
CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

Concentric Project Reference Number:
06-1405

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

CONTENTS

1. EXECUTIVE SUMMARY

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon. The scope of work for the assignment has been undertaken in accordance with Concentric's proposal 06-1405.

The site inspection and reporting were conducted on August 17 and 24, 2006, by Allan Murray, P.Eng., of Concentric.

It is recommended that the next DSI be conducted prior to October 2007.

OBSERVATIONS:

No significant changes in condition were observed since the previous DSI, with the following exceptions:

- The sewage lagoon is currently inactive, as all sewage is being processed at the sewage treatment plant.
- The sewage lagoon has been drawn down to a near empty level as a result of its inactive status
- As a result of the draw down, considerable sludge accumulation is now visible, which has likely reduced the lagoon capacity
- The west berm repairs recommended in previous DSI's have been completed.

RECOMMENDATIONS:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File, remains incomplete, however, the City has authorized this work to proceed this year.
2. Undertake the next DSI prior to October 2007.
3. The capacity of the sewage lagoon should be confirmed and sludge removal undertaken if required.
4. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration (pending the capacity check recommended in Item 3, above) should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

2. INTRODUCTION

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon located in Iqaluit, Nunavut.

This assignment and the scope of work described herein has been undertaken in accordance with Concentric's proposal 06-1405.

The site visit and reporting were conducted on August 17 and 24, 2006.

Allan Murray, P.Eng., of Concentric, met with the following personnel at the City of Iqaluit:

- Geoff Baker, Director of Engineering, City of Iqaluit

This report summarizes our terms of reference for the assignment, observations, conclusions and recommended action.

3. BACKGROUND

The Canadian Dam Safety Guidelines (DSG) requires that all structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals.

A DSR is a comprehensive, formal review process that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The sewage lagoon requires a DSR every ten (10) years. The DSR for the sewage lagoon was conducted in 2001.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection only to identify any changes in condition, or any observed concerns.

A detailed historical perspective may be referenced in the DSR on file with the City of Iqaluit.

4. SCOPE OF SERVICES

Our directive has been to undertake a Dam Safety Inspection (DSI) in accordance with the DSG, for the sewage lagoon. The inspection consisted of an on-site visual assessment, notation of any significant changes in condition since the last available DSI, preparation of a written report in a format compatible with the DSR, and a photographic record.

The following is a summary of the scope of work for this assignment. The DSI report is the primary deliverable, and has been prepared in accordance with the DSG document.

- Review available record documentation, to be provided by the City
- Review, in particular, reports and/or repairs/upgrades conducted since the 2001 DSR
- Interview and/or solicit input from maintenance personnel and City Administration regarding operating performance, concerns, incidents, repairs, and any notable concerns
- Conduct a visual on-site assessment of the sewage lagoon
- Prepare a photographic record documenting general and representative conditions
- Identify, characterize, and risk-assess any actual or potential concerns
- Prepare a written report summarizing our observations, items of concern, and recommendations
- Indicate any recommended repairs
- Prioritize action items
- Submit final documents in electronic format and hard copy

Limitations

The DSI is based on visual assessment; no invasive inspection/assessment was done.

5. SUMMARY OF PREVIOUS DSI'S

The following is a summary of observations and recommendations made from the previous DSI's:

January 7, 2003 (2002) DSI

A DSI was conducted by Trow Consulting Engineers (Report MA15882A, dated January 7, 2003) in October 2002. The DSI was termed "...an interim step prior to the implementation of remedial measures..." recommended in the 2001 DSR.

The DSI noted no significant changes since the 2001 DSR, but highlighted the seepage concerns of the east berm and the threat of overtopping in the spring.

The DSI reiterated the recommendations of the 2001 DSR, as follows:

- There is inadequate information concerning the as-built conditions of the berms
- The berms are not considered safe in their current condition and are non-compliant with the design and performance standards of the DSG.
- Remedial measures include three (3) options - an impermeable liner; buttressing the berms; and building a new lagoon.

