Water Resources Division
Nunavut Regional Office
P.O. Box 100
Iqaluit, NU, X0A 0H0

December 14, 2015

Matthew Hamp
Director of Public Works and Engineering
City of Iqaluit
P.O. Box 460
Iqaluit, NU X0A 0X0

Re: Second reply to City of Iqaluit's response to Aboriginal Affairs and Northern Development Canada's comments regarding its renewal application for water licence 3AM-IQA

Dear Mr. Hamp,

This letter is to follow the one Aboriginal Affairs and Northern Development Canada (AANDC) sent on November 27 2015. It includes replies to responses the City of Iqaluit (City) provided addressing our submissions made in the course of the City's water licence renewal application process. Both a technical memorandum and an Excel table are provided. The information in both is identical, the only difference being the presentation.

The format of the response is that which we would send to the Nunavut Water Board (NWB or Board) in order to share with you our position on the different information requests and recommendations. Though the NWB has not requested a reply, we are sending it to you in hopes that we can discuss unresolved issues. This would be extremely helpful; allowing us to simplify discussions at the technical meeting and focus on those issues which are real sticking points. The Board encourages such discussions as they streamline the application process. The final decision always remains with the NWB and they must be informed of any agreements we might reach.

I would specifically like to speak with you regarding the ponds and run-off water treatment at the West 40 landfill because the message in this application is different than that which the City is giving Justin Hack, the AANDC Water Resources Inspector working on this file. I would also be happy to speak with you about any other topic in the technical memorandum we are sending. Do not hesitate to contact me via email at sarah.forte@aandc-aadnc.gc.ca or by phone at 867-975-3876.

Sincerely,

Sarah Forté

Water Management Coordinator

c.c.: Andrew Keim, Acting Manager of Water Resources, AANDC
Sean Joseph, Technical Advisor, Nunavut Water Board

Technical Memorandum

To: Matthew Hamp, Director of Public Works and Engineering, City of Iqaluit

From: Amjad Tariq, Regulatory and Science Advisor, AANDC
Sarah Forté, Water Management Coordinator, AANDC

Date: December 14, 2015

Re: Replies to City of Iqaluit's responses to technical comments for water licence renewal and amendment application #3AM-IQA0612

As part of the water licence renewal and amendment process for water licence #3AM-IQA0612, on November 13 2015, the City of Iqaluit (Licensee or City) responded to technical comments that had been submitted to the Nunavut Water Board (NWB or Board). Over the course of the renewal process, Aboriginal Affairs and Northern Development Canada (AANDC or Department) had sent three submissions to the Board. The City responded in three separate letters.

The first section of this memorandum presents the scope of the licence application and its evolution. The next section is a tracking table for all information requests and recommendations submitted by the Department to the Board. In the last three sections, AANDC's previous interventions are transcribed as well as the City of Iqaluit's responses and our replies. This is to give context to the replies.

The comments, responses and replies are also provided in an Excel table format, in case people find it easier to track issues with a different layout. The information in the table is identical to the information in this document.

A. SCOPE

The total scope of the present renewal and amendment application includes the original scope, the addition to the original scope and new requests to the original scope. Though extra scope modifications were not explicitly requested in the City's last intervention, some of their replies necessarily modify the scope further.

Original Scope (2012)

- Upgrade, operation and the eventual decommissioning of the Water Treatment Plant and other associated systems that supply water extracted from Lake Geraldine for municipal use with a maximum withdrawal of 1,100,000 cubic meters annually.
- Upgrade, operation and the eventual decommissioning of the infrastructure for managing wastewater at the existing West 40 Wastewater Treatment Plant and backup Sewage Lagoon.
- Operation and eventual decommissioning of the solid waste management facility at the existing West 40 Landfill and associated infrastructure.

Additions to the Original Scope (2014)

- Construction, operation and the eventual decommissioning of a new solid waste management facility approximately 7.5 kilometers northwest of Iqaluit City Centre.

New Requests to the Original Scope (2015)

- The City is requesting that the length of term of the licence be twenty-five (25) years.
- An additional location for water extraction on Apex River to supplement Lake Geraldine.
- The City has requested to change its Monitoring Program requirements.

Modifications to New Requests (2015)

- The City is requesting that the length of term of the licence be ten (10) years.
- Removal of the additional location for water extraction on the Apex River.
- Addition of West 40 Landfill run-off water treatment system.

B. TRACKING TABLE FOR INFORMATION REQUESTS AND RECOMMENDATIONS

Legend: R Resolved to AANDC's satisfaction
U Unresolved, precisions on reason included

Information request		Status
2013-11-08-IR#1	Compliance	R
2013-11-08-IR#2	Solid waste management	R
2013-11-08-IR#3	Solid waste management	U-minor changes
2013-11-08-IR#4	Solid waste management	R
2015-03-28-IR#1	Emergency preparedness plan – sewage lagoon	R
2015-07-10-IR#1	Sampling frequency	U-difference of opinion
2015-07-10-IR#2	Wastewater treatment plant drawings	R
2015-07-10-IR#3	Dam safety inspections – Lake Geraldine	R
2015-07-10-IR#4	Dam safety inspections – Lake Geraldine	U-more info requested
2015-07-10-IR#5	Thawing rates	R
2015-07-10-IR#6	Basin geometry	R
2015-07-10-IR#7	Timing of reservoir filling	R
2015-07-10-IR#8	Water withdrawal location	R
2015-07-10-IR#9	Water withdrawal location	R
2015-07-10-IR#10	Minimum flow requirements	R
2015-07-10-IR#11	Minimum flow requirements	R
2015-07-10-IR#12	Water withdrawal quantity	R
2015-07-10-IR#13	Water conservation measures	R
2015-07-10-IR#14	Sewage lagoon operation & maintenance	U-difference of opinion
2015-07-10-IR#15	West 40 landfill leachate & runoff	U-City requested info
2015-07-10-IR#16	West 40 landfill leachate & runoff	U-difference of opinion
2015-07-10-IR#17	West 40 landfill leachate & runoff	U-more info requested
2015-07-10-IR#18	West 40 landfill decommissioning	U-minor change
2015-07-10-IR#19	West 40 landfill decommissioning	R
2015-07-10-IR#20	West 40 landfill decommissioning	U-minor changes

Recommendation		Status
2013-11-08-R#1	Quarry operation & management	U-difference of opinion
2015-07-10-R#1	Licence term	U-minor changes
2015-07-10-R#2	Monitoring program requirements	U-difference of opinion
2015-07-10-R#3	Monitoring program requirements	U-difference of opinion
2015-07-10-R#4	Monitoring program requirements	R
2015-07-10-R#5	Monitoring program requirements	U-difference of opinion
2015-07-10-R#6	Annual reports	R
2015-07-10-R#7	Inspector's annual reports	R
2015-07-10-R#8	Water use	U-minor changes
2015-07-10-R#9	Water use	R
2015-07-10-R#10	Monitoring Lake Geraldine levels	U-difference of opinion
2015-07-10-R#11	Apex River as supplementary source	R
2015-07-10-R#12	Location for additional water withdrawal	R
2015-07-10-R#13	Minimum flow for Apex River	R
2015-07-10-R#14	Minimum flow for Apex River	R
2015-07-10-R#15	Water withdrawal quantity	R
2015-07-10-R#16	Wastewater management	U-difference of opinion
2015-07-10-R#17	West 40 wastewater plant upgrade	U-City requested info
2015-07-10-R#18	Sewage lagoon operation & maintenance	R
2015-07-10-R#19	Solid waste management	R
2015-07-10-R#20	West 40 landfill leachate & runoff	U-City requested info
2015-07-10-R#21	West 40 landfill leachate & runoff	U-difference of opinion
2015-07-10-R#22	Actions required after landfill fire	U-difference of opinion
2015-07-10-R#23	Use of sewage sludge compost	R

C. RESULTS OF NOVEMBER 11, 2013 COMPLETENESS REVIEW

Information Requests

Compliance

1. A stand-alone Compliance Assessment / Summary Report should be provided pursuant to Block 23 of the NWB's Application for Water Licence Renewal Form. This submission should identify measures taken to address any non-compliance

with the water licence terms and conditions and/or the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (the Act).

Context: A stand-alone Compliance Assessment / Summary Report would provide a clear record of the City of Iqaluit's compliance status as noted above (including any issues noted by Aboriginal Affairs and Northern Development Canada (AANDC) Inspectors). Although pertinent information is provided in the 2006 to 2012 Annual Reports, an October 2, 2012 concordance table of licence conditions (Appendix A-11 of the application), an October 2, 2012 follow-up memo to the July 3, 2012 AANDC Inspection Report (Appendix A-11 of the application), and various email correspondence between the City of Iqaluit and the NWB, an up to date stand-alone Compliance Assessment / Summary Report should be provided because the submitted information is now dated and not consolidated into a single document.

