3AM-IQA1626 Application for Amendment – *"2019 Apex and Unnamed Lake Supplementation Project"* Supporting Submission

July 31, 2019

ISSUED FOR USE

NUNAMI
STANTEC LIMITED

Table of Contents

1 INTRODUCTION

1.1 Purpose of this Document

The purpose of this document is to supplement the Application to Amend Type A Water Licence 3AM-IQA1626 for the City of Iqaluit dated July 30, 2019 pertaining to water withdrawal from the Apex River and "Unnamed Lake" in 2019. This document should be read in conjunction with and constitutes part of, that application. The application arises out of a need to respond to an emergency created by a potable water shortage for the City of Iqaluit.

2 DETAILS OF AMENDMENT APPLICATION

2.1 Purpose of Amendment – Emergency Direction

The City of Iqaluit (the "City") obtains its potable water from Lake Geraldine. Lake Geraldine is an engineered reservoir designed to contain the volume of water necessary to satisfy the drinking water needs of the City. The reservoir is refilled annually during spring and summer by natural inflows from snowmelt and precipitation. Draw down of the available water in the reservoir occurs during winter. In years when natural inflows or precipitation are low and the reservoir does not fill to full capacity, or, when seasonal demand has been high, there is a potential for a shortage of drinking water available to the City over the winter.

The City is currently pursuing an amendment to its water licence to supplement the Lake Geraldine reservoir from the Apex (Niaqunguk) River from 2019 to 2026 during open water conditions (June to October). Supplementation is intended to fill the reservoir prior to freeze-up to maximize the available water within the reservoir during the winter months. The "Apex Amendment" application is currently in the Public Hearing phase of review, with public hearings scheduled for August 8-9, 2019. This regular application review process will not conclude prior to the end of the open water season in 2019. Based on a water balance assessment of the reservoir completed in June 2019, the reservoir will not recharge naturally in 2019. The City will face an overwinter water supply shortage this year if it is not able to supplement the reservoir.

On July 10, 2019, the City notified the Nunavut Water Board (NWB) that it would be seeking approval to withdraw water from the Apex River immediately, and that it would also be seeking approval to supplement water to the reservoir from additional sources. On July 12 2019, the City applied to the NWB for the "Water Withdrawal Apex River 2019" project. This application was supported by a letter from the Chief Medical Officer of Health concurring with the City's predicted water shortage and recommending that pumping activities begin as soon as possible. ***The City is withdrawing that application, and combining its scope with this request to supplement from the Apex River and Unnamed Lake in 2019***.

Due to ongoing exceptionally dry conditions in 2019, flows in the Apex River are at historic lows and the reservoir is experiencing the lowest levels ever recorded for this time period. The City is aware that the Apex River alone may not provide sufficient water to fill the reservoir prior to winter. On July 23, the City wrote to the Ministers of CIRNA and Community and Government Services and Chief Medical Officer of Health asking them to recognize the potential water shortage as an emergency. The City is proposing to obtain water to supplement the Lake Geraldine reservoir in 2019 from the Apex River, and a source north of the Apex River, unofficially called “Unnamed Lake”. The City has requested that its application be processed on an emergency basis.

2.2 Background

Background and context to this amendment application is presented in a related application to amend 3AM-IQA1626 for Supplementary Water Supply (February 1, 2019) supporting documents, as well as the City’s letter to the NWB of July 10, 2019.

As was indicated in the City’s letter to the NWB of July 10, 2019, the City will face an overwinter shortage of potable water in 2019-2020 without supplementing the Lake Geraldine reservoir – the City’s primary source of potable water. Approval to begin supplementation immediately, and on an emergency basis is being sought, recognizing that an application to amend the City’s water licence for the term 2019 to 2026 is currently before the NWB.

A water balance assessment of Lake Geraldine completed in June 2019 (Golder 2019) and provided to the NWB on July 10, indicates that based on a consumption rate of 115,000 m^3/month, a reservoir deficit of between 88,000 m^3 and 761,000 m^3 is predicted for 2019. As of July 22, 2019, flows in the Apex River are below historical minimums for this time, as based on a 35-year historical record, and are below 30% of mean annual discharge (MAD) (Figure 2-1). Federal guidelines for protection of fish stipulate that withdrawals that occur when flows are less than 30% MAD increase the risk of impacts to fisheries.

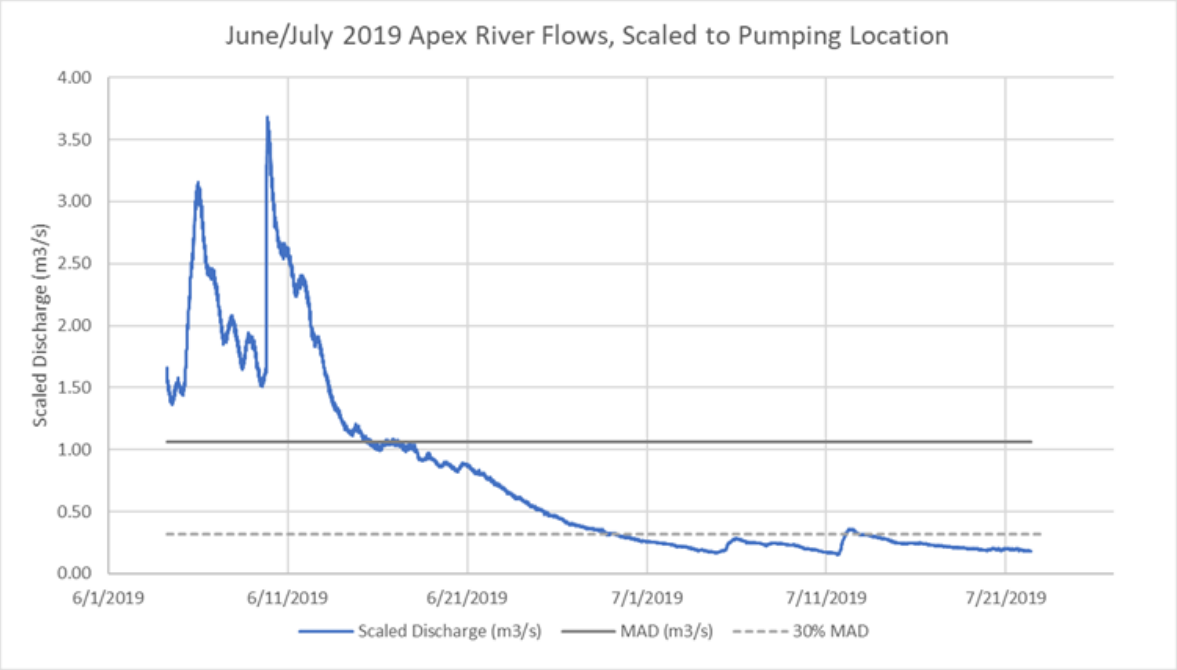

Figure 2-1: Apex River flows at proposed withdrawal location June 1 to July 22, 2019, compared against mean annual discharge (MAD) and 30% MAD at that location.

Due to low precipitation and meagre freshet, water levels in Lake Geraldine reservoir are also at the lowest level ever recorded on this date (Figure 2-2).

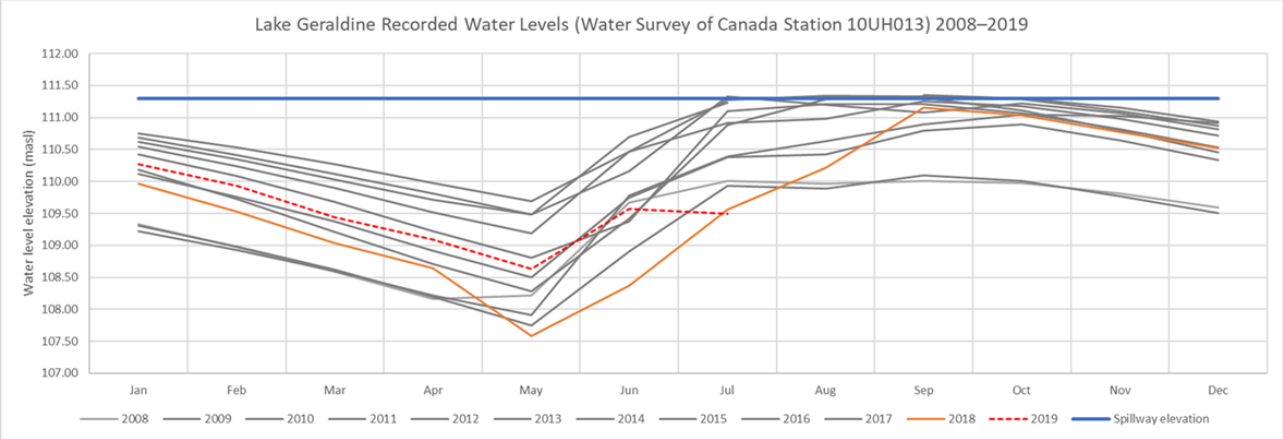

Figure 2-2: Historical water levels in Lake Geraldine reservoir 2008 to 2019. Supplementation from Apex River was conducted August – September 2018.

These compounding conditions of low flows and low reservoir levels strongly suggest that the reservoir will not be able to be filled during the remaining open water period prior to winter (estimated August 1 to October 15) using water from Apex River alone. The City considers this a critical situation and is seeking immediate approval to obtain water from another source in 2019 to avoid a public health emergency. The City has identified “Unnamed Lake”,

approximately 3 km north of the Apex River pumping site as a source for additional supplementation in 2019.

2.3 Scope of Amendment

The City is applying to:

- Withdraw up to 700,000 m^3 of water from “Unnamed Lake”
- Withdraw up to 700,000 m^3 from Apex River (previous amount applied for is 500,000 m^3)
- To increase the amount allowed to be withdrawn from Lake Geraldine to 2,000,000 m^3
- Temporarily alter the flow of water in the Apex (Niaqunguk) River watershed

The period of the requested amendment is August 1, 2019 to March 31, 2020.

2.4 Description of Undertaking

The City proposes to withdraw water from the Unnamed Lake and transfer it approximately 1.5 km via flexible hoses into the Apex River at a location approximately 2.3 km upstream of the proposed Apex River pump location. This water will then be captured and withdrawn at the Apex River pump location and conveyed by pipeline to Lake Geraldine (Figure 2-3).