Not stated in the 2002 DSI, but recommended in the 2001 DSR, were the following additional requirements, which are believed to be still outstanding:

- Complete the remaining outstanding non-compliance requirements of Section Nos. 3 and 4 of the DSG, as follows:
  - Permanent file
  - Operation, Maintenance and Surveillance Manual
  - Logbook
  - Emergency Preparedness Plan

2003 DSI

Based on our discussions with the City of Iqaluit Engineering Department, there is no 2003 DSI on file. However, a geotechnical investigation was conducted by Trow Associates Inc. (Report OTGE00016794A, dated October 8, 2003) in 2003.

The scope of the geotechnical investigation was to undertake a topographic survey of the lagoon and conduct a slope stability analysis of the berms. A separate hydrologic report is referenced, but was not provided to us. It would appear that the geotechnical investigation was attempting to address some of the as-built issues discussed in the 2002 DSI.

Salient points from the geotechnical investigation include:

- Adequate (satisfying the Dan Safety Guidelines) factors of safety exist for steady state seepage and rapid drawdown scenarios
- The berm slopes should remain stable provided they are protected against overtopping and adequate erosion protection is installed on downstream faces
- Catastrophic failure is unlikely with the above provisos, however, localized failures or seeps are expected until such time as the lagoon is lined with an impervious material, or rebuilt

2004 DSI

A 2004 DSI was commissioned, however, it was not authorized by the City of Iqaluit until February 2005. The DSI was conducted by Concentric.

Much of the site was snow covered at the time of the 2004 DSI so the report was limited in nature and basically reiterated previous concerns and items that remained outstanding.

2005 DSI

A 2005 DSI was not conducted.

6. COMMENTARY ON DAM SAFETY GUIDELINES

The Canadian Dam Association publication, Dam Safety Guidelines (DSG), governs the nature and frequency of inspection and review activities for structures which fall under its umbrella criteria.

The DSG applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their "consequence category", that is, the consequence of dam failure in terms of life safety, and socio-economic impact. The category assigned may range from very low to very high. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The frequency of DSR's varies depending on consequence category. For structures where significant life safety and/or socio-economic consequence exist, the DSR is usually conducted every five (5) to ten (10) years. The sewage lagoon requires a DSR every ten (10) years. The initial DSR for the sewage lagoon was conducted in 2001; therefore, the sewage lagoon is due for an updated DSR in 2011. If significant alterations (not including repairs that do not change the height or volume of the structure) to the structure take place before this date, an updated DSR would be required.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection (DSI) would be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns. The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.

7. OBSERVATIONS

The sewage lagoon was accessed on foot. Based on our visual assessment we have the following comments:

- The lagoon is currently not in use. All sewage is being processed at the sewage treatment plant. The City of Iqaluit intends to use the lagoon as a back up facility only.
- As a result of inactivity, (loss of inflow) the lagoon has been gradually drawn down by the outflow to a near empty state.
- The repairs to the west berm that were recommended in previous DSI's and other reports have been completed.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- Considerable sludge build up was noted now that the lagoon has been drawn down

Overall, the condition of the structure has not changed significantly since the previous DSI, with the above noted exceptions

8. RECOMMENDATIONS

The following actions are recommended:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File, remains incomplete, however, the City has authorized this work to proceed this year.

2. Undertake the next DSI prior to October 2007.

3. The capacity of the sewage lagoon should be confirmed and sludge removal undertaken if required.

4. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration (pending the capacity check recommended in Item 3, above) should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

We would be pleased to discuss this report with you.

Should there be any questions, please contact the undersigned.

Yours truly,

Concentric Associates International Incorporated

Allan D. Murray, P.Eng.,
Project Manager

APPENDIX A
Photographs

Photograph 1
Overview, East Berm; note sludge buildup visible now that lagoon is inactive.

Photograph 2
Overview, West Berm; looking south during 2006 repairs

Photograph 3
Overview, West Berm, completed 2006 repairs, looking north

CONCENTRIC

Concentric Associates International Incorporated

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

October 29, 2009
REPORT

Produced For:
THE CITY OF IQALUIT

Produced By:
CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

Concentric Project Reference Number:
09-2930

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

CONTENTS

1. EXECUTIVE SUMMARY

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon. The scope of work for the assignment has been undertaken in accordance with Concentric's proposal 09-2930 dated October 15 2009.

The site inspection was conducted on October 22, 2009, by Allan Murray, P.Eng., of Concentric. It is recommended that the next DSI be conducted prior to October 2010.