Response:

It is the City of Iqaluit's understanding that the Compliance Assessment/Summary report would be completed by the NWB.

Reply:

It is the City's responsibility, as indicated on Block 23 of the NWB's Application for Water Licence Renewal Form. AANDC will use the information provided in many documents in order not to hold up this licence renewal process, but would like to stress that it makes it more difficult for us to properly assess the licensee's current standing.

Solid Waste Management

2. A Long-term Solid Waste Management Plan prepared in accordance with Part E, Item 10 of the licence should be included in the application review. The City of Iqaluit has committed to provide this plan by November 30, 2013.

Response:

A Long-Term Solid Waste Management Plan has been provided to the Nunavut Water Board as part of this response to submissions from stakeholders.

Reply:

AANDC is satisfied with the January 2014 submission.

3. An Updated Operation and Maintenance Manual for the West 40 Landfill prepared in accordance with Part E, Items 12 and 15 of the licence should be

included in the application review. The City of Iqaluit has committed to provide this plan by November 30, 2013.

Response:

The Updated Operation and Maintenance Manual for the West 40 Landfill has been provided to the Nunavut Water Board as part of this response to submissions from stakeholders.

Reply:

AANDC notes that the Operation and Maintenance manual submitted does not include sufficient information on sampling and monitoring. Section 14.7 mentions that water monitoring reports are part of the City's water licence reporting requirements. However the manual contains no instructions on where and how the sampling should be done, the sampling frequency or the parameters to be measured in the field and analysed by a laboratory. **(R i)** We recommend that these omissions be corrected and an updated version of the Operation and Maintenance manual be submitted with the 2015 annual report.

4. An Abandonment and Restoration Plan for the West 40 Landfill prepared in accordance with Part J, Item 1 of the licence should be included in the application review. The City of Iqaluit has committed to provide this plan by November 30, 2013.

Response:

The Abandonment and Restoration Plan for the West 40 Landfill has been provided to the Nunavut Water Board as part of this response to submissions from stakeholders.

Reply:

AANDC has commented on this Plan in our July 2015 comments.

Other Considerations

<u>Quarry Operation and Management</u>

- The scope of the water licence should be amended to include the development, operation, and closure of quarries. Consequently, the renewed water licence should include applicable terms and conditions specific to the use of water and deposit of waste into or near water.

  Context: Quarries can negatively impact water sources through inadequate site selection (i.e., metal leachate and acid rock generation), sedimentation, and petroleum hydrocarbon spills. It is not uncommon for licenses issued for mining undertakings to include terms and conditions specific to the development,

operation, and closure of quarries (e.g., management plans, monitoring requirements, and closure planning). Similar requirements should be applied to municipal undertakings.

Currently, the City of Iqaluit is excavating aggregate from the Trail Area Deposit, crushing and sorting this material at the North 40 site (former quarry and metal dump), and is planning to develop the Northwest Quarry, as referenced in the June 2013 Iqaluit Waste Management Project newsletter.

On April 2, 2008, the NWB issued a Type 'B' Industrial Water Licence to the City of Iqaluit, #8BC-TAD0811, to allow for access road construction, water course crossings, and quarrying operations associated with the Trail Area Deposit. This licence expired on March 31, 2011. When applying for this licence the City of Iqaluit recommended that it be granted a three year term as opposed to a five year term (typical duration) because it intended to "roll the operation of the Trail Area Deposit into its Type 'A' Municipal Water Licence." The City of Iqaluit may have overlooked the inclusion of this quarry in its application as it is not referenced in the submitted documentation.

Response:

The City contends that the operation of a quarry typically does not involve the use of water or deposition of waste into or near water, and as such the operation of a quarry should not be licenced under the NWB water licence. The City agrees with conditions pertaining to water use and deposit of waste as they pertain to operations of a quarry.

Reply:

The operation of a quarry has the potential to negatively impact water quality unless adequate management practises are used to prevent the entrainment of blast residue and sediment during freshet and rain events. Additionally it will alter drainage patterns in the area and therefore must be licensed. AANDC therefore recommends that the water licence include conditions for the operation of quarries including requiring an operation manual that addresses points described in Indian and Northern Affairs Canada's *Northern Land Use Guidelines – Pits and Quarries*.

D. RESULTS OF MARCH 28, 2015 COMPLETENESS REVIEW

Information Requests

Emergency Preparedness Plan for Sewage Lagoon

The Dam Safety Inspection Report recommends the completion of an Emergency Preparedness Plan for the sewage lagoon. The City of Iqaluit has an intention to retain the lagoon as a back-up facility. In light of the City's consultant report, localized failures and/or seeps are expected. The proponent should be requested to provide an Emergency Preparedness Plan accordingly.

Response:

The City has received a letter from a Structural Engineer that is submitted with the City response that states the sewage lagoon is a Low-Risk Dam Classification and an Emergency Preparedness Plan is not required.

Reply:

AANDC thanks the City for providing the letter clarifying that an Emergency Preparedness plan is not needed. We are satisfied with the November 2015 submission on this topic.

E. RESULTS OF JULY 10, 2015 TECHNICAL REVIEW

Comments and recommendations are provided following the same large subdivisions that are present in the licence as well as a general section for comments pertaining to the whole licence.

1 GENERAL

1.1 Licence term

Reference:

- Letter: RE: Confirmation of Submissions and Scope for Type "A" Water Licence 3AM-IQA0611 Renewal Amendment Application, City of Iqaluit, March 2, 2015

Comment:

The Licensee has requested a twenty-five (25) year licence renewal term.

This requested term is not appropriate in light of the many changes to major undertakings such as the wastewater treatment plant, the landfills and water withdrawal sources planned for the next 5 years as well as the continued non-compliance with the expired licence.

Non-compliance issues are reported in all the Water Licence Inspections and gave rise to an Inspector's Direction from Environment Canada and Aboriginal Affairs and Northern Development Canada (AANDC) on March 5, 2013. Some of the problems raised by this direction have not yet been resolved, though there is a project schedule in place to do so.

Recommendation:
(R 1) Aboriginal Affairs and Northern Development Canada (AANDC) recommends that the license should be renewed for five years but we are not opposed to a term up to ten years, should the Board consider it suitable.

Response:
The City believes that a long term licence is in the best interest of both the City and the NWB, and that any changes to the operations regulated under the water licence during the licence term could be dealt with through the amendment process. The City would support a 10 year term.

Reply:
AANDC is of the opinion that by removing the additional water source from the scope of this application, the City provides additional incentive for a five year licence term. According to the projected water consumption rates presented in the Lake Geraldine Water Balance Assessment (August 2013) the water withdrawal quantity requested in the application will be insufficient by 2019 and an amendment to the water licence will be necessary. The licence term could be lengthened at the time of this amendment, when presumably the City will have a better compliance record.

1.2 Monitoring program requirements

Reference:

- Letter: RE: Confirmation of Submissions and Scope for Type “A” Water Licence 3AM-IQA0611 Renewal Amendment Application, City of Iqaluit, March 2, 2015
- Letter: Water Sampling Criteria discontinuance and alteration, AANDC, December 5, 2014
- Canadian Environmental Protection Act (1999) Follow-up Report on a PSL1 Assessment for Which Data Were Insufficient to Conclude Whether the Substances Were "Toxic" to the Environment and to the Human Health – Chlorinated Paraffins, August 2008
- City of Iqaluit Annual Monitoring Report – 2014, exp Services, January 23, 2015

Comments and Recommendations:
The Licensee has requested several changes in the monitoring requirements of the licence (Part I and Schedule C), which are discussed individually below.

1.2.1 Chlorinated paraffins

The City is requesting the tests for chlorinated paraffins (now referred to as chlorinated alkanes) be removed from the water monitoring requirements. Their argument is the following: "*Chlorinated Paraffins are mainly found in heavily industrialized areas and the probability of receiving tests that show Chlorinated Paraffins above the accepted limit is assumed to be low*."

Short-chain chlorinated alkanes have been found in the Arctic food web. The higher volatility of certain short-chain compounds suggests that their presence resulted from long-range atmospheric transportation. Chlorinated alkanes are persistent pollutants and bio-accumulate. The available toxicity data indicate that they may be harmful to certain aquatic species at low concentrations.

(R 2) AANDC believes the possibility of chlorinated alkane concentrations in water exists and recommends keeping this testing requirement in the licence until the Licensee has sample results over three years to demonstrate that it is not a concern.

Response:
The comment that "The higher volatility of certain short-chain compounds suggests that their presence resulted from long-range atmospheric transportation" implies that the chlorinated paraffins are not a result of the City's water use. Therefore, testing for their presence should not be part of the water licence. Any study of long range transportation of chlorinated parafins is outside the scope of a water licence.

Reply:
The City is assuming there is a low probability of chlorinated alkanes concentrations above accepted limits in its wastewater. AANDC is requesting that their concentration be measured as evidence verifying the assumption. We would be satisfied if the City could provide past test results and are of the opinion that until sample results have demonstrated chlorinated alkanes are not a concern, they should be included in the licence.