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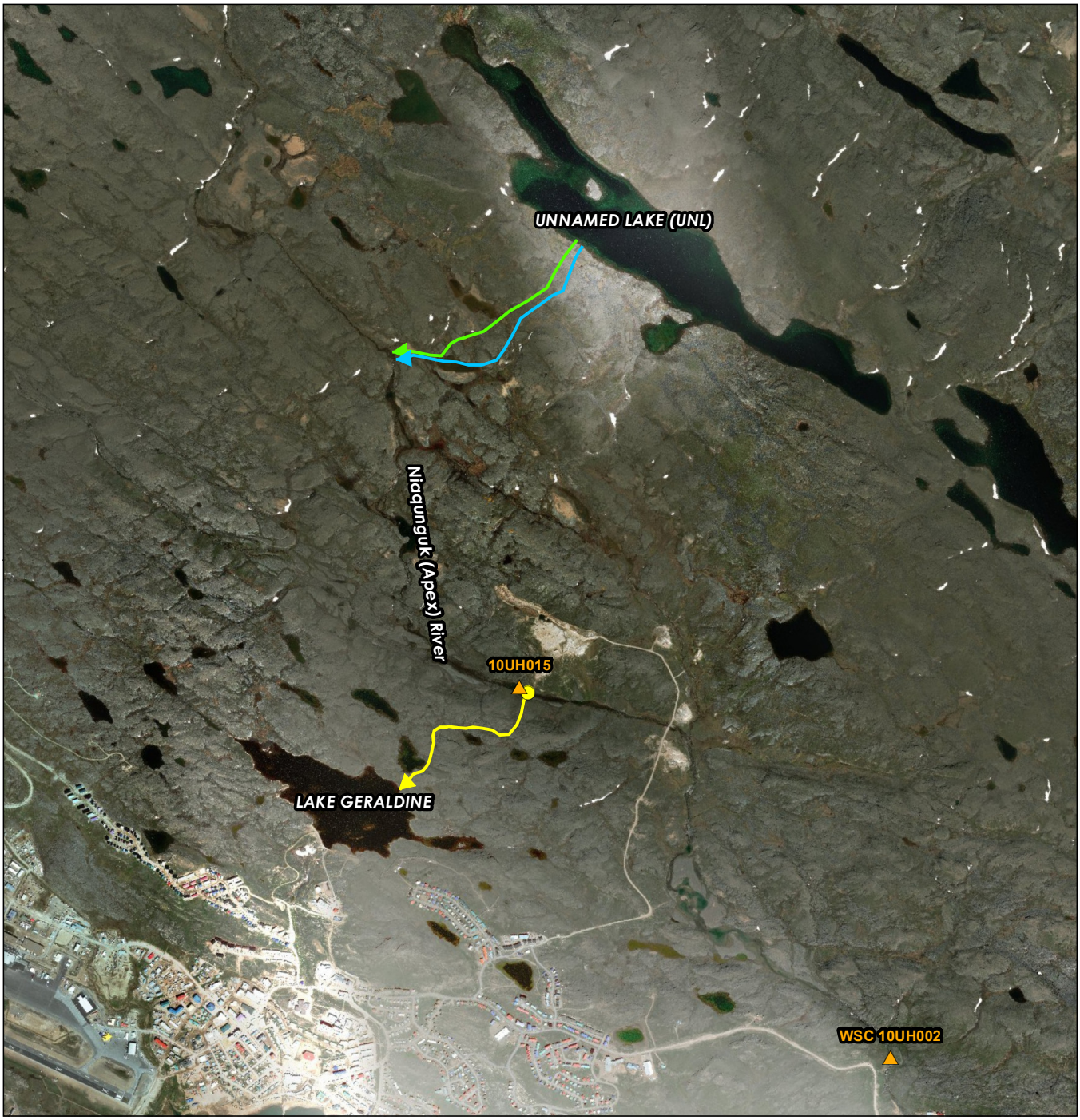

Legend

- Intake
- Hydrometric Monitoring Station
- Apex River Pumping Route
- UNL Pumping Route Option 1
- UNL Pumping Route Option 2

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Project Location
Iqaluit,
Nunavut

Prepared by ACampigotto on 2019-07-29
Reviewed by EBonhomme on 2019-07-29

Client/Project
City of Iqaluit

144902884

Figure No.
1

DRAFT

Title
Site Location

Notes
1. Coordinate System: NAD 1983 UTM Zone 19N
2. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

2.4.1 Water Withdrawal from Unnamed Lake

Unnamed Lake is a large lake (1.1 million square metres surface area) approximately 3 km north of the Apex River pumping location. There is not enough known about this lake to confirm its suitability as a long-term water supply for the City. It is currently being studied to determine if the annual water balance is sufficient for long-term supply, and these studies will be completed over the next several years. However, as a one-time source (2019), it can provide water necessary to fill the reservoir in addition to what will be supplied by the Apex River. Year-round flows in and out of this lake have not been confirmed, but it is seasonally connected to the Apex River. Outflow has been observed during the months of June, July and August. This natural outflow follows a tributary of the Apex River that joins the main Apex River downstream of the Road to Nowhere and contributes to the overall flow in the lower Apex River. The depth of Unnamed Lake is unknown, but a single measurement has been reported at in excess of 16 m at the centre of the lake. A bathymetric survey and lake level measurements will be undertaken concurrent with the proposed withdrawal in 2019 to confirm the lake morphometry and drawdown during the proposed 2019 project. Surface water samples taken in early July 2019 demonstrate water at surface meets Health Canada's (June 2019) Guidelines for Canadian Drinking Water Quality for all parameters (Appendix A). The location of levelloggers, water quality samples and outflow measurements taken is shown in Figure 2-4.

During engagement meetings with the Amaruq Hunters and Trappers Association on ongoing studies of water supply, Indigenous land users encouraged the City to look at using Unnamed Lake to obtain water, over the more easily accessed Sylvia Grinnell River, due to the cultural importance of that river (Appendix B).

Due to the distance and difficult terrain between Unnamed Lake and Lake Geraldine, it is not possible to convey water directly from Unnamed Lake to Lake Geraldine. Instead, the City proposes to convey water from Unnamed Lake overland to the Apex River, where it will be discharged. This additional water will flow downstream within the existing Apex River channel to the location of the Apex River pumping location. The excess flow will be captured by the pumping infrastructure at this location and conveyed from there to Lake Geraldine as proposed in the Apex River Supplementation Application.

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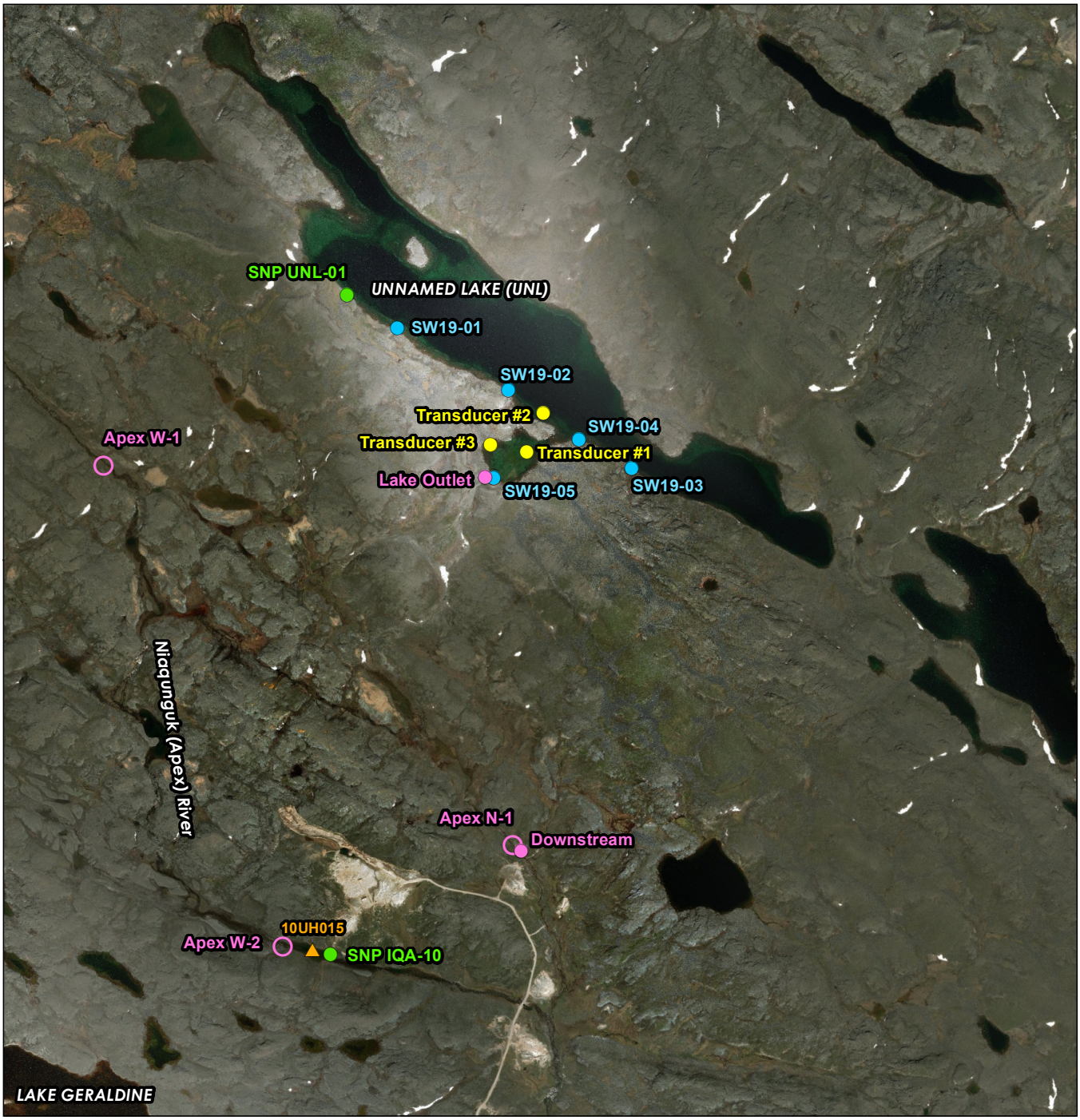

Legend

- Water Quality Sampling Location 2019
- Water Level Monitoring Location
- Flow Measurement July 2019
- SNP Location
- Water Survey of Canada Station
- 2019 Flow Monitoring Location

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Project Location
Iqaluit,
Nunavut

Prepared by ACampigotto on 2019-07-31
Reviewed by EBonhomme on 2019-07-31

Client/Project
City of Iqaluit

144902884

Figure No.
2

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Title
Apex River and Unnamed Lake Data Collection and Monitoring Locations

Notes
1. Coordinate System: NAD 1983 UTM Zone 19N
2. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

2.4.1.1 Withdrawal

The withdrawal requirements are based on a range of probabilistic climate situations and various demand scenarios as presented in Golder (2019). A summary of the results is shown in Table 2-1. Current monthly water use for the City is closer to the presented water use scenario of 115,000 m^3/month.

Table 2-1 Predicted Deficit in Lake Geraldine, 2019 (Golder, 2019)

Predicted Reservoir Deficit, m^3 (Golder, 2019)			
Water use scenario	Upper Case	50th Percentile Case	Lower Case
100,000 m^3/month	705,000	522,790	64,000
115,000 m^3/month	761,000	588,000	88,000

Apex pumping infrastructure has been designed to pump at 150 litres per second (L/s), while not exceeding 10% of the instantaneous flow of the river and when discharge is greater than 30% of the mean annual discharge (MAD). The addition of a third pump will bring this capacity to up to 200 L/s, which is now the preferred configuration given the short time within which the water deficit must be addressed. Current water levels in Lake Geraldine reservoir indicate that the total supplementation requirement is closer to 700,000 m^3, which is at the higher end of Golder (2019) estimates. Based on the current information, 41 days of pumping at 200 L/s will be required to fill Lake Geraldine, and 54 days at 150 L/s. With the installation of infrastructure in Apex River currently delayed by sea ice in Frobisher Bay, supplementation will not be able to begin before August 12, 2019. While there is hope that there will be rain events over the remainder of the summer, an increase to the pumping capacity to 200 L/s will provide greater confidence that the supplementation needs will be met over the remaining open water period.