OBSERVATIONS:

No significant changes in condition of the lagoon and retention berms were observed since the previous DSI which was conducted in 2006.

Representative existing conditions have been documented by photographs in Appendix A.

The required documentation (discussed further below) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

RECOMMENDATIONS:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.

2. The Emergency Preparedness Plan has not been completed; it is suggested that the relevance of this document be assessed and a decision made regarding its requirement to exist.

3. The capacity of the sewage lagoon should be confirmed.

4. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration (pending the capacity check recommended in Item 3, above) should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

5. Complete the next DSI prior to October 2010.

2. INTRODUCTION

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon located in Iqaluit, Nunavut.

This assignment and the scope of work described herein has been undertaken in accordance with Concentric's proposal 09-2930 submitted on October 15, 2009.

The site visit was conducted on October 22, 2009.

Allan Murray, P.Eng., of Concentric, met with the following personnel at the City of Iqaluit:

- Paul Clow, Director of Engineering, City of Iqaluit

This report summarizes our terms of reference for the assignment, observations, conclusions and recommended action.

3. BACKGROUND

The Canadian Dam Safety Guidelines (DSG) requires that all structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals.

A DSR is a comprehensive, formal review process that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The sewage lagoon requires a DSR every ten (10) years. The current DSR for the sewage lagoon was conducted in 2001.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection only to identify any changes in condition, or any observed concerns.

A detailed historical perspective may be referenced in the DSR on file with the City of Iqaluit.

4. SCOPE OF SERVICES

Our directive has been to undertake a Dam Safety Inspection (DSI) in accordance with the DSG, for the sewage lagoon. The inspection consisted of an on-site visual assessment, notation of any significant changes in condition since the last available DSI, preparation of a written report in a format compatible with the DSR, and a photographic record.

The following is a summary of the scope of work for this assignment. The DSI report is the primary deliverable, and has been prepared in accordance with the DSG document.

- Review available record documentation.
- Conduct a visual on-site assessment of the sewage lagoon
- Prepare a photographic record documenting general and representative conditions
- Identify, characterize, and risk-assess any actual or potential concerns
- Prepare a written report summarizing our observations, items of concern, and recommendations
- Indicate any recommended repairs
- Prioritize action items
- Submit final documents in electronic format and hard copy

Limitations

The DSI is based on visual assessment; no invasive inspection/assessment was done.

This report has been prepared for the sole use of The City of Iqaluit.

5. SUMMARY OF PREVIOUS DSI'S

The following is a summary of observations and recommendations made from past DSI's conducted since the 2001 DSR:

January 7, 2003 (2002) DSI

A DSI was conducted by Trow Consulting Engineers (Report MA15882A, dated January 7, 2003) in October 2002. The DSI was termed "…an interim step prior to the implementation of remedial measures…" recommended in the 2001 DSR.

The DSI noted no significant changes since the 2001 DSR, but highlighted the seepage concerns of the east berm and the threat of overtopping in the spring.

The DSI reiterated the recommendations of the 2001 DSR, as follows:

- There is inadequate information concerning the as-built conditions of the berms
- The berms may not be safe in their current condition and may be non-compliant with the design and performance standards of the DSG.
- Remedial measures include three (3) options - an impermeable liner; buttressing the berms; and building a new lagoon.

Not stated in the 2002 DSI, but recommended in the 2001 DSR, were the following additional requirements:

- Complete the remaining outstanding non-compliance requirements of Section Nos. 3 and 4 of the DSG, as follows:
  - Permanent file
  - Operation, Maintenance and Surveillance Manual
  - Logbook
  - Emergency Preparedness Plan

2003 DSI

Based on our discussions with the City of Iqaluit Engineering Department, there is no 2003 DSI on file. However, a geotechnical investigation was conducted by Trow Associates Inc. (Report OTGE00016794A, dated October 8, 2003) in 2003.

The scope of the geotechnical investigation was to undertake a topographic survey of the lagoon and conduct a slope stability analysis of the berms. A separate hydrologic report is referenced, but was not provided to us. It would appear that the geotechnical investigation was attempting to address some of the as-built issues discussed in the 2002 DSI.