Atmospheric deposition of chlorinated alkanes in water is likely a secondary source, with industrial activity remaining the primary source.

1.2.2 LC50 Bioassay

The City is requesting the LC50 Bioassay be removed from the water monitoring requirements for stations IQA-02, IQA-03 and IQA-05 and suspended until after 2018 for station IQA-04. Their argument is the following: "*It is understood that wastewater entering the WWTP is considered toxic and completing an LC50 Bioassay test on the influent provides no useful data for regulating effluent.*"

(R 3) AANDC agrees with the statement regarding influent toxicity and recommends removal of the LC50 Bioassay requirement IQA-03 and IQA-05 from the licence. AANDC also recommends suspending the testing requirement for station IQA-04 until after 2018, when the wastewater treatment plant will provide secondary treatment. Finally, AANDC recommends keeping the testing requirement for station IQA-02, the final discharge point from the sewage lagoon.

Response:

The City requests the requirement for LC50 Bioassay testing be tied to the commissioning of the secondary wastewater treatment facility as oppose to a specific date to allow for changes in the schedule of the wastewater treatment plant project.

The logic of suspending the LC50 Bioassay until after the wastewater plant is upgraded which AANDC supports is based on the understanding that the effluent would not pass the test prior to upgrading the facility. As it is understood that the sewage lagoon effluent would not pass the LC50 Bioassay requirements, the same logic should apply to the testing at station IQA-02 and the requirement should not be included in the water licence.

Reply:

AANDC made the recommendation of tying the LC50 Bioassay testing requirement for station IQA-04 to a date since the City has committed to improving their wastewater treatment by 2018 following a direction issued by Environment Canada and AANDC. Additionally, the Iqaluit WWTP Upgrade/Expansion Feasibility Study the City submitted in November 2015 includes a timeline for completion of work by 2018. We are concerned that including wording to tie the resumption of testing uniquely to the commissioning of the new facility might not put sufficient constraints on the City.

If the sewage lagoon effluent at IQA-02 would not pass the LC50 Bioassay requirement, than it should not be discharged directly, but treated in the wastewater treatment plant. AANDC does not agree with removing this requirement from the licence.

1.2.3 Station IQA-01 – raw water supply

The City is requesting the station IQA-01 be removed from the water monitoring requirements. Their argument is the following: "*Water quality is already sampled and monitored by the City of Iqaluit and the Government of Nunavut, Environment and Health, in relation to safer drinking water standards set out in the Public Water Supply Regulations.*"

AANDC has noted the Licensee's 2014 Annual Monitoring Report (section 3.2.1) substantiates exceedances of the Guidelines for Canadian Drinking Water Quality for raw water quality (IQA-01). The parameters for which exceedances were measured are chromium, iron, copper, nickel, manganese, and fecal coliform. Reporting test results to the NWB will help the Board monitor raw water quality in order to determine if sufficient measures are in the licence to protect the City's water source.

(R 4) AANDC recommends keeping station IQA-01 in the renewed licence, but perhaps measures can be taken to streamline the process to allow presentation of sampling results taken for the City or the Government of Nunavut, Environment and Health.

Response:

Testing for water quality as it pertains to raw water being taken for use as potable water should not be part of the water licence process. This is a water quality issue and testing is required under the Public Water Supply Regulations. The City requests that the monitoring requirement be removed and replaces with the requirement that the City provides test results as per the Public Water Supply Regulations.

Reply:

AANDC agrees with the City's proposal in the measure that the sampling location is clearly marked and its coordinates are made known to the Board.

1.2.4 Stations IQA-03 and IQA-05 – influent sewage lagoon and influent wastewater treatment plant

The City is requesting the stations IQA-03 and IQA-05 be removed from the water monitoring requirements. Their argument is the following: "*It is understood that the influent (to these stations) is deleterious to the environment and the only data that should require reporting is the discharge effluent.*" The City also mentions that the location of the influent pipe of the sewage lagoon is inaccessible making station IQA-03 inaccessible.

AANDC believes that influent and effluent water quality tests for a wastewater treatment plant not only determine the concentration of the contaminants of concern, but also provide data for the design (degree of treatment) and any future upgrade/modification of a particular wastewater treatment system. To help understand the efficiency of a primary wastewater treatment facility, it is imperative to continue monitoring the raw sewage within the plant from input through to the final discharge.

(R 5) AANDC recommends keeping stations IQA-03 and IQA-05 in the renewed licence, but perhaps measures can be taken to streamline the process to allow presentation of sampling results taken for the City. Station IQA-03 should be moved to a location that allows access.

Response:

Collection of information required for design is not part of the NWB's mandate. It should be part of the design of the expansion to the plant but as per the AANDC letter should not be a condition of the licence.

IQA-03 is the inlet to the lagoon and as there is typically no flow to the lagoon it is not possible to schedule an annual sampling protocol. Furthermore, the location of IQA-03 is located approximately 200 m upstream of IQA-05. There are no additional sources of wastewater between IQA-03 and IQA-05 therefore for all intents and purposes they are the same sampling point and the quality of effluent should be the same. Requiring sampling at both locations provides no additional information.

Reply:

In order for the NWB and other intervenors to evaluate the adequacy of the wastewater treatment methods proposed, they need to have access to the data used for method design.

AANDC accepts the City's argument that the wastewater sampled at stations IQA-03 and IQA-05 would be the same and therefore agrees to the removal of station IQA-03 from the sampling locations. However, we do not agree with removing station IQA-05 from the required sampling locations because of the argument stated in the paragraph above.

1.2.5 Stations IQA-07 and IQA-09 – surface water entering West 40 landfill and contaminated soils accepted at West 40 landfill

The City is requesting the station IQA-07 be removed from the water monitoring requirements because a perimeter berm prevents surface water from entering the

landfill. The City is requesting the station IQA-09 be removed from the water monitoring requirements because no contaminated soils are accepted at the West 40 landfill.

AANDC supports the City's request to remove stations IQA-07 and IQA-09 from the renewed licence.

1.2.6 Sampling frequency

The City is requesting altered sampling frequencies for stations IQA-02 (sewage lagoon effluent), IQA-04 (wastewater treatment plant effluent) and IQA-06 (wastewater treatment plant sludge). The Licensee has not provided the reasons to change the testing frequency requirements.

AANDC supports the City's request to change the monitoring frequency for station IQA-02 from bi-monthly and annually, as appears in Table 2 of the expired water licence, to intermittently (before decants). The water in the lagoon is contained and does not pose a risk to the environment until it is released, therefore it is appropriate to test it only before decants.

(IR 1) AANDC requests that the Licensee provide motivation for changing the sampling frequency at stations IQA-04 and IQA-06 and presently does not support the change.

Response:

The City requests the change in sampling frequency for operational costs and scheduling reasons. This request has been supported by AANDC in their letter dated December 5th, 2014.

Reply:

In his December 2015 letter to the City, the AANDC Water Resources Inspector did instruct the City to do quarterly testing of stations IQA-04 and IQA-06, adding that "*alteration to the sampling and reporting requirement may continue until either a new treatment plant is operational, as required in a new water licence issued by the Nunavut Water Board, or, as required by an Inspector*."

When sampling on a quarterly basis, awareness of a potential problem can take three months, which delays finding and implementing a solution. In the case of station IQA-04 (wastewater treatment plant effluent), reduced sampling may be justifiable in the case of the non-operational sewage treatment plant. However, given that the majority of the licence term to be covered will be for a period when the new wastewater treatment plant is operational, AANDC recommends more frequent sampling. The expired licence

required bi-monthly sampling and in keeping with other municipal licences, monthly sampling may be an adequate interval.

Since sludge treatment occurs at the landfill, where run-off is contained, AANDC is satisfied with quarterly testing for station IQA-06 (wastewater treatment plant sludge). This is with the understanding that: the sewage sludge is treated at composting facility at the West 40 landfill; run-off from the composting facility is contained, will be treated and is sampled before release; and the composted sludge will also be tested before use.

1.3 Annual reports

Reference:

- City of Iqaluit Annual Reports, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014

Comment:

Several Annual Reports (2007, 2008, 2009, 2010, 2011) that have been provided are incomplete, lacking monitoring data and information. AANDC has noted an improvement in the quality of the Monitoring Reports over the years. The 2014 Annual Monitoring was thorough and the Master Analytical Summary Table provided was helpful.

Recommendation:

(R 6) AANDC recommends requiring the Licensee to provide water quality monitoring data in a tabular format that identifies the station sampled and any criteria exceedance.

Response:

The City agrees with this recommendation.

Reply:

AANDC has no further comment.