Up to two pumps will be installed on shore at Unnamed Lake with intakes extending into the water. These pumps will be powered by a diesel-powered generator with integrated fuel storage and containment system, or the pumps themselves may be powered. Flexible hoses used to convey water will be connected to the pumps by a HDPE manifold. To mitigate for potential fish entrainment, DFO's Freshwater Intake End-of-Pipe Fish Screen Guideline (1995) will be applied. To mitigate against excessive sediment entrainment, the intakes will be extended away from the shoreline on floats.

Pumps and associated infrastructure will be transported to the Unnamed Lake pumping site by helicopter. Fuel and personnel will be transported to site by helicopter or ATV once per day to refuel the generator/pumps and to perform maintenance . A three-day fuel supply will be stored on site (amount) as a contingency for weather delays. Fuel will be stored in 208 L (45 gallon) drums within secondary containment. Pumps/generator will also be placed within secondary containment. Recognizing the use of the water source as potable water supply, pumps, power and refueling will be located greater than 30 m from shore and spill containment methods and procedures will be checked daily.

2.4.1.2 Conveyance Unnamed Lake to Apex River

The preferred conveyance route from Unnamed Lake to Apex River is approximately 1,500 m in length. Water is proposed to be conveyed using eight to ten trains of 4” flexible hoses available from the Government of Nunavut for emergency purposes. These hoses were employed during the 2018 Emergency Apex Pumping setup and have not been utilized for other purposes since then. Hose reels will be transported to site by helicopter and laid out overland on foot.

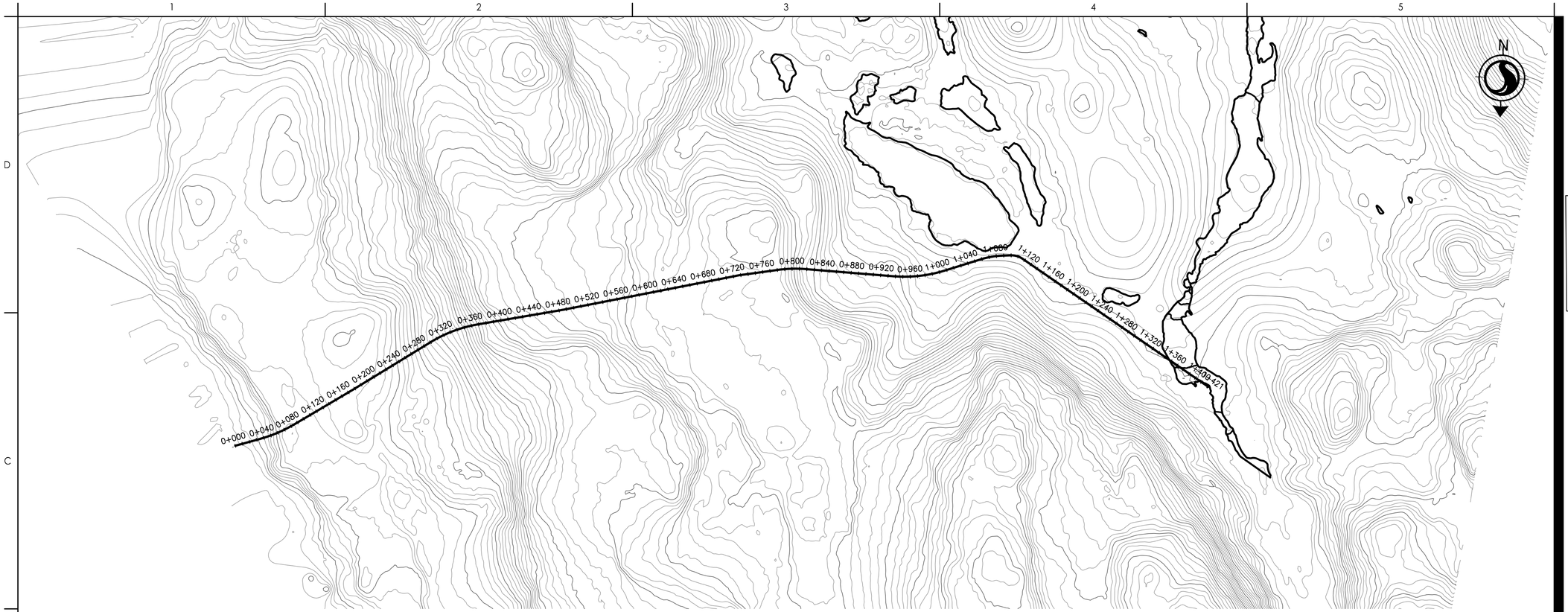
2.4.2 Altering Flows in the Apex River

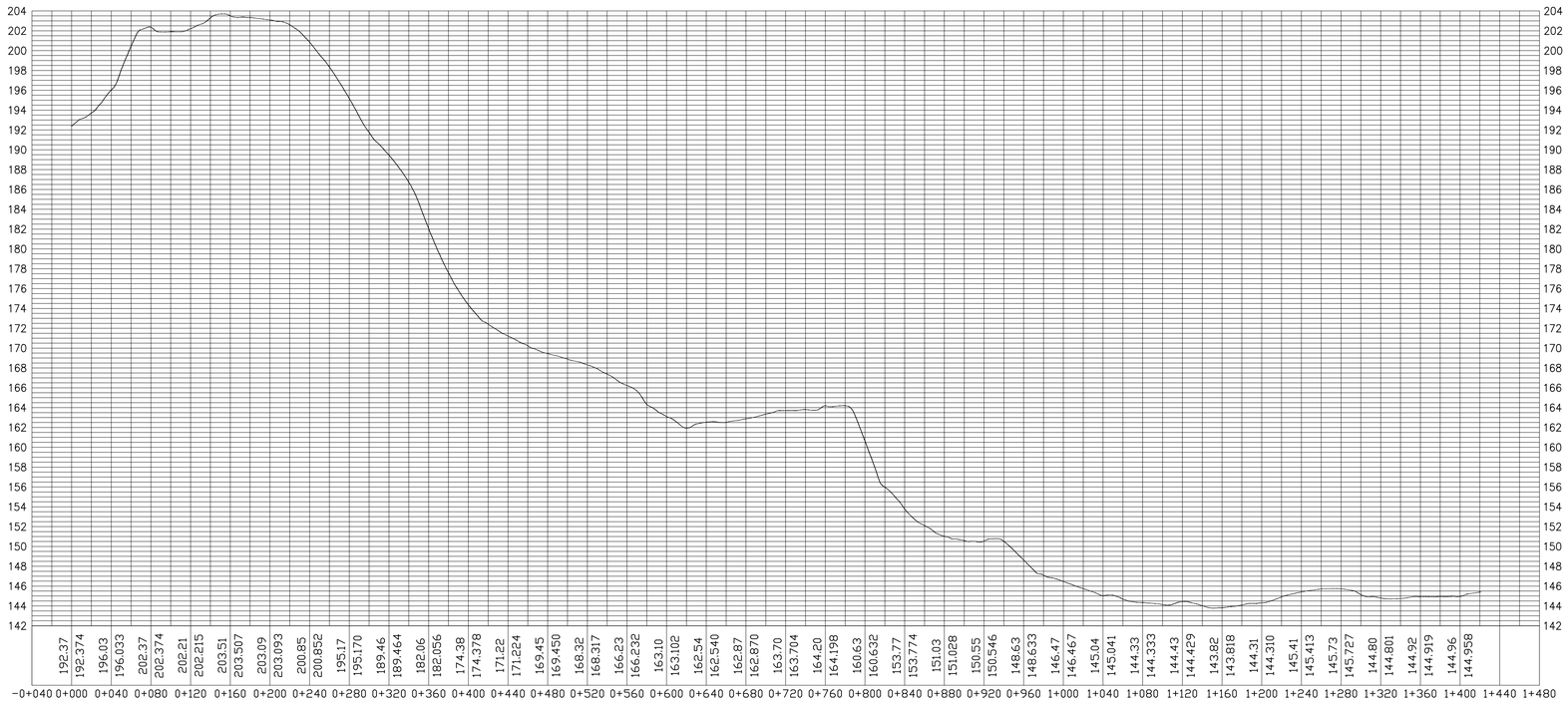
2.4.2.1 Discharge to Apex River

The profile of the conveyance (hose) route from Unnamed Lake to the Apex River is such that the elevation gain is minimal and occurs along the initial portion of the route (Figure 2-5). From there, the downhill gradient will allow water to flow freely through hoses to the discharge location. At the end of pipe, discharge will flow directly into a pool within the Apex River. Flow will be diffused to minimize erosion at the discharge site by installing a splash pad or a section of HDPE pipe drilled with holes.

Up to 200 L/s (0.2 m^3/s) of flow will be added to the Apex River. This is well within the range of natural streamflow based on flow recorded at the downstream Apex River hydrometric station (WSC 10UH002). A conservative scaling factor of 0.75 was applied to the discharge location such that natural flows range from 0 m^3/s to 6.24 m^3/s during the months of August to October for the available period of record from 1973 to 2018. As water from the discharge site flows downstream to the proposed pumping location approximately 2.3 km, some water may be lost to adjacent channels or wet areas. Ten percent of the 200 L/s will be allocated as loss and the remaining 180 L/s will be withdrawn. Flows in the lower Apex River (downstream of the Apex pump location) are expected to be unchanged. The amount of loss will be confirmed through monitoring.

Unnamed Lake is seasonally connected to the Apex River via an outflow channel along its southern shore. During the period of withdrawal of August 1, 2019 to the end of the open water season (October 15), this outflow may carry water. Drawing down water in Unnamed Lake has the potential to change the interconnectivity of Unnamed Lake to the Apex River in future years. This is discussed further in Section 4.





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Notes

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File Name: Arctic UAV Lake Survey 08-18_elev10cm_hs30cm_ms50cm_plot5_DTM.dwg	Dwn.	Chkd.	19.07.23 Dsgn. YY.MM.DD

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CITY OF IQALUIT

IQALUIT APEX WATER SUPPLY

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Figure 2-5: Plan and Profile Unnamed Lake Hose Route

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2.4.2.2 Capture

Water from Unnamed Lake will flow from the discharge location in the Apex River downstream approximately 2.3 km to the Apex River pumping location. The pumps at the Apex River pumping location will be set to withdraw the amount of water as is added from Unnamed Lake (up to 200 L/s), less 10% to account for losses. A hydrometric station installed for the Apex River pumping program (WSC 10UH015) will record combined natural and added flows in the Apex River immediately upstream of the Apex withdrawal location. It is expected that all additional water flowing downstream in the Apex River from Unnamed Lake will be recorded at that hydrometric station. Manual monitoring of flows will be undertaken at this location while the hydrometric station continues to be set up.