Salient points from the geotechnical investigation include:

- Adequate (satisfying the Dan Safety Guidelines) factors of safety exist for steady state seepage and rapid drawdown scenarios
- The berm slopes should remain stable provided they are protected against overtopping and adequate erosion protection is installed on downstream faces
- Catastrophic failure is unlikely with the above provisos, however, localized failures or seeps are expected until such time as the lagoon is lined with an impervious material, or rebuilt

2004 DSI

A 2004 DSI was commissioned, however, it was not authorized by the City of Iqaluit until February 2005. The DSI was conducted by Concentric.

Much of the site was snow covered at the time of the 2004 DSI so the report was limited in nature and basically reiterated previous concerns and items that remained outstanding.

2005 DSI

A 2005 DSI was not conducted.

2006 DSI

The following is a summary of observations and recommendations from the 2006 DSI prepared by Concentric:

- The lagoon is not in use and sewage is being processed at the sewage treatment plant.
- The lagoon has been drawn down by the outflow with some sludge accumulation.
- The recommended repairs to the west berm have been completed.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.

- Preparation of the required Operation & Safety Manual, Logbook, Permanent File, and Emergency Preparedness Plan remains incomplete.
- The capacity of the sewage lagoon should be confirmed.
- It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

Overall, the condition of the structure did not changed significantly since the previous DSI.

6. COMMENTARY ON DAM SAFETY GUIDELINES

The Canadian Dam Association publication, Dam Safety Guidelines (DSG), governs the nature and frequency of inspection and review activities for structures which fall under its umbrella criteria.

The DSG applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their "consequence category", that is, the consequence of dam failure in terms of life safety, and socio-economic impact. The category assigned may range from very low to very high. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, that involves completion of checklist items in accordance with the Dam Safety Guidelines.

The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The frequency of DSR's varies depending on consequence category. For structures where significant life safety and/or socio-economic consequence exist, the DSR is usually conducted every five (5) to ten (10) years. The sewage lagoon requires a DSR every ten (10) years. The initial DSR for the sewage lagoon was conducted in 2001; therefore, the sewage lagoon is due for an updated DSR in 2011. If significant alterations (not including repairs that do not change the height or volume of the structure) to the structure take place before this date, an updated DSR would be required.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection (DSI) would be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns. The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.

7. OBSERVATIONS

The sewage lagoon was accessed on foot. Based on our visual assessment we have the following comments:

- There were no significant changes in the lagoon or berm structures since the previous DSI, which was conducted in 2006.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- To our knowledge, the sewage lagoon capacity has not been confirmed; this should be done as inactivity and sludge/sediment accumulation may have reduced the effective capacity significantly.
- To our knowledge, the required documentation (discussed previously) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

8. RECOMMENDATIONS

The following actions are recommended:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.

2. The Emergency Preparedness Plan has not been completed; it is suggested that the relevance of this document be assessed and a decision made regarding its requirement to exist.

3. The capacity of the sewage lagoon should be confirmed.

4. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

5. Complete the next DSI prior to October 2010.

We would be pleased to discuss this report with you.

Should there be any questions, please contact the undersigned.