1.4 Outstanding licence requirements

Reference:

- Application for Water Licence Renewal, Appendices C-2 to C-5, City of Iqaluit, October 2, 2012
- City of Iqaluit Annual Reports, 2012, 2013, 2014
- Inspection Reports, AANDC, July 2010, July 2011, October 2012, July 2013, October 2013, June 2014, October 2014

Comments and Information Request:
In reviewing the documents submitted for the application, some deficiencies with regards to requirements of the expired licence were noted. Clarifications are requested for the following three comments:

1.4.1 Wastewater treatment plant drawings

The Wastewater Treatment Plant design and drawings available in appendices C-2 and C-3 of the application have the following shortcomings:

- The design (process flow) for Phase 1 of the Wastewater Treatment Plant has not been signed by the Professional Engineer.
- Mechanical drawings, electrical drawings, instrumentation drawings are not signed the Professional Engineer.

Additionally, only the As-Built drawings in appendix C-5 are signed by a Professional Engineer whilst those in appendix C-4 are not. Pursuant to Part F, Item 5 of the licence, all construction of engineered structures should be supervised and field-checked by an Engineer in such a manner that the project specification can be enforced and, where required, the quality control measures can be followed.

(IR 2) AANDC request the Licensee to provide the construction record which shows that the construction was supervised and field-checked by an Engineer and recommends keeping the requirement for all plans and drawings to be stamped by a Professional Engineer registered with the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (NAPEG) in the renewed licence.

Response:
Record drawings for the original plant do not exist. The record drawings (not stamped) for the 2006 upgrade are being provided to the Nunavut Water Board as part of this response to submissions form stakeholders.

Reply:
AANDC thanks the City for the precisions and record drawings.

1.4.2 Ultraviolet lights at water treatment plant

The Licensee's 2013 and 2014 Annual Reports confirm that one Ultraviolet (UV) light system was not functional at the time of inspections. In five of the last seven Inspection Reports, the state of the water supply treatment system was found to be unacceptable and most often one of the UV light systems was non-functional.

AANDC encourages the Licensee to contact Public Health and keep them informed on what steps they are taking to ensure proper functioning of the UV system at the Water Treatment Plant.

1.5 Inspector's annual reports

Reference:

- Nunavut Water Board Licence 3AM-IQA0611

Comment:

Part A, Item 3 of the licence requires the Inspector to submit an annual report discussing five points including compliance, monitoring and emergency and unauthorised discharges. All these points are presently addressed in the Inspection Reports.

Recommendation:

(R 7) AANDC recommends rewording Part A, Item 3 of the licence so that the Inspector can address points 1 to 5 in their Inspection Reports rather than being required to produce a separate annual report.

Response:

The City has no comment.

Reply:

AANDC has no further comment.

2 WATER USE

The original renewal and amendment scope speaks of upgrade, operation and the eventual decommissioning of the Water Treatment Plant and other associated systems that supply water extracted from Lake Geraldine for municipal use with a maximum withdrawal of 1,100,000 cubic meters annually. No documentation was found regarding the eventual decommissioning of the water treatment plant. **(R 8)** AANDC requests the opportunity to review these documents when available and recommends that if the Water treatment plant decommissioning is included in the renewed licence, it be conditional on approval of a decommissioning plan.

Response:

There are no plans to decommission the Water Treatment Plant, therefore development of a closure plan for this facility would be premature. The City suggests the following

clause be added to allow the water licence to manage the potential closure of any facility.

The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities or upon submission of the final design drawings for the construction of new facilities to replace existing ones. Where applicable the Plan shall include information on the following:

a. water intake facilities;
b. the water treatment and waste disposal sites and facilities;
c. leachate prevention;
d. an implementation schedule;
e. maps delineating site facilities;
f. consideration of altered drainage patterns;
g. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment related to water use, waste deposit to water, or appurtenant undertakings related to water use and/or deposit of waste to water, subject to the act and regulations.

Reply:
AANDC agrees with the suggestion made by the City, with one modification. We recommend removing the possibility of submitting the Abandonment and Reclamation Plan less than six months before abandonment. This might be obtained by adding to the proposed wording:
*... at least six (6) months prior to abandoning any facilities or upon submission of the final design drawings for the construction of new facilities to replace existing one**, if available before the six month window**.*

In 2015, a new request for an additional location for water extraction on Apex River was added to the licence application to supplement Lake Geraldine.

2.1 Dam safety inspections for Lake Geraldine Reservoir

Reference:

- Lake Geraldine Dam Safety Inspection, McMillen, October 2014
- Lake Geraldine Dam Safety Review, Concentric Associates International Incorporated, 13-5021-B, March 27, 2014
- City of Iqaluit Dam Safety Inspection Lake Geraldine Dam Iqaluit, Nunavut, Concentric Associates International Incorporated, 12-4394, July 11, 2012
- Lake Geraldine Dam Iqaluit, Nunavut Dam Safety Inspection, Concentric Associates International Incorporated, 11-4000, September 21, 2011

- Lake Geraldine Dam Iqaluit, Nunavut Dam Safety Inspection, Concentric Associates International Incorporated, 10-3496, November 23, 2010

Comment:
The City has provided dam safety inspections and review for the Lake Geraldine Reservoir. The implementation status of several recommendations is unclear, including the following:

- In 2014, the Licensee's consultant recommended that repair to concrete spalling and joints on the upstream faces of the concrete structure is required by autumn 2016. However, the work should be completed sooner if concrete conditions deteriorate.
- The Licensee's 2013 Annual Report and states that, 'the Permanent Record File, Logbook and Operation and Surveillance manual requires updating for the year 2014.
- All of the inspection reports above mention an Emergency Preparedness Plan. Prior to 2012, the reports recommend its creation and after this they recommend including it in the documentation and Permanent Record File.

Information request:
(IR 3) AANDC requests that the Licensee provide details on actions taken in the light of consultant recommendations for the above mentioned items.

Response:
This City is currently in the process of addressing the spalling concrete issue and the work is currently under design. As per the terms of the Water Licence the design will be submitted for review prior to the work proceeding.

The Permanent Record File will be updated by the end of 2015.

The Emergency Preparedness Plan will be completed in 2016.

Reply:
AANDC thanks the City for these precisions.

(IR 4) Additionally, the Licensee should provide the 2014 Lake Geraldine Dam Safety Inspection Report signed by a Professional Engineer.

Response:
The 2014 Lake Geraldine Dam Safety Inspection Report has been submitted with the 2014 Annual Report.

Reply:
This information request was made because the 2014 Lake Geraldine Dam Safety Inspection Report provided with the 2014 Annual Report was not signed by a Professional Engineer.

Recommendation:
(R 9) AANDC recommends that the wording of Part D, Item 5 of the License be modified so that the Licensee is required to follow the current Canadian Dam Safety Guidelines, and submit inspections and reviews following the schedule in these guidelines. This would allow the inclusion of yearly inspections as necessary, as well as reviews as deemed necessary.

Response:
The City agrees with the requirement for following the Canadian Dam Safety Guidelines.

Reply:
AANDC has no further comment.

2.2 Lake Geraldine water balance

Reference:

- Lake Geraldine Water Balance Assessment, Golder Associates, 12-1151-0264, August 20, 2013
- Letter: Preliminary additional information in support of supplementation design, Golder Associates, 12-1151-0264(6000), August 20, 2013

Comments and Information Request:
Clarifications are requested for the following three comments made regarding the assumptions present in the above referenced documents.

2.2.1 Thawing rates

The preliminary additional information in support of supplementation design letter presents water volumes required for supplementing the reservoir. It is not clear if the rate of spring melting and reservoir replenishment during the spring has been taken into account. In Section 2.0 the following assumptions are included:

> *3) The last day of winter is defined as the first day which exhibits an average daily air temperature above 2°C immediately following three (3) consecutive days that have each exhibited daily average air temperatures above 0.5°C.*

5) Estimated supplementation volumes are based on the assumption that the reservoir supply will be exhausted on the first day of spring when a portion of the reservoir ice and watershed runoff replenishes the drinking water supply.

(IR 5) If the reservoir supply is exhausted at the end of winter, can spring melt provide the required daily water quantities on the fourth day after 3 consecutive days with air temperatures above 0.5°C?

Response:

The Lake Geraldine water balance was designed to estimate water levels within Lake Geraldine under predicted future conditions and inform the City of implications of different combinations of water supply stressors (i.e., historic combinations of precipitation, air temperature, winter durations and predicted climate change, coupled with future consumption rates). Within the tool itself, which is intended to be a water management planning tool, predicted and observed water levels (and therefore volumes) may differ from one another for a variety of climatic and operational reasons including;

- *winter lasting longer than predicted (and, thus, resulting in a delay in recharge of Lake Geraldine);*
- *increase in water takings (both because of changes in consumption, but even because damage to water taking equipment, burst pipes, etc.);*
- *lower precipitation than predicted (thus reducing the recharge to Lake Geraldine);and*
- *greater ice formation than normal (therefore reducing the available water for consumption through the winter).*

Because the model is simply an abstraction of the real work and predictions are confined to historic ranges in weather, predicted future climatic changes, and anticipated water consumption rates, the model should be used as a planning tool to 'guide' decision making while considering the possibility of variation outside the predicted extremes. Therefore, a cautious rather than optimistic approach regarding water supply outcomes should be employed in all cases as indicated in Section 7.0 of the report.