When flows in the Apex River (as measured at WSC 10UH002) are below 30% MAD, withdrawal from the Apex River pumping location will not exceed 180 L/s. This reflects the design basis that if 200 L/s is added to the Apex River from Unnamed Lake, 10% of that water may be lost to areas of muskeg and side channels within the 2.3 km of reach between the two locations. Under this scenario, natural conditions downstream of the pumping location (where fish are known to be present) will be unchanged from natural conditions. The amount of losses will be confirmed at the start of the supplementation project, and the withdrawal rate from Apex River will be adjusted accordingly.

When flows in the Apex River are greater than 30% MAD, up to 200 L/s will be withdrawn at the Apex River. This takes into account up to 180 L/s reaching the pump location from supplementation, and 20 L/s taken from natural flow. When flows are >30% MAD, less water may be withdrawn from Unnamed Lake, and more from Apex River. Withdrawals at the pumping location will not exceed 10% of the natural instantaneous flow (i.e., without supplementation) as measured at Water Survey of Canada (WSC) 10UH015. It should be noted that the WSC station has recently been installed and additional manual measurements will be required to be undertaken by the City until a rating curve for the new station has been developed by WSC. As with the <30% MAD scenario, keeping downstream conditions within acceptable conditions (i.e., flows above 30% MAD, not withdrawing more than 10% of natural instantaneous flow), known downstream fish and fish habitat are not expected to be adversely impacted.

2.4.3 Waste

No wastes will be discharged to the environment from the Unnamed Lake 2019 Project.

3 ALTERNATIVES

The consideration of alternatives to Unnamed Lake as a supplementary water source to the Apex River supplementary source takes into account:

- Availability of pumping and conveyance equipment
- Ease of implementation
- Availability and quality of water
- Potential impacts to the environment
- Community input

The following alternatives were considered:

1. Taking all available water from Apex River: This option was not selected as it would result in serious harm to a fish population known to be present downstream of the pumping site. As this is temporary supplementation project, the City did not wish to cause a serious and likely permanent impact to this population. Furthermore, taking all water from the Apex River during low flows currently being experienced does not provide certainty that the 2019 supplementation requirements will be met.
2. Taking water from other, smaller lake sources within 1 km of the Apex River: there are several small (20,000 m^2 or less) lakes in and around the Apex River watershed. The City decided not to proceed with taking water from these lakes as their depth and presence of fish is unknown, therefore limiting the amount of water that could be taken without causing serious harm to fish. Furthermore, installing, removing and moving pumping infrastructure to take water from several lakes would result in loss of pumping time.
3. Sylvia Grinnell River: The Sylvia Grinnell River would have adequate water to support the City's supplementation requirements; however, dry conditions in 2019 applicable to the Apex River are also being experienced in the Sylvia Grinnell River. Water would not be withdrawn when flows are less than 30% MAD due to the importance of this river as a fishery. Furthermore, water withdrawal from this river has not been supported by the Amaruq Hunters and Trappers Association during engagement meetings on water supply. When flow conditions are greater than 30% MAD, the City has considered withdrawing water into 10,000 L water trucks up to 25 times daily for addition into the water supply. This option alone will not provide sufficient water for supplementing the reservoir, but could provide up to 235 m^3 per day, or approximately 10,000 m^3 over a 41 day pumping period directly to residents currently receiving trucked water.

4 ENVIRONMENTAL EFFECTS

4.1 Existing Conditions – Aquatic Resources

Fish presence in Unnamed Lake is unknown. It is known to not be part of a commercial, recreational or Aboriginal fishery as based on information provided by local land users during engagement in 2019. However, the lake is assumed to have fish present. The Apex River supports a resident population of Arctic charr (Salvelinus alpinus) (Nunami Stantec 2017). All fish sampled from this population were collected at one site immediately below what is locally known as Swimming Lake. Two other reaches further downstream were sampled but no fish

were captured. One site upstream at the Road to Nowhere bridge was also sampled with no fish captured. It is unknown whether fish are present in the upper Apex River at the discharge and pumping locations. No fish were observed in the Upper Apex River during monitoring of the 2018 Supplementary Pumping Program.

The resident population of Arctic charr is not expected to be part of a commercial, recreational or Aboriginal (CRA) fishery; due to the small size of the individual fish within the population, which is common of resident populations. The Apex River is not known to have been a fishery in the past. It is unknown whether individuals of this population support a CRA fishery and would likely only occur during spring freshet if some individuals were flushed from the system into Koojesse Inlet. Due to the small size of this resident population it is unlikely they would be captured in the existing Arctic charr fishery. Any potential supporting contribution would be negligible to other fisheries.

4.2 Potential Impacts – Aquatic Resources

Potential Impacts to aquatic resources are summarized in Table 4-1.

Table 4-1: Potential impacts to aquatic resources from Unnamed Lake and Apex River water withdrawal

Activity	Water Quality	Hydrology	Fish and Fish Habitat
Installation, operation and removal of pumps and hoses in Apex River and Unnamed Lake	• Change in sediment concentrations • Deposit of deleterious substance	-	• Change in substrate composition • Increased potential for erosion or sedimentation
Water withdrawal from Apex River and Unnamed Lake	-	• Change in water level Unnamed Lake • Change in flows Apex River • Loss of connection between Unnamed Lake and Apex River	• Entrainment or impingement in pumps • Fish stranding • Reduction or loss of fish habitat in Apex River or Unnamed Lake
Water discharge into Apex River	• Change in sediment concentrations • Change in temperature	• Increased flow	• Change in habitat from erosion or sedimentation • Change in seasonal habitat above the Apex pumping site due to increased flows

4.2.1 Potential Impacts to Water Quality

The placement of the water intake pumps using machinery, and the maintenance of the pumps, may cause bank and bed erosion leading to increased sediment entering the watercourse. Onshore activities, such as maintenance activities in work areas prone to erosion (e.g., on sand or fine materials), may also lead to increased sediment entering the waterbody. The use of machinery near water can lead to the deposit of deleterious substances (e.g., grease, oil) into the water which may affect the use of the water as a potable water source, and fish health.

4.2.2 Potential Impacts to Hydrology

Changes to water levels in Unnamed Lake may occur as a result of the 2019 Iqaluit Supplementation Project, as up to 700,000 m^3 will be withdrawn from this lake. A bathymetric survey of the lake has been completed (July 26, 2019), however the information has not yet been processed. It is estimated that the lake level may decrease by up to 1 m as a result of the supplementation project, estimate is based on surface area calculation and will be refined once bathymetric data has been processed. Unnamed Lake has an outflow located along its southern shore. This outflow contributes to flows seasonally to the lower Apex River. Reducing the lake level in Unnamed Lake has the potential to reduce water surface elevation to below the invert elevation of the lake and thus reducing flows in the tributary. This could result in a reduction of flows in Apex River during this time. The acquired bathymetric information for Unnamed Lake will be analyzed to predict the expected drawdown of the lake and shoreline changes in 2019. Furthermore, three pressure transducers (to measure water surface levels) have been installed within the lake to record water level measurements throughout the year. Streamflow of 0.134 m^3/s was measured in the outlet channel in early July, this was approximately 24 days past the peak flow measured in the Apex River. This information will be reported in the water licence annual report.

Adding water to the Apex River will increase the flows in the upper Apex River, between the input and withdrawal locations, for the duration of the supplementation program. This increase is not anticipated change flows downstream of the Apex pumping site as all additional water from Unnamed Lake entering the Apex River will be withdrawn at this location. Withdrawal from Apex River will not exceed 200 L/s. When streamflows in the Apex are less than 30% MAD as measured at WSC 10UH002, water withdrawn from the Apex will not exceed what is added to Apex from Unnamed Lake. Conditions downstream will be unchanged. When streamflows are greater than 30% MAD as measured at WSC 10UH002, no more than 10% of the instantaneous natural flow (i.e., excluding added flow) as measured at WSC 10UH015 will be withdrawn, to a maximum of 200 Ls. This will result in flows in the Apex River that are protective of fish as specified in DFO guidelines.

4.2.3 Potential Impacts to Fish and Fish Habitat

In a previous Authorization issued to the City for the 2018 Supplementary Pumping Program (18-HCAA-01025), Fisheries and Oceans Canada (DFO) advised that water withdrawal not exceeding 10% instantaneous flow when conditions are greater than 30% MAD represents a low risk of serious harm to fish (“low risk criteria”).

Serious harm to the resident population of charr may occur when withdrawal exceeds 10% of the instantaneous flow or when withdrawal is under conditions below 30% MAD. Potential effects are:

- reduction of fish habitat including overwintering habitat due to water withdrawal, and
- mortality of fish by stranding due to water withdrawal.

Changing (increasing) the flows in the Apex River can lead to erosion of the bed and banks of the river and may cause fish to be unable to move into or through areas of higher flows. Changes in water temperature between water in Unnamed Lake and Apex River can also result in impacts to fish.

Impingement or entrainment of fish causing injury or death can occur when pumps are not fitted with fish screens meeting applicable guidelines.

4.3 Assessment of Residual Effects on Aquatic Resources

Residual environmental effects are those effects which remain after the application of mitigation. The classification of residual effects is presented in Table 4-2.

Table 4-2 Assessment Criteria for Potential Residual Environmental Effects

Criteria	Potential Outcomes			
Duration	**Short-Term:** Effect lasts for duration of Project Construction	**Medium-Term:** Effect lasts for up to 5 years after construction activity ceases	**Long-Term:** Effect lasts beyond final remediation of site	
Frequency	**Once:** Effect occurs once	**Intermittent:** Effect occurs intermittently	**Continuous:** Effect occurs continuously	
Seasonal Timing	**Season-Specific:** Effect is restricted to a particular season or seasons	**Non Season-Specific:** Effect could occur year round		
Geographic Extent	**Project Footprint** Within project footprint	**Project Area** 500m surrounding project footprint	**Regional** 25km buffer around the Project footprint	
Reversibility[1]	**Reversible or Irreversible**			
Magnitude of effect	**None/negligible**	**Low**[2]	**Moderate**[3]	**High**[4]

NOTES:

1 Reversibility: The likelihood that the environmental component will recover from an environmental effect.

2 Low: The predicted trend in the measurable parameter under projected levels of development may result in a decline in the environmental component in the study area during the life of the Project, but levels should recover to baseline after Project closure.

3 Moderate: The predicted trend in the measurable parameter under projected levels of development will likely result in a decline in the environmental component to lower than baseline, but stable levels in the study area after Project closure and into the foreseeable future.

4 High: The predicted trend in the measurable parameter under projected levels of development could threaten the sustainability of the environmental component in the study area, after Project closure, and into the foreseeable future.

4.3.1 Assessment of Effects on Water Quality

The City will implement mitigations during all project activities to reduce the effects of project activities on the aquatic environment.