Yours truly,

Concentric Associates International Incorporated

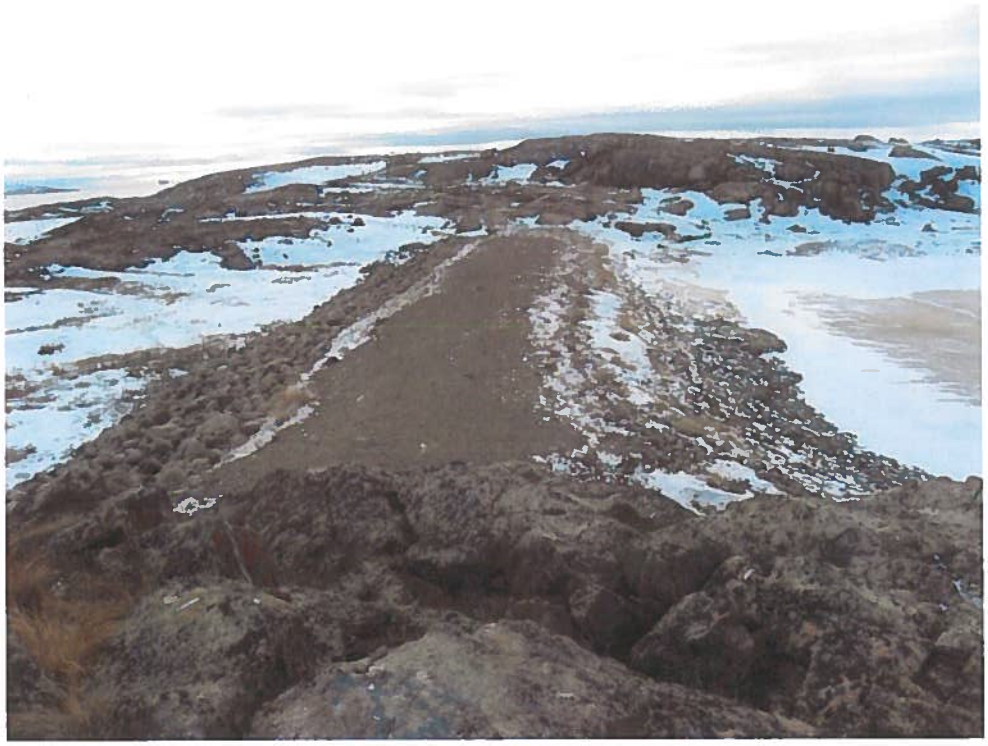
Allan Murray, P.Eng.,
Project Manager

APPENDIX A
Photographs

Photograph 1
Overview looking East.

Photograph 2
Overview looking West

Photograph 3
East Berm, North segment; no change since 2006



Photograph 4
East Berm, South segment; no change since 2006

Photograph 5
West Berm, no change since 2006

Photograph 6
Discharge from Sewage Treatment Plant

Concentric Associates International Incorporated

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

September 21, 2011

REPORT

Produced For:
THE CITY OF IQALUIT

Produced By:
CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

Concentric Project Reference Number:
11-3999

City of Iqaluit Sewage Lagoon
Iqaluit, Nunavut
Dam Safety Inspection

CONTENTS

1. EXECUTIVE SUMMARY

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon. The scope of work for the assignment has been undertaken in accordance with Concentric's proposal to the City.

The site inspection was conducted on September 14, 2011, by Allan Murray, P.Eng., of Concentric. It is recommended that the next DSI be conducted prior to October 2012.

OBSERVATIONS:

No significant changes in condition of the lagoon and retention berms were observed since the previous DSI which was conducted in 2009.

Representative existing conditions have been documented by photographs in Appendix A.

The required documentation (discussed further below) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

RECOMMENDATIONS:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.

2. The Emergency Preparedness Plan has not been completed; it is suggested that the relevance of this document be assessed and a decision made regarding its requirement to exist. We can assist with this exercise.

3. The capacity of the sewage lagoon should be confirmed.

4. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration (pending the capacity check recommended in Item 3, above) should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

5. A Dam Safety Review (DSR) is required prior to October 2012.

2. INTRODUCTION

Concentric Associates International Inc., (Concentric) was retained by the City of Iqaluit, to undertake a Dam Safety Inspection (DSI) of the City of Iqaluit sewage lagoon located in Iqaluit, Nunavut.

This assignment and the scope of work described herein has been undertaken in accordance with Concentric's proposal to the City.

The site visit was conducted on September 14, 2011.

This report summarizes our terms of reference for the assignment, observations, conclusions and recommended action.

3. BACKGROUND

The Canadian Dam Safety Guidelines (DSG) requires that all structures exceeding prescribed height and volume minimums be subject to Dam Safety Reviews (DSR's) and Dam Safety Inspections (DSI's) at regular intervals.

A DSR is a comprehensive, formal review process that involves completion of checklist items in accordance with the Dam Safety Guidelines. The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The sewage lagoon requires a DSR every ten (10) years. The current DSR for the sewage lagoon was conducted in 2001/2002.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection only to identify any changes in condition, or any observed concerns.

A detailed historical perspective may be referenced in the DSR on file with the City of Iqaluit.

4. SCOPE OF SERVICES

Our directive has been to undertake a Dam Safety Inspection (DSI) in accordance with the DSG, for the sewage lagoon. The inspection consisted of an on-site visual assessment, notation of any significant changes in condition since the last available DSI, preparation of a written report in a format compatible with the DSR, and a photographic record.