Reply:

AANDC does not see mention of employing a cautious approach in Section 7.0 of the report, and believes that assuming spring melt can provide the required daily water quantities on the fourth day after 3 consecutive days with air temperatures above 0.5°C is optimistic.

We are satisfied with the response from the City because it demonstrates their awareness of the uncertainty in the modelled water quantities, and recommend using extra caution when interpreting the data from this report as one of the assumptions used in the calculations is optimistic.

2.2.2 Basin geometry

The Assessment states that the spillway elevation has been increased to 111.3 m above sea level (asl) and the reservoir bathymetry is only available to 109.3 m asl. Section 3.1.4 states that the reservoir geometry was extrapolated from 109.6 to 111.3 m asl. The basin geometry determines the reservoir storage.

(IR 6) How was the reservoir geometry extrapolation done? Was this extrapolated data used to develop the stage-storage relationship presented in Table 3 of Section 4.2? The reservoir volume between 109.3 and 111.3 m asl accounts for 32% of the available water supply. Given the sensitivity of reservoir volume to the topography/bathymetry, are the results accurate enough to have confidence in building a multi-year water management plan with them?

Response:

The bathymetry provided to Golders by the City was limited to a water level elevation of 109.6 m asl. In order to account for additional storage between this water level and the reservoir spillway, the stage-storage relationship was extrapolated to 111.3 m asl by assuming that the ratio between stage and storage would remain identical to that reported (Canada Centre for Remote Sensing, Natural Resources Canada) between 108.6 and 109.6 m asl. This probably results in a conservative estimation of storage volumes above 109.6 m asl.

As noted above and discussed in the Golders report (Sections 5.4, 6.0, 7.0) there are a number of reasons why the model should be employed only as a water management planning tool rather than assumed to provide exact or precise outcomes months or even years down the line. In most cases, it likely provides a fairly reasonable estimation of water supply outcomes for the input variables selected by the user, but unpredictable changes in weather and consumptive use may result in a difference between simulated and observed results.

Reply:
AANDC is satisfied that employing the stage-storage relationship between 108.6 and 109.6 m asl for water levels above 109.6 m asl is a conservative estimate, and appropriate for use in a water management plan.

2.2.3 Timing of reservoir filling

A recommendation is made to fill the reservoir close to its maximum storage capacity during the early portion of the summer. One of the characteristics of changing climate is more frequent extreme events including extreme rains.

(IR 7) If the reservoir is filled to near capacity in early summer, what measures would be taken to prevent the dam from being overtopped during an extreme rain event? Would the Emergency Preparedness Plan referred to in comment 2.1 address this concern?

Response:
The Lake Geraldine dam is designed with a spillway elevation at 111.3 m. The spillway is designed to allow any excess water to be released to the stream below.

Reply:
AANDC thanks the City for these precisions.

2.3 Monitoring Lake Geraldine reservoir levels

Reference:

- Lake Geraldine Water Balance Assessment, Golder Associates, 12-1151-0264, August 20, 2013

Comment:

The Licensee's consultant has provided the following recommendations:

- Monitoring of Lake Geraldine reservoir levels (at the Water Survey of Canada (WSC) gauge) should continue to remain a priority in order to provide information for water supply forecasting.
- The City should consider installing a secondary water level monitoring device for redundancy purposes and the City should establish a monitoring configuration that provides a real-time reservoir level.

AANDC agrees with the consultant and believes installing a water level monitor providing real-time levels could help with proper management of the water available. Incorporating redundancy in the system is also important because if the WSC gauge were to malfunction critical information for managing the reservoir would be unavailable.

Recommendation:
(R 10) AANDC recommends including the requirement for a real-time water level monitor to measure the reservoir level in Lake Geraldine in the renewed Licence.

Response:
The City requests that this recommendation not be adopted as part of the water license as a monitoring program exists and the requirement for a redundant system is an operational issue for the City and therefore should not be a condition of the water licence.

Reply:
AANDC has no further comment.

2.4 Apex River as supplementary water source

Reference:

- Screening Decision Report 13UN034, Nunavut Impact Review Board (NIRB), November 3, 2014

Comment:
AANDC notes that the Apex River as a supplementary water source was not included in the project screened by the NIRB. In appendix A of their decision report, they specifically write: "*additional assessment by the NIRB would be required at such time as the Proponent wishes to undertake these or other activities:*

- *...*
- *Supplementary water supply in additional to Geraldine Lake;*
- *..."*

Recommendation:
(R 11) AANDC recommends that the Licensee be required to submit its proposed project of an additional water source to the NIRB for screening prior to including it in a water licence amendment.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

2.5 Location selection for additional water withdrawal location on Apex River

Reference:

- City of Iqaluit Supplementary Water Supply Study, exp Services Inc., FRE-00209588-A0, August 2014

Comment:
The consultant's report states that the two possible water intake locations A1 and A2 were identified in an earlier work (Trow, 2004). The suitability of these locations is further assessed in section 4.1.4 of the present report based on a discussion of the pictures taken during the 2013 sampling activities.

Location A2 was deemed more suitable as a water extraction location because the stream flow is more channeled than at location A1 and there is a pool that might allow for sedimentation of finer material.

The consultant's report also discusses stream flow using data for the years 1973-1995 and 2007-2012. There is no stream flow data presented for the year the pictures were taken. It is therefore not possible to assess the flow relative to median and low flow years. If 2013 was a high flow year, perhaps the selected location would not be suitable in a median or low flow year.

Information request:
(IR 8) AANDC would like the Licensee to provide the referenced report (City of Iqaluit Raw Water Supply and Storage Review, Trow Associates Inc., OTC00016888A, April 2004). We would like to know if a Topography and Bathymetry Survey as well as Sedimentation and Erosional Analysis have been considered.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

(IR 9) AANDC requests that the Licensee demonstrate that the proposed water intake location A2 is suitable in all years and flow conditions in a report signed by a Professional Engineer registered with NAPEG.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

Recommendation:
(R 12) AANDC recommends withholding the inclusion of an additional water withdrawal location until it has been determined to be adequate.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

2.6 Minimum flow requirements for Apex River

Reference:

- City of Iqaluit Supplementary Water Supply Study, exp Services Inc., FRE-00209588-A0, August 2014

Comment:
The Licensee's consultant has assumed there is no minimum flow requirement in the Apex River because it is not a commercial or an active recreational fishery. The only fishing activity noted is beyond the point of discharge where the Apex enters into the estuary at its mouth.

Fish are likely present in the Apex River and the Licensee would have to demonstrate that those fish do not support the fishing activity occurring at the River's discharge in order to be exempt of protecting fish habitat.

AANDC believes that a minimum flow should be required for ecological reasons as well as for social acceptability (esthetic flow).

Information Request:
(IR 10) AANDC requests the Licensee provide a discussion of the potential impacts of leaving no flow in the river and what mitigation measures proposed. Specific detail should be provided regarding the impact on stopping the river flow on the fishing occurring at the mouth of the river.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

(IR 11) Additionally, AANDC requests information on any public consultation that has taken place regarding potential water withdrawals on the Apex River.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

Recommendation:
(R 13) If public consultation regarding using the Apex River as a water source and minimum flow requirements has not been undertaken, AANDC recommends it be included in the planning process.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

(R 14) AANDC recommends that any water withdrawal quantity authorized on the Apex River be limited to a fraction of the flow.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

2.7 Water withdrawal quantity

Reference:

- Application for Water Licence Renewal, City of Iqaluit, October 2, 2012
- Letter: RE: Confirmation of Submissions and Scope for Type "A" Water Licence 3AM-IQA0611 Renewal Amendment Application, City of Iqaluit, March 2, 2015
- Lake Geraldine Water Balance Assessment, Golder Associates, 12-1151-0264, August 20, 2013
- Letter: Preliminary additional information in support of supplementation design, Golder Associates, 12-1151-0264(6000), August 20, 2013

Comment:
The Licensee has requested permission for the use of less than 3013.7 m^3/day or 1 100 000 m^3/year or water from Lake Geraldine.

Projected water consumption rates are included in Table 4 of the Lake Geraldine Water Balance Assessment. At the City's design consumption rate of 400 L/person/day, the daily required consumption for a population of 8000 (3200 m^3) will exceed the requested water quantity. The shortfall between required and requested water quantities will

increase as the population grows. The high projection population for 2040, which is the term of renewal requested, would result in a shortfall of 4986.6 m^3/day.

Supplementation requirements for different scenarios are presented in Table 2 of the Supplementation Design letter. However, the City's letter requesting an additional water intake location in the scope of the licence's renewal does not specify a withdrawal quantity for this location.