Table 4-3 lists mitigations to be applied to reduce effects to water quality during supplemental pumping.

Table 4-3: Mitigations for potential effects to water quality

Potential Effect	Mitigation
Potential release of deleterious substance due to operation of machinery in and around water	• Machinery is to arrive on site in a clean condition and maintained free of fluid leaks, invasive species and noxious weeds. Eco friendly (e.g., biodegradable vegetable oil) hydraulic fluid and lubrication is to be used on equipment, where feasible. • Develop and implement a Spill Contingency Plan (Appendix A) that minimizes risk of accidental spills or releases from entering a watercourse or water body during all phases of the pumping. • Whenever possible, operate machinery on land above the high water mark (HWM), to minimize disturbance to the banks and bed of the water body. • Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water. • Remove all construction materials from site upon project completion.
Potential increase in erosion and sedimentation from operation of machinery in and around water	• Install effective erosion and sediment control measures before starting work to prevent sediment from entering the water body. • Clearing of riparian vegetation should be kept to a minimum; use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. • Avoid areas of steep banks or slopes when entering or exiting water body. • Inspect and maintain erosion and sediment control measures and structures during the course of construction. • Repair erosion and sediment control measures and structures, if damage occurs. • Remove non-biodegradable erosion and sediment control materials once site is stabilized. • Minimize in-water works • Adhere to measures provided in the Erosion and Sedimentation Control Plan
Potential increase in sediment loads due to erosion at discharge point into Apex River	• Install effective erosion and sediment control measures such as a diffuser or splash pad before starting work to prevent erosion and sediment from entering the water body. • Direct discharge directly into water at a deeper or rocky location

With the application of measures to reduce the potential for, and effects of sediments entering the Apex River and release of deleterious substance, the residual effects to water quality will be short-term, restricted to open-water season, limited to the project area and will be reversible. The residual effect to water quality is predicted to be negligible.

4.3.2 Assessment of Effects on Hydrology

Table 4-4 identifies the mitigations to be applied to reduce the potential effects on hydrology.

Table 4-4: Mitigations for potential changes to hydrology of Unnamed Lake and Apex River

Potential Effect	Mitigation
Change in water level Unnamed Lake	• Withdraw only amount needed for supplementation. Withdrawal to cease when Lake Geraldine is full or if/when Apex River alone can meet supplementation requirements • Limit volume withdrawals from Unnamed Lake to 10% of total volume.
Decrease in flows in Apex River	• When flows are <30% MAD as measured at WSC 10UH002, withdraw only what is added to Apex River • When flows are >30% MAD as measured at WSC 10UH002, withdraw no more than 10% of instantaneous natural (i.e., not including added) flow as measured at WSC 10UH015.
Increase in flows in the Apex River	• Flows added to river (up to 200 L/s) are within range of normal flows for that portion of the river • Withdraw all that is added – no change to flows in the Apex River downstream of withdrawal location
Loss of surface water connection between Unnamed Lake and Apex River	• Withdraw only amount needed for supplementation. Withdrawal to cease when Lake Geraldine is full or if/when Apex River alone can meet supplementation requirements

With the application of measures to reduce the potential for changes to hydrology of the Apex River, the residual effects to hydrology are short-term in duration, will be continuous during pumping, and will occur during open-water season. The residual effect to hydrology in the Apex River is reversible and the magnitude of the effect is negligible.

With the application of measures to reduce the potential for changes to hydrology of Unnamed Lake, the residual effects to hydrology are medium-term in duration, will be continuous during pumping, and have the potential to occur year-round. The geographic extent of this effect is downstream of the lake and potentially downstream into the Apex River. The residual effect to hydrology in Unnamed Lake and the magnitude of the effect is moderate. It is anticipated at the proposed withdrawal rates from Unnamed Lake, water levels in the lake are anticipated to recover during freshet in the following year.

4.3.3 Assessment of Effects on Fish and Fish Habitat

Table 4-5 lists mitigations to be applied to reduce effects to fish and fish habitat.

Table 4-5: Mitigations for potential effects to fish and fish habitat

Potential Effect	Description	Mitigation
Fish mortality and health	• Potential fish entrapment or entrainment during pumping	• Screen water intakes pipes to prevent entrainment or impingement of fish in accordance with DFO's Freshwater Intake end-of-Pipe Fish Screen Guideline (1995). Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself. • Openings in the guides and seals are to be less than the opening criteria to make "fish tight". • Intakes are to be installed in a manner that prevents the uptake or entrainment of sediment and aquatic organisms associated with the bottom area. Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse. If the water depth is less than 300 mm (12 in.), additional measures may need to be implemented (e.g., using a screen basket with a solid bottom). • Structural support is to be provided to the screen panels to prevent sagging and collapse of the screen. • Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where there is debris loading (woody material, leaves, algae mats, etc.). A150 mm (6 in.) spacing between bars is typical. • Make provision for the removal, inspection, and cleaning of screens. • Implement regular maintenance and repair of cleaning apparatus, seals, and screens is carried out to prevent debris-fouling and impingement of fish. • Shut down pumps when fish screens are removed for inspection and cleaning.
	• Potential effects to fish from changes in water temperature due to discharge of water from Unnamed lake into the Apex River	• Spread out location of discharges if temperature difference between outlet and receiving water is >5 degrees Celsius • Water discharge from unnamed lake to the Apex River will be conducted on a ramp up procedure

Potential Effect	Description	Mitigation
Alteration of fish habitat	• Degradation of fish habitat in Apex River	• It is preferable to adjust pumping rate as required such that withdrawal rate is less than 10% of flow as measured or derived from hydrometric data, when flows are greater than 30% of mean annual discharge. • When flows are less than 30% mean annual discharge as measured at WSC 10UH002, withdraw as much as is added to the river, less 10% to account for losses. • Implement Sedimentation and Erosion Control Plan • Install effective erosion and sediment control measures such as a diffuser or splash pad before starting work to prevent sediment from entering the water body. • Direct discharge directly into water at a deeper or rocky location
	• Reduction or loss of fish habitat in Unnamed Lake due to drawdown	• Withdraw only amount needed for supplementation. Withdrawal to cease when Lake Geraldine is full or if/when Apex River alone can meet supplementation requirements • Withdrawal from lake will be <10% volume of lake

With the application of mitigation serious harm to fish is not anticipated. Water withdrawal during the 2018 emergency withdrawal did not result in any observed significant effects to fish or fish habitat (Nunami Stantec 2019). Assessment predictions are provided in Table 4-6.

Table 4.6: Assessment predictions on fish and fish habitat

Criteria	Fish Mortality and Health	Alteration of Fish Habitat
Duration	Short-term	Medium
Frequency	Continuous over project	Continuous over project
Seasonal timing	Fall	Fall
Geograhic extent	Project footprint	Project footprint
Reversibility	Reversible	Reversible
Magnitude of effect	Low	Low

5 MONITORING AND REPORTING

The 2019 Supplementary Pumping Monitoring Plan for the period of water withdrawal is intended to provide information to inform adjustments of system installation and pumping rates, and to collect information to identify potential effects to fish and fish habitat. Locations of data collected in 2019 and monitoring proposed for the 2019 Apex and Unnamed Lake Supplementation Project are shown in Figure 2-4. The monitoring plan includes:

- Metered monitoring of water withdrawal at the Unnamed Lake pump location (SNP UNL-01)

- Metered monitoring of water withdrawal at the Apex River pump location (SNP IQA-10)
- Streamflows as recorded at WSC Apex River station (WSC 10UH002) will be monitored daily against MAD.
- Streamflows directly upstream of the Apex pump location will be monitored daily at a new hydrometric station (WSC 10UH015) and manually while this new station is established (Apex W-2).
- Water flow measurements will be taken weekly at locations: (1) upstream of the Apex River discharge site (Apex W-1); (2) tributary of Unnamed Lake upstream of confluence with the Apex River (Apex N-1)
- Bathymetric information will be obtained for Unnamed Lake
- Daily water level measurements will be collected at Unnamed Lake (three locations – Transducer #1, #2, #3))
- Water temperature and TDS will be monitored at the Apex River discharge location (Apex W-1) prior to startup, immediately after implementation and after rain events.

A report of the 2019 Apex and Unnamed Lake Supplementation Project will be provided by March 31, 2019. This report will include:

- Daily and total amounts withdrawn from Unnamed Lake at SNP UNL-01
- Daily and total amounts withdrawn from the Apex River at SNP IQA-10
- Unnamed Lake drawdown as recorded by Transducers (levelloggers)
- Daily flows recorded at WSC 10UH002 and WSC 10UH015 compared against MAD
- General observations of flow conditions and channel conditions along the Apex River
- Summary of project implementation schedule, project setup and environmental mitigations

A Technical Memo of Hydrologic Monitoring will be provided by July 31, 2020. This memo will include:

- Bathymetric information about Unnamed Lake
- Modeled changes to Unnamed Lake from 2019 supplementation project
- Flow measurements from Unnamed Lake outflow (Apex N-1) for the period August 2019 to July 2020.
- A discussion of the changes to the hydrology of Unnamed Lake and Apex River as a result of the 2019 Apex and Unnamed Lake Supplementation Project

6 REFERENCES

Nunami Stantec 2019. Iqaluit Emergency Water Supply Project: Apex River Supplementary Pumping – DFO Authorization Monitoring Report. Prepared for the City of Iqaluit.

Nunami Stantec. 2016. Fish and Fish Habitat Assessment of the Niaqunguk (Apex) River, Lake Geraldine, and the Lake Geraldine Drainage Channel. Prepared for the City of Iqaluit.