The following is a summary of the scope of work for this assignment. The DSI report is the primary deliverable, and has been prepared in accordance with the DSG document.

- Review available record documentation.
- Conduct a visual on-site assessment of the sewage lagoon
- Prepare a photographic record documenting general and representative conditions
- Identify, characterize, and risk-assess any actual or potential concerns
- Prepare a written report summarizing our observations, items of concern, and recommendations
- Indicate any recommended repairs
- Prioritize action items
- Submit final documents in electronic format and hard copy

Limitations

The DSI is based on visual assessment; no invasive inspection/assessment was done.

This report has been prepared for the sole use of The City of Iqaluit.

5. SUMMARY OF PREVIOUS DSI'S

The following is a summary of observations and recommendations made from past DSI's conducted since the 2001 DSR:

January 7, 2003 (2002) DSI

A DSI was conducted by Trow Consulting Engineers (Report MA15882A, dated January 7, 2003) in October 2002. The DSI was termed "...an interim step prior to the implementation of remedial measures..." recommended in the 2001 DSR.

The DSI noted no significant changes since the 2001 DSR, but highlighted the seepage concerns of the east berm and the threat of overtopping in the spring.

The DSI reiterated the recommendations of the 2001 DSR, as follows:

- There is inadequate information concerning the as-built conditions of the berms
- The berms may not be safe in their current condition and may be non-compliant with the design and performance standards of the DSG.
- Remedial measures include three (3) options - an impermeable liner; buttressing the berms; and building a new lagoon.

Not stated in the 2002 DSI, but recommended in the 2001 DSR, were the following additional requirements:

- Complete the remaining outstanding non-compliance requirements of Section Nos. 3 and 4 of the DSG, as follows:
  - Permanent file
  - Operation, Maintenance and Surveillance Manual
  - Logbook
  - Emergency Preparedness Plan

2003 DSI

Based on our discussions with the City of Iqaluit Engineering Department, there is no 2003 DSI on file. However, a geotechnical investigation was conducted by Trow Associates Inc. (Report OTGE00016794A, dated October 8, 2003) in 2003.

The scope of the geotechnical investigation was to undertake a topographic survey of the lagoon and conduct a slope stability analysis of the berms. A separate hydrologic report is referenced, but was not provided to us. It would appear that the geotechnical investigation was attempting to address some of the as-built issues discussed in the 2002 DSI.

Salient points from the geotechnical investigation include:

- Adequate (satisfying the Dan Safety Guidelines) factors of safety exist for steady state seepage and rapid drawdown scenarios
- The berm slopes should remain stable provided they are protected against overtopping and adequate erosion protection is installed on downstream faces
- Catastrophic failure is unlikely with the above provisos, however, localized failures or seeps are expected until such time as the lagoon is lined with an impervious material, or rebuilt

2004 DSI

A 2004 DSI was commissioned, however, it was not authorized by the City of Iqaluit until February 2005. The DSI was conducted by Concentric.

Much of the site was snow covered at the time of the 2004 DSI so the report was limited in nature and basically reiterated previous concerns and items that remained outstanding.

2005 DSI

A 2005 DSI was not conducted.

2006 DSI

The following is a summary of observations and recommendations from the 2006 DSI prepared by Concentric:

- The lagoon is not in use and sewage is being processed at the sewage treatment plant.
- The lagoon has been drawn down by the outflow with some sludge accumulation.
- The recommended repairs to the west berm have been completed.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.

- Preparation of the required Operation & Safety Manual, Logbook, Permanent File, and Emergency Preparedness Plan remains incomplete.
- The capacity of the sewage lagoon should be confirmed.
- It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

2009 DSI

The following is a summary of observations and recommendations from the 2009 DSI prepared by Concentric:

- There were no significant changes in use, or the lagoon/berm structures since the previous DSI.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- To our knowledge, the sewage lagoon capacity has not been confirmed; this should be done as inactivity and sludge/sediment accumulation may have reduced the effective capacity significantly.
- To our knowledge, the required documentation (discussed previously) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.
- Update the Operation & Safety Manual, Logbook, and Permanent File.
- The Emergency Preparedness Plan has not been completed; it is suggested that the relevance of this document be assessed and a decision made regarding its requirement to exist.
- It is understood that the intent of the City is to retain the sewage lagoon as a back-up facility only. Localized failures and/or seeps are to be expected. The lagoon operates on old technology; it is essentially a "leaky dam", and its use may be prohibited at any time in the future.
- Complete the next DSI prior to October 2010.