Information request:
(IR 12) AANDC requests that the Licensee provide the maximum quantity of water it proposes to withdraw from the Apex River.

Response:
The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC has no further comment.

Recommendation:
(R 15) AANDC recommends adjusting the water withdrawal quantity with the term of the licence whilst considering the reservoir's capacity. AANDC also recommends including a water withdrawal quantity for the additional water withdrawal location that is respectful of ecological flow requirements.

Response:
Actual water consumption in 2014 was approximately 990,000 m^3. The City recognizes the limitations on the existing water supply and the requirement for supplemental water supply for the long term. The City recommends that the maximum quantity of water remain at 1,100,000 m^3 until demand dictates that it be increased and at that time it can be dealt with as an amendment.

The City concurs with recommendation R12 and is removing the supplemental water source project from the licence renewal as it will require NIRB Review. The Supplemental Water Source if and when the City plans to implement will be dealt with as a water licence amendment, therefore this comment will be addressed at that time.

Reply:
AANDC agrees with the City's request to leave the authorized water withdrawal quantity at 1 100 000 m^3/year, unchanged from the previous licence.

2.8 Water conservation measures

Reference:

- City of Iqaluit Supplementary Water Supply Study, exp Services Inc., FRE-00209588-A0, August 2014
- Lake Geraldine Water Balance Assessment, Golder Associates, 12-1151-0264, August 20, 2013

Comment:
The Licensee's consultant suggests that: "*when water conservation measures are implemented, that the demands are monitored to determine the 'elasticity' of the water demand, e.g. what is the effectiveness of the City's conservation measures and communication, and associated minimum consumption rate which conservation measures can attain?*"

A high consumption rate of 400L/person/day was used for the Water Balance assessment as a conservative measure. Between 2007 and 2012 the City's average consumption rate was 300L/person/day and the national trend since the mid-2000s has been a reduction in per capita consumption.

Information Request:
(IR 13) AANDC would like to know what measures if any the Licensee is taking or planning to take for the promotion of responsible water use because they would reduce the water necessary and thereby the efforts to procure and treat it.

Response:
The City current does not have any programs to promote responsible water use. However, the City plans to identify potential sources of water losses in the City's water system in 2016 and develop a plan to address these over the next 3 to 5 years.

Reply:
AANDC thanks the City for providing these precisions.

3 WASTEWATER MANAGEMENT

The original renewal and amendment scope speaks of upgrade, operation and the eventual decommissioning of the West 40 Wastewater Treatment Plant and back-up

Sewage Lagoon. No documentation was found regarding the upgrade, operation of upgraded facility or eventual decommissioning of the wastewater treatment plant or sewage lagoon. **(R 16)** AANDC requests the opportunity to review these documents when available and recommends that if the Water treatment plant upgrade and decommissioning are included in the renewed licence, it be conditional on approval of appropriate plans.

Response:

Appendix C-9 - Iqaluit WWTP Technical Overview of 2005 Secondary Sewage Treatment Plant Design was provided as part of the water licence renewal submission. The City has completed the Feasibility Study for the Upgrade/Expansion of the Wastewater Treatment Plant and is provided to the Nunavut Water Board as part of this response to submissions from stakeholders.

The current Water Licence includes the following clause that would ensure that any upgrade to the wastewater treatment facility be reviewed by the NWB. The City supports inclusion of this clause in the new licence.

PART G: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written consent from the Board, carry out Modifications to Water Supply Facilities and Water Disposal 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 60 days prior to beginning the Modifications;

b. such Modifications do not place the Licensee in contravention of the Licence or the Act;

c. the Board has not, during the 60 days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than 60 days; and

d. 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 drawing of the Modifications referred to in this Licence within 90 days of completion of the Modifications. These plans and drawings shall be stamped by an Engineer.

There are no plans to decommission either the Wastewater Treatment Plant or the lagoon therefore development of a closure plan for these facilities would be premature. The City recommends that the following clause be added to allow the water licence to manage the potential closure of any facility.

The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities or upon submission of the final design drawings for the construction of new facilities to replace existing ones. Where applicable, the Plan shall include information on the following:

a. water intake facilities;
b. the water treatment and waste disposal sites and facilities;
c. leachate prevention;
d. an implementation schedule;
e. maps delineating site facilities;
f. consideration of altered drainage patterns;
g. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment related to water use, waste deposit to water, or appurtenant undertakings related to water use and/or deposit of waste to water, subject to the act and regulations.

Reply:

AANDC thanks the City for providing the Iqaluit WWTP Upgrade/Expansion Feasibility Study. The study contains an apparent inconsistency with regards to design objectives for un-ionized ammonia. Table 1 in section 2.1 indicates the design objective for un-ionized ammonia should be ≤ 1.25 mg/L, following the *Wastewater Systems Effluent Regulations*, yet section 2.1.1 concludes with the sentence "*an ammonia limit will not be required for the new Iqaluit water license, and as such the plant will not be specifically designed to remove ammonia (nitrification).*" The discussion of the activated sludge design proposed in 2006 (option 2A) includes design criteria for un-ionized ammonia (≤ 1.25 mg/L) but no such discussion is found for the recommended moving bed biofilm reactor (MBBR) design (option 2B). The maximum anticipated total ammonia concentration with secondary treatment is approximately 30 mg/L.

The conclusion regarding the requirement of having a limit for ammonia is reached because pH drift can cause wastewater treatment plant effluent to fail acute toxicity tests done using Environment Canada test protocol EPS 1/RM/13. pH affects the un-ionized – ammonium (ionized ammonia) equilibrium, and the test protocol increases pH, which shifts the equilibrium toward acutely lethal un-ionized ammonia. The study recommends that "*the future water license contain language indicating that either the EPS/1/RN/13 or EPS/1/RM/50 testing protocol can be used, depending on whether the City anticipates that pH stabilization in the test is required after the implementation of secondary treatment*."

The EPS 1/RM/50 test protocol is an add-on procedure and includes the following instructions for conditions under which it can be used: "*a wastewater effluent sample must meet three conditions: (i) total ammonia must be measured on all wastewater effluent samples submitted for testing with EPS 1/RM/13, (ii) the wastewater effluent must have failed an acute lethality test using rainbow trout (EPS 1/RM/13) on a previously collected sample, and (iii) pH stabilization techniques may only be used when the un-ionized ammonia concentration present in the 100% wastewater effluent sample does not equal or exceed 1.25 mg/L at 15°C or when the total ammonia concentration does not equal or exceed the maximum total ammonia concentration (*y*) in mg/L determined using the following formula and the initial pH of the wastewater effluent sample at 15°C:* $y = 1.25 \times (10^{(9.564136638-pH)} + 1)$"

Therefore, in order to apply the EPS1/RM/50 test protocol, the effluent must meet the *Wastewater Systems Effluent Regulations* for un-ionized ammonia or exceed the total ammonia concentration calculated with the formula above. The anticipated maximum total ammonia concentration is approximately 30 mg/L, and at *in situ* pH and temperature the ammonia equilibrium should be such that un-ionized ammonia concentrations would be well below the *Wastewater Systems Effluent Regulations* of 1.25 mg/L. Modifications to the proposed MBBR technology may further reduce the nitrogen level if necessary. **(R ii)** AANDC therefore recommends that an un-ionized ammonia criterion be included in the renewed water licence.

With two modifications, AANDC agrees with the text for proposed licence conditions. For the first, condition, we would recommend the addition of the word "existing".
*... carry out Modifications to **existing** Water Supply Facilities and **existing** Water Disposal Facilities provided that such Modifications are ...*
For the second condition, as in our reply for **R8**, we recommend removing the possibility of submitting the Abandonment and Reclamation Plan less than 6 months before abandonment. . This might be obtained by adding to the proposed wording:
*... at least six (6) months prior to abandoning any facilities or upon submission of the final design drawings for the construction of new facilities to replace existing one**, if available before the six month window**.*

3.1 West 40 wastewater treatment plant upgrade

Reference:

- Inspector's Direction, AANDC, March 5, 2013
- Water Licence Compliance 3rd Quarterly Update 2014, City of Iqaluit, October 16, 2014

- Technical Memorandum: Iqaluit Wastewater Treatment Plant Technical Overview of 2005 Secondary Sewage Treatment Design, AECOM, 60225321-400, November 7, 2011

Comment:
Presently the majority of the treatment equipment has been removed from the Wastewater Treatment Plant building, leaving only the primary treatment portion in place. Biological oxygen demand (BOD) and total suspended solids (TSS) consistently exceed the effluent criteria stipulated by the water licence and resulted in directions being issued by Environment Canada and AANDC in March 2013. In response to the direction, the Licensee created a project schedule for the upgrade of the wastewater treatment plant which culminates with an operational upgraded plant in December 2018.