Appendix A: Unnamed Lake Surface Water Quality Results Summary

Table
Summary of Surface Water Analytical Results
Lake Geraldine Water Supply
Nunami Stantec Limited

Sample Location			SW19-01	SW19-02	SW19-03	SW19-04	SW19-05
Sample Date			4-Jul-19	4-Jul-19	4-Jul-19	4-Jul-19	4-Jul-19
Sample ID			SW19-01	SW19-02	SW19-03	SW19-04	SW19-05
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			BV	BV	BV	BV	BV
Laboratory Work Order			B9I5722	B9I5722	B9I5722	B9I5722	B9I5722
Laboratory Sample ID	Units	Health Canada	KEV013	KEV014	KEV015	KEV016	KEV017
General Chemistry							
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	16	16	16	16	17
Ammonia (as N)	mg/L	n/v	0.15	0.25	0.072	<0.050	<0.050
Bicarbonate(as CaCO3, Calculated)	mg/L	n/v	16	16	16	16	17
Chloride	mg/L	≤250[A]	1.6	1.3	1.5	1.2	1.4
Electrical Conductivity, Lab	µmhos/cm	n/v	46	45	45	45	47
Hardness (as CaCO3)	mg/L	n/v	20	19	19	19	20
Langelier Index (at 20 C)	none	n/v	-1.77	-1.85	-1.78	-1.79	-1.67
Langelier Index (at 4 C)	none	n/v	-2.02	-2.10	-2.03	-2.04	-1.92
Nitrate (as N)	mg/L	10[B]	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite (as N)	mg/L	1[B]	<0.010	<0.010	<0.010	<0.010	<0.010
Orthophosphate (as P)	mg/L	n/v	<0.010	<0.010	<0.010	<0.010	<0.010
pH, lab	S.U.	7.0-10.5[A]	7.48	7.43	7.49	7.47	7.54
Phosphorus, Total	mg/L	n/v	0.006	0.013	0.008	0.005	0.008
Saturation pH (at 20 C)	none	n/v	9.25	9.28	9.27	9.26	9.22
Saturation pH (at 4 C)	none	n/v	9.50	9.53	9.52	9.52	9.47
Sulfate	mg/L	≤500[i,A]	2.7	2.5	2.4	2.4	2.8
Total Dissolved Solids (Calculated)	mg/L	≤500[A]	23	22	22	22	24
Total Organic Carbon	mg/L	n/v	1.6	1.4	1.4	1.3	1.4
Turbidity, Lab	NTU	≤0.3/1.0/0.1[C]	<0.1	<0.1	<0.1	<0.1	<0.1
Metals, Dissolved							
Calcium	mg/L	n/v	6.6	6.4	6.5	6.5	6.7
Magnesium	mg/L	n/v	0.80	0.77	0.74	0.76	0.81
Potassium	mg/L	n/v	<1	<1	<1	<1	<1
Sodium	mg/L	≤200[A]	0.7	0.7	0.7	0.7	0.7
Metals, Total							
Aluminum	µg/L	<100/200[a,A]	5.5	5.5	5.1	5.1	8.0
Antimony	µg/L	6[B]	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	µg/L	10[B]	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	µg/L	1,000[B]	<2.0	<2.0	<2.0	<2.0	<2.0
Beryllium	µg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50
Boron	µg/L	5,000[B]	<10	<10	<10	<10	<10
Cadmium	µg/L	5[B]	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium	µg/L	n/v	6,700	6,800	6,700	6,900	7,400
Chromium	µg/L	50[B]	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt	µg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50
Copper	µg/L	≤1000[A] 2,000[B]	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	µg/L	≤300[A]	<100	<100	<100	<100	<100
Lead	µg/L	5[B]	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	µg/L	n/v	760	710	740	750	820
Manganese	µg/L	≤20[A] 120[B]	3.1	2.6	2.9	3.5	2.8
Molybdenum	µg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50
Nickel	µg/L	n/v	<1.0	<1.0	<1.0	<1.0	<1.0
Potassium	µg/L	n/v	<200	<200	<200	<200	<200
Selenium	µg/L	50[B]	<2.0	<2.0	<2.0	<2.0	<2.0
Silicon	µg/L	n/v	480	460	460	450	540
Silver	µg/L	n/v	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	µg/L	≤200000[A]	660	670	660	650	730
Strontium	µg/L	n/v	10	9.7	9.9	9.9	10
Thallium	µg/L	n/v	<0.050	<0.050	<0.050	<0.050	<0.050
Titanium	µg/L	n/v	<5.0	<5.0	<5.0	<5.0	<5.0
Vanadium	µg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	µg/L	≤5000[A]	<5.0	<5.0	<5.0	<5.0	<5.0
Microbiological Analysis							
Total Coliform Background	cfu/100mL	n/v	0	7	8	0	2
Total Coliforms	cfu/100mL	0[C]	0	0	0	0	0
E. Coli/Fecal Coliform	cfu/100mL	n/v	0	0	0	0	0

Notes:

Health Canada	Health Canada (June 2019). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
A	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives/ Operational Guidelines
B	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentration
C	Guidelines for Canadian Drinking Water Quality - Microbiological Parameters
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
a	This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
i	High levels (above 500 mg/L) can cause physiological effects such as diarrhea or dehydration.

Your Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Your C.O.C. #: 725587-01-01

Attention: Andrew Sullivan

Stantec Consulting Ltd
PO Box 1680
Yellowknife, NT
CANADA X1A2P3

Report Date: 2019/07/11
Report #: R5793199
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9I5722
Received: 2019/07/06, 07:40

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity (1)	5	N/A	2019/07/08	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide (1)	5	N/A	2019/07/09	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry (1)	4	N/A	2019/07/08	CAM SOP-00463	SM 4500-Cl E m
Chloride by Automated Colourimetry (1)	1	N/A	2019/07/09	CAM SOP-00463	SM 4500-Cl E m
Conductivity (1)	5	N/A	2019/07/08	CAM SOP-00414	SM 23 2510 m
Hardness (calculated as CaCO3) (1)	5	N/A	2019/07/09	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP (1)	5	2019/07/08	2019/07/09	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS (1)	5	N/A	2019/07/10	CAM SOP-00447	EPA 6020B m
Total Coliforms/ E. coli, CFU/100mL (1)	5	N/A	2019/07/06	CAM SOP-00551	MOE E3407
Total Ammonia-N (1)	5	N/A	2019/07/09	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1, 2)	5	N/A	2019/07/08	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH (1)	5	2019/07/06	2019/07/08	CAM SOP-00413	SM 4500H+ B m
Orthophosphate (1)	4	N/A	2019/07/08	CAM SOP-00461	EPA 365.1 m
Orthophosphate (1)	1	N/A	2019/07/09	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C) (1)	5	N/A	2019/07/09		
Sat. pH and Langelier Index (@ 4C) (1)	5	N/A	2019/07/09		
Sulphate by Automated Colourimetry (1)	4	N/A	2019/07/08	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry (1)	1	N/A	2019/07/09	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc) (1)	5	N/A	2019/07/09		
Total Organic Carbon (TOC) (1, 3)	5	N/A	2019/07/08	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric) (1)	5	2019/07/10	2019/07/10	CAM SOP-00407	SM 23 4500 P B H m
Turbidity (1)	5	N/A	2019/07/08	CAM SOP-00417	SM 23 2130 B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Your Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Your C.O.C. #: 725587-01-01

Attention: Andrew Sullivan

Stantec Consulting Ltd
PO Box 1680
Yellowknife, NT
CANADA X1A2P3

Report Date: 2019/07/11
Report #: R5793199
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9I5722
Received: 2019/07/06, 07:40

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Laboratories Mississauga
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Augustyna Dobosz, Project Manager
Email: Augustyna.Dobosz@bvlabs.com
Phone# (905)817-5798
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

RESULTS OF ANALYSES OF WATER

BV Labs ID		KEV013			KEV013			KEV014		
Sampling Date		2019/07/04 13:25			2019/07/04 13:25			2019/07/04 13:55		
COC Number		725587-01-01			725587-01-01			725587-01-01		
	UNITS	SW19-01	RDL	QC Batch	SW19-01 Lab-Dup	RDL	QC Batch	SW19-02	RDL	QC Batch
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	16	1.0	6215157				16	1.0	6215157
Calculated TDS	mg/L	23	1.0	6215329				22	1.0	6215329
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	6215157				<1.0	1.0	6215157
Hardness (CaCO3)	mg/L	20	1.0	6215264				19	1.0	6215264
Langelier Index (@ 20C)	N/A	-1.77		6215327				-1.85		6215327
Langelier Index (@ 4C)	N/A	-2.02		6215328				-2.10		6215328
Saturation pH (@ 20C)	N/A	9.25		6215327				9.28		6215327
Saturation pH (@ 4C)	N/A	9.50		6215328				9.53		6215328
Inorganics										
Total Ammonia-N	mg/L	0.15	0.050	6216664				0.25	0.050	6216664
Conductivity	umho/cm	46	1.0	6215402				45	1.0	6215402
Total Organic Carbon (TOC)	mg/L	1.6	0.50	6216605				1.4	0.50	6216605
Orthophosphate (P)	mg/L	<0.010	0.010	6215391	<0.010	0.010	6215391	<0.010	0.010	6215249
pH	pH	7.48		6215403				7.43		6215403
Total Phosphorus	mg/L	0.006	0.004	6220218				0.013	0.004	6220218
Dissolved Sulphate (SO4)	mg/L	2.7	1.0	6215389	2.7	1.0	6215389	2.5	1.0	6215247
Turbidity	NTU	<0.1	0.1	6215380				<0.1	0.1	6215380
Alkalinity (Total as CaCO3)	mg/L	16	1.0	6215401				16	1.0	6215401
Dissolved Chloride (Cl-)	mg/L	1.6	1.0	6215388	1.5	1.0	6215388	1.3	1.0	6215246
Nitrite (N)	mg/L	<0.010	0.010	6215344				<0.010	0.010	6215344
Nitrate (N)	mg/L	<0.10	0.10	6215344				<0.10	0.10	6215344

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas Laboratories 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.bvlabs.com

BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

RESULTS OF ANALYSES OF WATER

BV Labs ID		KEV014			KEV015			KEV015		
Sampling Date		2019/07/04 13:55			2019/07/04 14:45			2019/07/04 14:45		
COC Number		725587-01-01			725587-01-01			725587-01-01		
	UNITS	SW19-02 Lab-Dup	RDL	QC Batch	SW19-03	RDL	QC Batch	SW19-03 Lab-Dup	RDL	QC Batch
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				16	1.0	6215157			
Calculated TDS	mg/L				22	1.0	6215329			
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	1.0	6215157			
Hardness (CaCO3)	mg/L				19	1.0	6215264			
Langelier Index (@ 20C)	N/A				-1.78		6215327			
Langelier Index (@ 4C)	N/A				-2.03		6215328			
Saturation pH (@ 20C)	N/A				9.27		6215327			
Saturation pH (@ 4C)	N/A				9.52		6215328			
Inorganics										
Total Ammonia-N	mg/L				0.072	0.050	6216664			
Conductivity	umho/cm	45	1.0	6215402	45	1.0	6215402			
Total Organic Carbon (TOC)	mg/L				1.4	0.50	6216605			
Orthophosphate (P)	mg/L				<0.010	0.010	6214161			
pH	pH	7.48		6215403	7.49		6215403			
Total Phosphorus	mg/L				0.008	0.004	6220218	0.010	0.004	6220218
Dissolved Sulphate (SO4)	mg/L				2.4	1.0	6214184			
Turbidity	NTU	0.1	0.1	6215380	<0.1	0.1	6215380			
Alkalinity (Total as CaCO3)	mg/L	17	1.0	6215401	16	1.0	6215401			
Dissolved Chloride (Cl-)	mg/L				1.5	1.0	6214160			
Nitrite (N)	mg/L				<0.010	0.010	6215344			
Nitrate (N)	mg/L				<0.10	0.10	6215344			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