6. COMMENTARY ON DAM SAFETY GUIDELINES

The Canadian Dam Association publication, Dam Safety Guidelines (DSG), governs the nature and frequency of inspection and review activities for structures which fall under its umbrella criteria.

The DSG applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple embankments or dikes to massive and complex dams associated with hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their "consequence category", that is, the consequence of dam failure in terms of life safety, and socio-economic impact. The category assigned may range from very low to very high. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a comprehensive, formal review process, conducted at regular intervals, that involves completion of checklist items in accordance with the Dam Safety Guidelines.

The DSR forms a baseline of dam history, condition, repair requirements, and extensive documentation of monitoring, operating, safety and emergency procedures.

The frequency of DSR's varies depending on consequence category. For structures where significant life safety and/or socio-economic consequence exist, the DSR is usually conducted every five (5) to ten (10) years. The sewage lagoon requires a DSR every ten (10) years. The initial DSR for the sewage lagoon was conducted in 2001/2002; therefore, the sewage lagoon is due for an updated DSR by the end of 2012. If significant alterations (not including repairs that do not change the height or volume of the structure) to the structure take place before this date, an updated DSR would be required.

It is required in the DSG document that in the interval between DSR's, a Dam Safety Inspection (DSI) would be performed on an annual basis. The DSI is a much less comprehensive review, comprising a visual inspection to identify any changes in condition, or any observed concerns. The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.

7. OBSERVATIONS

The sewage lagoon was accessed on foot. Based on our visual assessment we have the following comments:

- There were no significant changes in the lagoon or berm structures since the previous DSI, which was conducted in 2009.
- Seepage was not observed downstream of any berms.
- Minimal flow was observed at the outflow.
- To our knowledge, the sewage lagoon capacity has not been confirmed; this should be done as inactivity and sludge/sediment accumulation may have reduced the effective capacity significantly.
- To our knowledge, the required documentation (discussed previously) under the Canadian Dam Safety Guidelines is not up to date, and remains incomplete.

8. RECOMMENDATIONS

The following actions are recommended:

1. Preparation of the required Operation & Safety Manual, Logbook, and Permanent File was completed in 2007; however, the documents require updating.

2. The Emergency Preparedness Plan has not been completed; it is suggested that the relevance of this document be assessed and a decision made regarding its requirement to exist.

3. The capacity of the sewage lagoon should be confirmed.

4. It is understood that the intent of the City of Iqaluit is to retain the sewage lagoon as a back-up facility only. Given this occasional use the facility in its current configuration should be adequate for the intended purpose. However, this does not mean preventative maintenance can be overlooked. Localized failures and/or seeps are to be expected. The City of Iqaluit should remain aware that the lagoon operates on old technology – it is essentially a "leaky dam", and its use may be prohibited at any time in the future.

5. A Dam safety Review (DSR) is required prior to October 2012.

We would be pleased to discuss this report with you.

Should there be any questions, please contact the undersigned.

Yours truly,

Concentric Associates International Incorporated

Allan Murray, P.Eng.,
Project Manager

APPENDIX A
Photographs

Photograph 1
Overview of West berm.

Photograph 2
Overview looking East; note lagoon level and sludge accumulation.

Photograph 3
Overview, Northeast berm.

Photograph 4
Overview, Southeast berm.

CONCENTRIC

Our file # 12-4487

June 29, 2012

City of Iqaluit
Department of Engineering
P.O. Box 460 via email
Iqaluit, Nunavut
X0A 0H0

Attention: **Mr. Paul Clow, Project Officer**

Re: **Iqaluit Sewage Lagoon**
DSR Requirement Investigation

Dear Paul:

Concentric Associates International Incorporated (Concentric) was retained to determine if and how often Dam Safety Reviews (DRS's) are required for the Sewage Lagoon in Iqaluit, Nunavut.

Background and Description

The Iqaluit Sewage Lagoon was constructed south of the FOL barracks, on the tidal plain at the head of Koojesse Inlet circa 1978. The lagoon is formed by 2 man-made berms (east and west) and the natural topography to the north and south.