Only an efficient primary treatment system can produce influent for the secondary treatment system that will yield effluent meeting the regulatory requirements. AANDC is concerned that the number and duration of plant shutdowns in order to do maintenance and repairs and the Salsnes filter will leave the secondary treatment system vulnerable.

A decision had been made to abandon membrane bioreactor process and advance conventional activated process (biological nitrification and denitrification) making use of existing infrastructure. AANDC is concerned that the design for the proposed conventional activated sludge process should be based on an accurate estimation of the sewage composition and its volume.

Recommendation:
AANDC encourages the Licensee continue to work with its consultants for effective wastewater treatment and recommends incorporating the project schedule to attain compliance into the renewed water licence.

(R 17) AANDC recommends adding criteria for more parameters for the wastewater treatment plant effluent discharge to be more in line with national standards.

Response:
Prior to responding to this recommendation the City requests clarification as to what parameters are being considered to be added to the water licence to fully understand the potential ramifications of the recommendation.

Reply:
AANDC recommends adding un-ionized ammonia and total residual chlorine criteria and changing the BOD_5 criterion to a carbonaceous BOD_5 criterion. These are referred to in the Iqaluit WWTP Upgrade/Expansion Feasibility Study submitted by the City and are included in the *Wastewater Systems Effluent Regulations*.

3.2 Sewage lagoon operation and maintenance

Reference:

- Process Operation & Maintenance Manual for the Iqaluit Wastewater Treatment Plant – Conversion & Expansion – Phase 1, 2006
- Sewage Lagoon Dam Safety Inspection, Concentric Associates International Incorporated, 13-5021-B, September 9, 2013

Comment:
The sewage lagoon is used as a backup facility during maintenance and malfunction of the primary treatment system at Wastewater Treatment Plant. According to the last few Annual Reports the lagoon is used for this purpose 4 to 6 times a year.

The Operation & Maintenance manual for the WWTP does not include information of the sewage lagoon. Moreover the 2013 Dam Safety Inspection notes that preventative maintenance should be undertaken because it is essentially a “leaky dam” and localized failure and/or seeps are expected. The Inspection report also recommends confirming the capacity of the sewage lagoon.

Information request:
(IR 14) AANDC would like the Licensee to provide an Operation and Maintenance Plan for the Sewage Lagoon and an update on the sewage lagoon capacity.

Response:
As part of the proposed upgrades to the Wastewater Treatment Plant an O&M Manual will be developed which will incorporate in the O&M Manual for the sewage lagoon. The City will complete a capacity analysis of the sewage lagoon along with the upgrades to the Wastewater Treatment Plant.

Reply:
AANDC is not satisfied with this answer since the lagoon already exists and will be in use before 2018. A manual would help ensure protection of both the environment and workers and could be integrated in the Wastewater Treatment Plant Operation and Maintenance Plan when it is created in 2018.

Recommendation:
(R 18) As in section 2.1, AANDC recommends that the wording of Part E, Item 8 of the License be modified so that the Licensee is required to follow the current Canadian Dam Safety Guidelines, and submit inspections and reviews following the schedule in these guidelines.

Response:
The City agrees with the proposed wording.

Reply:
AANDC has no further comment.

4 SOLID WASTE MANAGEMENT

The original renewal and amendment scope and additional scope include:

- operation and eventual decommissioning of the West 40 Landfill and associated infrastructure; and
- construction, operation and eventual decommissioning of a new solid waste management facility 7.5 km northwest of the City centre.

A report describing the site selection for the new facility was provided but no documentation regarding the construction, operation or eventual decommissioning of the new solid waste management facility. **(R 19)** AANDC requests the opportunity to review these documents when available and recommends that if the new solid waste management facility is included in the renewed licence, it be conditional on approval of appropriate plans.

Response:
The City agrees with the recommendation.

Reply:
AANDC has no further comment.

4.1 West 40 landfill leachate and runoff

Reference:

- West 40 Landfill Drainage Management Review, AECOM, 60221928, September 16, 2011
- City of Iqaluit 2012 Annual Water Licence Report, City of Iqaluit, March 2013
- Annual Monitoring Report – 2013, exp Services Inc., April 7, 2014
- Annual Monitoring Report – 2014, exp Services Inc., January 23, 2015

Comment:
The Drainage Management Review states: "*The landfill site relies on the local permafrost regime to provide a low permeability barrier to control the subsurface runoff.*"

AANDC is concerned with potential threats of leachate and contaminated water (runoff containing leachate) to the groundwater because no data has been presented regarding the permafrost regime in this location. It is not clear if permafrost has aggraded into the landfill or if leachate can escape through the active layer. Knowledge of the thermal distribution through the landfill is crucial if permafrost aggradation through the landfill contents is to be an integral part of the design.

Table 3 in the Review proposes maximum allowable concentrations for runoff to be discharged without specifying the units of the values.

The Review also discusses four treatment alternatives of the surface runoff collected which is collected in ponds. The recommended option is the Geotube ® physical-chemical treatment system. It is not clear if this solution has been fully implemented. The Licensee's 2012 Annual Report states: "*Landfill runoff continues to be managed though on-site detention ponds and an off-site retention pond. Run-off in the off-site retention pond is filtered through a Geotube before being discharged.*" However, the effluent still had high metal concentrations as discussed in the Licensee's Annual Monitoring Reports for 2013 and 2014. These reports indicate that landfill runoff exceeded Canadian Council of Ministers of the Environment (CCME) criteria for ammonia, mercury, arsenic, cadmium, copper, iron, and zinc, whilst the total suspended solids were effectively reduced through the use of the Geotube bag during the decant.

Information request:
(IR 15) AANDC would like the Licensee to provide information regarding the permafrost regime below the landfill and any information they have on the groundwater.

Response:
Prior to responding to this request for information the City requests clarification of the purpose of this request for information.

Reply:
The purpose of this request is to allow AANDC to evaluate the statement made in the Drainage Management Review; "*The landfill site relies on the local permafrost regime to provide a low permeability barrier to control the subsurface runoff.*" Our concerns,

detailed in the second paragraph of the comment, warrant verifying the data used to make the statement.

(IR 16) AANDC requests the Licensee provide the units for maximum allowable concentrations in Table 3 of the Review.

Response:
The City has revised the table to include the units as requested and is provided to the Nunavut Water Board as part of this response to submissions from stakeholders.

Reply:
AANDC thanks the City for providing the units in the table. With its recent submission, the City has provided a Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility report which also includes a table of proposed parameters and maximum allowable concentrations for landfill run-off. The tables have different parameters and concentrations. **(R iii)** AANDC recommends that the criteria for landfill run-off include non-acute toxicity according to the test method for rainbow trout and the parameters and concentrations provided in the first table of the Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility report. This is preferred over Table 3 provided with the Drainage Management Review because the parameters were based on concentrations measured in landfill run-off sampled in the retention ponds.

We may have further comments on the parameters and maximum allowable concentrations proposed.

(IR 17) AANDC requests that the Licensee provide details on treatment technologies for landfill runoff water. We would specifically like to understand why the Geotube method proposed by AECOM seems to result in only physical treatment instead of both physical and chemical treatment, as well as what solutions will be implemented for effective removal of all the contaminants of concern.

Response:
A report entitled "Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility" by Qikiqtaaluk Environmental dated October 26, 2015 has been provided to the Nunavut Water Board as part of this response to submissions from stakeholders.

Reply:
AANDC thanks the City for providing this report. According to the report the City has moved away from the Geotube method and we therefore no longer require the details of this technology. We have the following comments and related information requests and recommendations on the Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility report.

The report proposes a combination of coagulation, aerobic and adsorption treatments methods. Discharge criteria are proposed in a table with 13 parameters and maximum allowable concentrations. The run-off treatment facility proposed includes four ponds, which already exist and are labelled Leachate Catchment, Drafting, Retention and Bioreactor. The Discharge section of the report details how once treated, the water will be pumped into four holding basins to be sampled before discharge. After four consecutive samples meet discharge criteria, water would be continuously discharged with weekly sampling. According to the report, sludge produced in the bioreactor will consist mostly of dead organic matter and will be disposed of in the City's landfill.

Page 3 of the report states: "*Authorisation is required from AANDC to transfer water from a holding pond into the bioreactor*." This statement is incorrect. I have confirmed with the AANDC Water Resources Inspector working on this file, and once the run-off treatment plan is integrated into the water licence, it is not necessary to obtain his authorization, nor is it necessary to notify him, because the water would not be discharged to the environment during this transfer.

In reviewing the documents for the ponds, it has come to our attention that we could not find any reference to monitoring station IQA-08(#) referred to in the expired licence. The West 40 Landfill Drainage Management Review (2011) and its appendices include several discussions on water sampling for landfill monitoring, but it is not evident if any of these have been implemented.