RESULTS OF ANALYSES OF WATER

BV Labs ID		KEV016	KEV017		
Sampling Date		2019/07/04 15:00	2019/07/04 15:21		
COC Number		725587-01-01	725587-01-01		
	UNITS	SW19-04	SW19-05	RDL	QC Batch
Calculated Parameters					
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	16	17	1.0	6215157
Calculated TDS	mg/L	22	24	1.0	6215329
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	1.0	6215157
Hardness (CaCO3)	mg/L	19	20	1.0	6215264
Langelier Index (@ 20C)	N/A	-1.79	-1.67		6215327
Langelier Index (@ 4C)	N/A	-2.04	-1.92		6215328
Saturation pH (@ 20C)	N/A	9.26	9.22		6215327
Saturation pH (@ 4C)	N/A	9.52	9.47		6215328
Inorganics					
Total Ammonia-N	mg/L	<0.050	<0.050	0.050	6216664
Conductivity	umho/cm	45	47	1.0	6215402
Total Organic Carbon (TOC)	mg/L	1.3	1.4	0.50	6216605
Orthophosphate (P)	mg/L	<0.010	<0.010	0.010	6214161
pH	pH	7.47	7.54		6215403
Total Phosphorus	mg/L	0.005	0.008	0.004	6220218
Dissolved Sulphate (SO4)	mg/L	2.4	2.8	1.0	6214184
Turbidity	NTU	<0.1	<0.1	0.1	6215380
Alkalinity (Total as CaCO3)	mg/L	16	17	1.0	6215401
Dissolved Chloride (Cl-)	mg/L	1.2	1.4	1.0	6214160
Nitrite (N)	mg/L	<0.010	<0.010	0.010	6215344
Nitrate (N)	mg/L	<0.10	<0.10	0.10	6215344

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		KEV013	KEV014	KEV015	KEV016	KEV017		
Sampling Date		2019/07/04 13:25	2019/07/04 13:55	2019/07/04 14:45	2019/07/04 15:00	2019/07/04 15:21		
COC Number		725587-01-01	725587-01-01	725587-01-01	725587-01-01	725587-01-01		
	UNITS	**SW19-01**	**SW19-02**	**SW19-03**	**SW19-04**	**SW19-05**	**RDL**	**QC Batch**
Metals								
Dissolved Calcium (Ca)	mg/L	6.6	6.4	6.5	6.5	6.7	0.05	6216768
Dissolved Magnesium (Mg)	mg/L	0.80	0.77	0.74	0.76	0.81	0.05	6216768
Dissolved Potassium (K)	mg/L	<1	<1	<1	<1	<1	1	6216768
Dissolved Sodium (Na)	mg/L	0.7	0.7	0.7	0.7	0.7	0.5	6216768
Total Aluminum (Al)	ug/L	5.5	5.5	5.1	5.1	8.0	5.0	6218219
Total Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6218219
Total Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	6218219
Total Barium (Ba)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	6218219
Total Beryllium (Be)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6218219
Total Boron (B)	ug/L	<10	<10	<10	<10	<10	10	6218219
Total Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6218219
Total Calcium (Ca)	ug/L	6700	6800	6700	6900	7400	200	6218219
Total Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	6218219
Total Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6218219
Total Copper (Cu)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	6218219
Total Iron (Fe)	ug/L	<100	<100	<100	<100	<100	100	6218219
Total Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6218219
Total Magnesium (Mg)	ug/L	760	710	740	750	820	50	6218219
Total Manganese (Mn)	ug/L	3.1	2.6	2.9	3.5	2.8	2.0	6218219
Total Molybdenum (Mo)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6218219
Total Nickel (Ni)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	6218219
Total Potassium (K)	ug/L	<200	<200	<200	<200	<200	200	6218219
Total Selenium (Se)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	6218219
Total Silicon (Si)	ug/L	480	460	460	450	540	50	6218219
Total Silver (Ag)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6218219
Total Sodium (Na)	ug/L	660	670	660	650	730	100	6218219
Total Strontium (Sr)	ug/L	10	9.7	9.9	9.9	10	1.0	6218219
Total Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	6218219
Total Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	6218219
Total Vanadium (V)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6218219
Total Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	6218219

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

MICROBIOLOGY (WATER)

BV Labs ID		KEV013	KEV014	KEV015	KEV016	KEV017	
Sampling Date		2019/07/04 13:25	2019/07/04 13:55	2019/07/04 14:45	2019/07/04 15:00	2019/07/04 15:21	
COC Number		725587-01-01	725587-01-01	725587-01-01	725587-01-01	725587-01-01	
	UNITS	SW19-01	SW19-02	SW19-03	SW19-04	SW19-05	QC Batch
Microbiological							
Background	CFU/100mL	0	7	8	0	2	6215384
Total Coliforms	CFU/100mL	0	0	0	0	0	6215384
Escherichia coli	CFU/100mL	0	0	0	0	0	6215384

QC Batch = Quality Control Batch

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	2.0°C

Results relate only to the items tested.

BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6214160	ADB	Matrix Spike	Dissolved Chloride (Cl-)	2019/07/08		NC	%	80 - 120
6214160	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2019/07/08		103	%	80 - 120
6214160	ADB	Method Blank	Dissolved Chloride (Cl-)	2019/07/08	<1.0		mg/L	
6214160	ADB	RPD	Dissolved Chloride (Cl-)	2019/07/08	0.32		%	20
6214161	ADB	Matrix Spike	Orthophosphate (P)	2019/07/08		105	%	75 - 125
6214161	ADB	Spiked Blank	Orthophosphate (P)	2019/07/08		101	%	80 - 120
6214161	ADB	Method Blank	Orthophosphate (P)	2019/07/08	<0.010		mg/L	
6214161	ADB	RPD	Orthophosphate (P)	2019/07/08	NC		%	25
6214184	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2019/07/08		NC	%	75 - 125
6214184	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/07/08		105	%	80 - 120
6214184	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/07/08	<1.0		mg/L	
6214184	ADB	RPD	Dissolved Sulphate (SO4)	2019/07/08	3.1		%	20
6215246	ADB	Matrix Spike	Dissolved Chloride (Cl-)	2019/07/08		106	%	80 - 120
6215246	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2019/07/08		102	%	80 - 120
6215246	ADB	Method Blank	Dissolved Chloride (Cl-)	2019/07/08	<1.0		mg/L	
6215246	ADB	RPD	Dissolved Chloride (Cl-)	2019/07/08	5.2		%	20
6215247	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2019/07/08		102	%	75 - 125
6215247	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/07/08		109	%	80 - 120
6215247	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/07/08	<1.0		mg/L	
6215247	ADB	RPD	Dissolved Sulphate (SO4)	2019/07/08	13		%	20
6215249	ADB	Matrix Spike	Orthophosphate (P)	2019/07/08		103	%	75 - 125
6215249	ADB	Spiked Blank	Orthophosphate (P)	2019/07/08		101	%	80 - 120
6215249	ADB	Method Blank	Orthophosphate (P)	2019/07/08	<0.010		mg/L	
6215249	ADB	RPD	Orthophosphate (P)	2019/07/08	0.49		%	25
6215344	C_N	Matrix Spike	Nitrite (N)	2019/07/08		104	%	80 - 120
			Nitrate (N)	2019/07/08		101	%	80 - 120
6215344	C_N	Spiked Blank	Nitrite (N)	2019/07/08		106	%	80 - 120
			Nitrate (N)	2019/07/08		102	%	80 - 120
6215344	C_N	Method Blank	Nitrite (N)	2019/07/08	<0.010		mg/L	
			Nitrate (N)	2019/07/08	<0.10		mg/L	
6215344	C_N	RPD	Nitrite (N)	2019/07/08	NC		%	20
			Nitrate (N)	2019/07/08	NC		%	20
6215380	KAD	Spiked Blank	Turbidity	2019/07/08		92	%	85 - 115
6215380	KAD	Method Blank	Turbidity	2019/07/08	<0.1		NTU	
6215380	KAD	RPD [KEV014-01]	Turbidity	2019/07/08	NC		%	20
6215388	ADB	Matrix Spike [KEV013-01]	Dissolved Chloride (Cl-)	2019/07/09		102	%	80 - 120
6215388	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2019/07/09		104	%	80 - 120
6215388	ADB	Method Blank	Dissolved Chloride (Cl-)	2019/07/09	<1.0		mg/L	
6215388	ADB	RPD [KEV013-01]	Dissolved Chloride (Cl-)	2019/07/09	1.7		%	20
6215389	ADB	Matrix Spike [KEV013-01]	Dissolved Sulphate (SO4)	2019/07/09		115	%	75 - 125
6215389	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/07/09		103	%	80 - 120
6215389	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/07/09	<1.0		mg/L	
6215389	ADB	RPD [KEV013-01]	Dissolved Sulphate (SO4)	2019/07/09	0.99		%	20
6215391	ADB	Matrix Spike [KEV013-01]	Orthophosphate (P)	2019/07/09		108	%	75 - 125
6215391	ADB	Spiked Blank	Orthophosphate (P)	2019/07/09		101	%	80 - 120
6215391	ADB	Method Blank	Orthophosphate (P)	2019/07/09	<0.010		mg/L	
6215391	ADB	RPD [KEV013-01]	Orthophosphate (P)	2019/07/09	NC		%	25
6215401	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2019/07/08		96	%	85 - 115
6215401	SAU	Method Blank	Alkalinity (Total as CaCO3)	2019/07/08	<1.0		mg/L	
6215401	SAU	RPD [KEV014-01]	Alkalinity (Total as CaCO3)	2019/07/08	5.9		%	20
6215402	SAU	Spiked Blank	Conductivity	2019/07/08		101	%	85 - 115
6215402	SAU	Method Blank	Conductivity	2019/07/08	<1.0		umho/cm	
6215402	SAU	RPD [KEV014-01]	Conductivity	2019/07/08	0		%	25