The sewage lagoon has not been in use for several years, the water treatment plant constructed circa 2006 removes the need for the lagoon. However the lagoon is required as an emergency back-up in the event of a failure at the water treatment plant.

Observations

The Canadian Dam Safety Guidelines (DSG) were originally published in 1999. That document formed the basis for the Dam Safety Review (DSR) conducted by Trow (now exp) in 2001/2002. The Trow (now exp) DSR recommended a new DSR every ten (10) years.

The DSG's have since undergone significant revisions, with a new issue published in 2007.

Concentric suggested that, prior to a new DSR being conducted, a review of the classification criteria, and thus the DSR requirements of the 2007 DSG be conducted.

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F: 306.343.3601

REGINA
369 Park Street,
Regina, Saskatchewan
S4N 5B2
T: 306.522.6100
TF: 1.866.919.1861
F: 306.522.6101

WINNIPEG
300 - 1600 Ness Avenue,
Madison Square
Winnipeg, Manitoba
R3J 3W7
T: 204.783.1276
TF: 1.866.919.4531
F: 204.478.4940

LONDON
700 Richmond Street,
Suite 307,
London, Ontario
N6A 5C7
T: 519.452.7700
TF: 1.866.919.4531
F: 519.452.1712

OTTAWA
5310 Canotek Road,
Unit 30,
Ottawa, Ontario
K1J 9N5
T: 613.824.8900
TF: 1.866.919.4530
F: 613.824.8901

IQALUIT
P.O. Box 957,
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T: 867.979.3300
TF: 1.866.919.4533
F: 867.979.3302

According to the 2007 Dam Safety Guidelines, the suggested frequency for DSR's to be performed varies, based on the Dam Classification. For example, with a Significant Class Dam a DSR is required every 10 years.

Section 2.5 of the safety guidelines outlines the consequences to be evaluated for the various classifications.

Consequences for the determination of Dam Classification are as follows:

- Population at Risk (PAR), defined as the number of people who would be exposed to the hazard of a dam failure.
- Loss of Life, defined as the number of people would be exposed to flood waters and would experience consequences that could range from inconvenience and economic losses to loss of life.
- Environmental and Cultural Values: defined as significant environmental losses as assessed in terms of whether restoration of environment is feasible and how long it would take. Cultural losses include damage to irreplaceable historical and cultural features.
- Infrastructure and Economics, defined as economic losses including direct damage to third-party property, facilities, other utilities and infrastructure.

Concentric has determined that there is no PAR in the event of a dam failure. Localized seepage is to be expected with un-lined ("leaky") lagoon technology. In the event of a berm failure or wash out as the immediate surrounding area of the lagoon is unpopulated; no risk to human life is expected.

Loss of Life is determined to be zero for the same reasons stated above.

Environmental and Cultural Values: long term loss is not anticipated; there are no historical sites in the vicinity. The lagoon will continue to have localized seepage, and in the unlikely event of a berm failure or washout, the environmental impact will be minimal and temporary in nature.

Regarding Infrastructure and Economics, the immediate area contains limited infrastructure and services. The drainage path is towards Koojesse Inlet, with no threat to the airport and surrounding infrastructure.

Recommendations

Based on our observations, we believe that the Iqaluit Sewage Lagoon has a Low Risk Dam Classification; therefore, a Dam Safety Review is not required. However, the consequences of failure should be reviewed periodically, and the DSG's reviewed for any amendments or revisions.

Should there be any questions, please contact the undersigned.

Yours sincerely,

Concentric Associates International Incorporated

Lisa Koehler A.Sc.T.
Project Manager

Allan Murray P.Eng.
Partner

Appendix G EMERGENCY PREPAREDNESS PLAN

Currently, an Emergency Preparedness Plan does not exist for the Iqaluit WWTP Sewage Lagoon.

As the lagoon is considered a “Low Consequence” classification based on the Canadian Dam Association Classification Ratings (2016), an Emergency Preparedness Plan is not generally required.

Should the classification rating of the Iqaluit WWTP Sewage Lagoon be changed, or the regulations modified to require an Emergency Preparedness Plan, it shall replace the placeholder below.

– PLACEHOLDER –