(IR i) The pond labelled Retention Pond is included in the landfill drawings submitted in November 2012, where it is labelled Run-off Detention Pond. As-built drawings were provided for the berm that holds back the Leachate Catchment Pond with the 2014 annual report. We could not find drawings for either the Drafting Pond or the Bioreactor. Since the report submitted is proposing to integrate them for landfill run-off treatment, AANDC requests that the City provide as-built drawings for the Drafting and Bioreactor Ponds signed and stamped by an Engineer. The drawing for the ponds should include enough information on the adjacent topography for us to understand how the drainage around them is being managed.

(IR ii) We did not find any information regarding the sludge produced in the retention pond where the lime and polymers will be added. How will this sludge be disposed of and does the leachate water to be treated contain sufficient metals to render the sludge toxic?

(IR iii) Could specifications on the holding basins please be provided, as well as plans if appropriate?

(R iv) The sampling program proposed assumes continuous discharge after an initial verification of the treatment process. This does not fit with the batch treatment technology proposed where water will remain in the bioreactor one month before final polishing. AANDC recommends that the licensee be required to test the treated effluent of every bioreactor batch before its final release.

(R v) This report proposing a technology for treatment of landfill run-off has not been signed and stamped by a Professional Engineer registered in Nunavut. We recommend that this omission be corrected.

(R vi) AANDC recommends that a monitoring station be added downgradient of the leachate catchment pond to confirm that the retention berm constructed, which is only partially lined, is performing adequately. The sampling location could be in the ditch between the landfill and the adjacent fuel tank berm (beside the culvert) and we recommend monthly sampling during open water season.

Recommendation:
(R 20) AANDC recommends that the renewed licence include thermal monitoring at the landfill through the installation of thermistor strings with thermistor beads at selected intervals to provide ground temperature profiles at various locations in the landfill.

Response:
The City requests clarification as to the purpose for this condition prior the City providing a response.

Reply:
Including thermal monitoring in landfills in the North where permafrost is being used for leachate containment is good practise. It can be used to confirm that permafrost is distributed as assumed and can be counted on as a low permeability barrier. If

permafrost distribution is not as expected, alternate methods for leachate containment may be required to prevent the landfill from contaminating water.

(R 21) AANDC also recommends that the renewed licence include effluent discharge criteria that, at minimum, meet CCME freshwater quality guidelines for the protection of aquatic life for the parameters in Table 3 of the Drainage Management Review since the discharges are occurring in a freshwater environment. Additional parameters typically found in leachate or that may be produced at the sludge processing and composting facility that uses the same drainage system should have criteria as well, including chloride, nitrate, ammonia, phosphorous and Faecal Coliform.

Response:

A report entitled "Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility" by Qikiqtaaluk Environmental dated October 26, 2015 has been provided to the Nunavut Water Board as part of this response to submissions from stakeholders. Section 3 of the report contains a Discharge Criteria developed through consultation with Environment Canada.

Reply:

AANDC thanks the City for providing this report. Our comment here is the same as for **IR 16**. We support the use of the criteria in the Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility report rather than those in the Drainage Management Review and may have further comments on the parameters and maximum allowable concentrations proposed.

4.2 Actions required after 2014 West 40 landfill fire

Reference:

- City of Iqaluit 2014 Annual Water Licence Report – Appendix K: Schedule 2 Landfill Fire: Actions Required, City of Iqaluit, March 2014
- Letter: Drafting pond used to draw and recirculate water for the purposes of extinguishing a fire, AANDC, June 8, 2015

Comment:

On May 20, 2014 a fire began at the West 40 Landfill. The Licensee took actions to extinguish the fire resulting in the creation of a drafting pond used to draw and recirculate water for the purpose of extinguishing a fire as well as the collection of contact water from the fire extinguishment.

In appendix K of the 2014 Annual Report, the Licensee states: "*After the water from the new drafting pond has been treated and discharged, the liner will be removed and the grade reinstated*." No timeline has been proposed for this work.

Recommendation:
(R 22) AANDC recommends that the effluent discharge criteria for landfill runoff apply to the collected contact water discharge. Additionally, AANDC recommends that a timeline for the draft pond dismantling be included in the renewed licence.

Response:
The actions of the City with respect to the fire at the West 40 Landfill are considered emergency measures and the City is obligated to take direction from the AANDC Inspector. As this is an emergency measure and not part of the City normal operation it does not fall within the requirements of the Water Licence.

Reply:
AANDC's understanding of the Water Run-off Treatment and Discharge at the City of Iqaluit Solid Waste Facility report submitted is that this treatment system would be used to treat both contact water collected during the fire extinguishment and all leachate and run-off collected from the landfill.

From this report it also appears that the draft pond built as an emergency measure will be used for the treatment system and therefore, it should be integrated into the licence.

4.3 West 40 landfill decommissioning

Reference:

- Iqaluit Solid Waste Management Plan West 40 Landfill Decommissioning Technical Memorandum, AECOM, 60196419, January 2014

Comments and Information Request:
Clarifications are requested for the following four comments.

4.3.1 Drainage restoration

Section 4.4 of the technical memorandum states: "*Runoff and run-on surface water would be re-directed away from the cap via drainage ditching around the waste disposal area. The runoff drainage ditching will drain in a northern direction, and be further directed towards the offsite retention pond*." According to the maps presented, the offsite retention pond is to the south of the landfill.

Will another offsite retention be constructed to the north of the landfill? If so, will the pond used presently be decommissioned? If not, how will the water be moved from the runoff drainage ditching to the retention pond?

AANDC also has concerns with the potential threats from leachate to surface and groundwater as well as the proper treatment of the retention pond effluent. **(IR 18)** We seek confirmation that the solutions for these problems found for operation of the landfill will be continued after its decommissioning.

Response:
The City confirms that it will continue to manage the facility post decommissioning.

Reply:
AANDC thanks the City for providing this confirmation. We note that though the questions in the paragraph before **IR 18** are not explicitly answered in the text, which is likely due to the fact we forgot to label these as a numbered information request. **(R vii)** AANDC recommends that an updated Landfill decommissioning plan that addresses the questions above regarding drainage restoration.

4.3.2 Environment conditions existing prior to use

The provided memorandum does not present data or a discussion of environment conditions before the use of the site by the Licensee, as required by Part J, Item 4 of the licence. AANDC is concerned that if materials were present before the site opened, they may create environmental hazards if not taken into account properly.

(IR 19) Are the site conditions before it became a landfill known? If there were materials on site prior to its use as a landfill, were they properly disposed of?

Response:
The site conditions prior to the site of the West 40 Landfill prior to the construction of the facility are unknown.

Reply:
AANDC thanks the City for providing these precisions.

4.3.3 Sewage sludge composting site

The portion of the landfill used for composting sewage sludge is not included the drawing of the covered landfill.

(IR 20) Will the composting site be decommissioned in the same time as the landfill? If so, what are the plans? If not, how will the drainage for this portion of the landfill be altered by the decommissioning and how will runoff be contained?

Response:

It is unknown at this time if the new solid waste facility will incorporate a sludge composting area, as part of the development of the new solid waste facility the relocation of the sludge composting site will be considered.

Reply:

(R viii) AANDC recommends that plans for the sludge composting area be required six months prior to West 40 landfill decommissioning to allow for their review. Depending on whether the composting area relocated, this plan should include either the altered drainage and runoff containment or an abandonment and reclamation plan.

4.4 Use of sewage sludge compost

Reference:

- Iqaluit Sewage Sludge Management Composting Pilot Project Report, AECOM, March 31, 2009
- Standards for the Use or Disposal of Sewage Sludge; Final Rules, 40 CFR Part 257 et al., United States Environmental Protection Agency (US EPA), February 19, 1993
- Guidelines for Compost Quality, PN1340, CCME, 2005
- Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, CCME, 1999

Comment:

The Licensee's consultant concludes that Iqaluit's composted sewage sludge is suitable for use as a cover material for the landfill decommissioning based on a pilot project for which three compost samples were analysed, only one of which was tested for metals. Metal concentrations are compared to US EPA standards for land applied sewage sludge.

The list of metals for which the EPA has standards is the same as the "maximum acceptable trace elements for Category B compost" list of the CCME, with the exception of including chromium and excluding cobalt. The US EPA ceiling metal concentrations are often significantly higher than the CCME guidelines for both compost quality and for the protection of environmental health for industrial land use.

All three compost samples tested met the CCME compost quality guideline of <1000 MPN/g for Faecal Coliforms. Metal concentrations in the one compost sample tested also met the CCME guidelines for both Category B compost and protection of environmental health for industrial land use.

Recommendation:
(R 23) AANDC recommends that the renewed licence include quality criteria for composted sludge before it is used as a landfill cover or elsewhere. At a minimum it should meet the CCME compost quality guideline for Faecal Coliform concentrations. Additional criteria would be appropriate for trace metals that are pollutants of concern. Metals which appear in the US EPA and both CCME lists are: arsenic, cadmium, lead, mercury, nickel, selenium and zinc.

Response:
The City has no comment on this recommendation.

Reply:
AANDC has no further comment.