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6215403	SAU	Spiked Blank	pH	2019/07/08		102	%	98 - 103
6215403	SAU	RPD [KEV014-01]	pH	2019/07/08	0.61		%	N/A
6216605	KRM	Matrix Spike	Total Organic Carbon (TOC)	2019/07/08		90	%	80 - 120
6216605	KRM	Spiked Blank	Total Organic Carbon (TOC)	2019/07/08		96	%	80 - 120
6216605	KRM	Method Blank	Total Organic Carbon (TOC)	2019/07/08	<0.50		mg/L	
6216605	KRM	RPD	Total Organic Carbon (TOC)	2019/07/08	2.7		%	20
6216664	MT4	Matrix Spike	Total Ammonia-N	2019/07/09		101	%	75 - 125
6216664	MT4	Spiked Blank	Total Ammonia-N	2019/07/09		101	%	80 - 120
6216664	MT4	Method Blank	Total Ammonia-N	2019/07/09	<0.050		mg/L	
6216664	MT4	RPD	Total Ammonia-N	2019/07/09	NC		%	20
6216768	AFZ	Matrix Spike	Dissolved Calcium (Ca)	2019/07/09		NC	%	80 - 120
			Dissolved Magnesium (Mg)	2019/07/09		NC	%	80 - 120
			Dissolved Potassium (K)	2019/07/09		109	%	80 - 120
			Dissolved Sodium (Na)	2019/07/09		105	%	80 - 120
6216768	AFZ	Spiked Blank	Dissolved Calcium (Ca)	2019/07/09		95	%	80 - 120
			Dissolved Magnesium (Mg)	2019/07/09		99	%	80 - 120
			Dissolved Potassium (K)	2019/07/09		106	%	80 - 120
			Dissolved Sodium (Na)	2019/07/09		103	%	80 - 120
6216768	AFZ	Method Blank	Dissolved Calcium (Ca)	2019/07/09	<0.05		mg/L	
			Dissolved Magnesium (Mg)	2019/07/09	<0.05		mg/L	
			Dissolved Potassium (K)	2019/07/09	<1		mg/L	
			Dissolved Sodium (Na)	2019/07/09	<0.5		mg/L	
6216768	AFZ	RPD	Dissolved Calcium (Ca)	2019/07/09	0.24		%	25
			Dissolved Magnesium (Mg)	2019/07/09	0		%	25
			Dissolved Potassium (K)	2019/07/09	NC		%	25
			Dissolved Sodium (Na)	2019/07/09	0.061		%	25
6218219	JBW	Matrix Spike	Total Aluminum (Al)	2019/07/10		103	%	80 - 120
			Total Antimony (Sb)	2019/07/10		100	%	80 - 120
			Total Arsenic (As)	2019/07/10		96	%	80 - 120
			Total Barium (Ba)	2019/07/10		94	%	80 - 120
			Total Beryllium (Be)	2019/07/10		91	%	80 - 120
			Total Boron (B)	2019/07/10		NC	%	80 - 120
			Total Cadmium (Cd)	2019/07/10		99	%	80 - 120
			Total Calcium (Ca)	2019/07/10		NC	%	80 - 120
			Total Chromium (Cr)	2019/07/10		93	%	80 - 120
			Total Cobalt (Co)	2019/07/10		97	%	80 - 120
			Total Copper (Cu)	2019/07/10		NC	%	80 - 120
			Total Iron (Fe)	2019/07/10		95	%	80 - 120
			Total Lead (Pb)	2019/07/10		96	%	80 - 120
			Total Magnesium (Mg)	2019/07/10		92	%	80 - 120
			Total Manganese (Mn)	2019/07/10		93	%	80 - 120
			Total Molybdenum (Mo)	2019/07/10		104	%	80 - 120
			Total Nickel (Ni)	2019/07/10		90	%	80 - 120
			Total Potassium (K)	2019/07/10		NC	%	80 - 120
			Total Selenium (Se)	2019/07/10		101	%	80 - 120
			Total Silicon (Si)	2019/07/10		93	%	80 - 120
			Total Silver (Ag)	2019/07/10		95	%	80 - 120
			Total Sodium (Na)	2019/07/10		NC	%	80 - 120
			Total Strontium (Sr)	2019/07/10		91	%	80 - 120
			Total Thallium (Tl)	2019/07/10		97	%	80 - 120
			Total Titanium (Ti)	2019/07/10		NC	%	80 - 120
			Total Vanadium (V)	2019/07/10		93	%	80 - 120
			Total Zinc (Zn)	2019/07/10		97	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6218219	JBW	Spiked Blank	Total Aluminum (Al)	2019/07/10		98	%	80 - 120
			Total Antimony (Sb)	2019/07/10		99	%	80 - 120
			Total Arsenic (As)	2019/07/10		99	%	80 - 120
			Total Barium (Ba)	2019/07/10		96	%	80 - 120
			Total Beryllium (Be)	2019/07/10		91	%	80 - 120
			Total Boron (B)	2019/07/10		89	%	80 - 120
			Total Cadmium (Cd)	2019/07/10		100	%	80 - 120
			Total Calcium (Ca)	2019/07/10		105	%	80 - 120
			Total Chromium (Cr)	2019/07/10		99	%	80 - 120
			Total Cobalt (Co)	2019/07/10		101	%	80 - 120
			Total Copper (Cu)	2019/07/10		102	%	80 - 120
			Total Iron (Fe)	2019/07/10		98	%	80 - 120
			Total Lead (Pb)	2019/07/10		95	%	80 - 120
			Total Magnesium (Mg)	2019/07/10		102	%	80 - 120
			Total Manganese (Mn)	2019/07/10		96	%	80 - 120
			Total Molybdenum (Mo)	2019/07/10		104	%	80 - 120
			Total Nickel (Ni)	2019/07/10		95	%	80 - 120
			Total Potassium (K)	2019/07/10		102	%	80 - 120
			Total Selenium (Se)	2019/07/10		106	%	80 - 120
			Total Silicon (Si)	2019/07/10		100	%	80 - 120
			Total Silver (Ag)	2019/07/10		99	%	80 - 120
			Total Sodium (Na)	2019/07/10		102	%	80 - 120
			Total Strontium (Sr)	2019/07/10		95	%	80 - 120
			Total Thallium (Tl)	2019/07/10		95	%	80 - 120
			Total Titanium (Ti)	2019/07/10		100	%	80 - 120
			Total Vanadium (V)	2019/07/10		96	%	80 - 120
			Total Zinc (Zn)	2019/07/10		101	%	80 - 120
6218219	JBW	Method Blank	Total Aluminum (Al)	2019/07/10	<5.0		ug/L	
			Total Antimony (Sb)	2019/07/10	<0.50		ug/L	
			Total Arsenic (As)	2019/07/10	<1.0		ug/L	
			Total Barium (Ba)	2019/07/10	<2.0		ug/L	
			Total Beryllium (Be)	2019/07/10	<0.50		ug/L	
			Total Boron (B)	2019/07/10	<10		ug/L	
			Total Cadmium (Cd)	2019/07/10	<0.10		ug/L	
			Total Calcium (Ca)	2019/07/10	<200		ug/L	
			Total Chromium (Cr)	2019/07/10	<5.0		ug/L	
			Total Cobalt (Co)	2019/07/10	<0.50		ug/L	
			Total Copper (Cu)	2019/07/10	<1.0		ug/L	
			Total Iron (Fe)	2019/07/10	<100		ug/L	
			Total Lead (Pb)	2019/07/10	<0.50		ug/L	
			Total Magnesium (Mg)	2019/07/10	<50		ug/L	
			Total Manganese (Mn)	2019/07/10	<2.0		ug/L	
			Total Molybdenum (Mo)	2019/07/10	<0.50		ug/L	
			Total Nickel (Ni)	2019/07/10	<1.0		ug/L	
			Total Potassium (K)	2019/07/10	<200		ug/L	
			Total Selenium (Se)	2019/07/10	<2.0		ug/L	
			Total Silicon (Si)	2019/07/10	<50		ug/L	
			Total Silver (Ag)	2019/07/10	<0.10		ug/L	
			Total Sodium (Na)	2019/07/10	<100		ug/L	
			Total Strontium (Sr)	2019/07/10	<1.0		ug/L	
			Total Thallium (Tl)	2019/07/10	<0.050		ug/L	
			Total Titanium (Ti)	2019/07/10	<5.0		ug/L	
			Total Vanadium (V)	2019/07/10	<0.50		ug/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Zinc (Zn)	2019/07/10	<5.0		ug/L	
6218219	JBW	RPD	Total Aluminum (Al)	2019/07/10	11		%	20
			Total Cadmium (Cd)	2019/07/10	NC		%	20
			Total Chromium (Cr)	2019/07/10	NC		%	20
			Total Copper (Cu)	2019/07/10	2.9		%	20
			Total Iron (Fe)	2019/07/10	6.9		%	20
			Total Lead (Pb)	2019/07/10	3.1		%	20
			Total Nickel (Ni)	2019/07/10	5.7		%	20
			Total Zinc (Zn)	2019/07/10	2.3		%	20
6220218	NS3	Matrix Spike [KEV015-02]	Total Phosphorus	2019/07/10		88	%	80 - 120
6220218	NS3	QC Standard	Total Phosphorus	2019/07/10		93	%	80 - 120
6220218	NS3	Spiked Blank	Total Phosphorus	2019/07/10		100	%	80 - 120
6220218	NS3	Method Blank	Total Phosphorus	2019/07/10	<0.004		mg/L	
6220218	NS3	RPD [KEV015-02]	Total Phosphorus	2019/07/10	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

Bureau Veritas Laboratories 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.bvlabs.com

BV Labs Job #: B9I5722
Report Date: 2019/07/11

Stantec Consulting Ltd
Client Project #: 144930114
Site Location: UNKNOWN LAKE SAMPLING
Sampler Initials: AS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

Ranju Chaudhari

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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MICRO

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06-Jul-19 07:40
Augustyna Dobosz
B9I5722
URE ENV-668

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#24125 Stantec Consulting Ltd	Company Name:	Stantec Consulting Ltd.	Quotation #:	B77373
Attention:	Accounts Payable	Attention:	Andrew Sullivan	P.O. #:	
Address:	PO Box 1680 Yellowknife NT X1A2P3	Address:	102-40 Highfield Park Drive. Dartmouth NS	Project:	144930114
Tel:	(867) 920-2216 Fax: (867) 920-2278	Tel:	902-476-2391 Fax: 902 468 9009	Project Name:	Unknown Lake Sampling
Email:	SAPinvoices@Stantec.com	Email:	Andrew.Sullivan@stantec.com	Site #:	
				Sampled By:	A. Sullivan + Isaac Freda

Bottle Order #: 725587
COC #: C#725587-01-01
Project Manager: Augustyna Dobosz

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
- ☐ Table 1 ☐ Res/Park ☐ Medium/Fine
- ☐ Table 2 ☐ Ind/Comm ☐ Coarse
- ☐ Table 3 ☐ Agri/Other ☐ For RSC
- ☐ Table ___

Other Regulations
- ☐ CCME ☐ Sanitary Sewer Bylaw
- ☐ Reg 558. ☐ Storm Sewer Bylaw
- ☐ MISA Municipality _____
- ☐ PWQO
- ☐ Other _____

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? _____

Field Filtered (please circle): Metals / Hg / Cr VI

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT:
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: _____ Time Required: _____
Rush Confirmation Number: _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	RCAP - Surface Water	Total Coliforms/ E. coli, CFU/100mL	# of Bottles	Comments
1		SW19-01	July 4 2019	13:25	SW	✓	✓	5	
2		SW19-02	July 4 2019	13:55	SW	✓	✓	5	
3		SW 19-03	July 4 2019	14:45	SW	✓	✓	5	
4		SW19-04	July 4 2019	15:00 ~~14:45~~	SW	✓	✓	5	RECEIVED IN OTTAWA
5		SW19-05	July 4 2019	15:21	SW	✓	✓	5	
6									on ice
7									
8									
9									
10									

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Andrew Sullivan	19/07/04	18:15	Jonathan Urban	19/07/06	8:40	
Jonathan Urban	19/07/06	12:57	Rosen Mitchell	2019/07/06	12:58	

Laboratory Use Only
Time Sensitive
Temperature (°C) on Recei: 3, 2, 1
Custody Seal Present: Yes ✓ No
Custody Seal Intact: Yes ✓ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

4/5/6

Bureau Veritas Canada (2019) Inc.

Appendix B: Engagement Record

Current to 31 August 2019

APEX RIVER AND UNNAMED LAKE WATER WITHDRAWAL: ENGAGEMENT PLAN AND RECORD

PURPOSE

This Engagement Plan and Record provides the approach to engaging with persons potentially affected by the City's proposed withdrawal of water from the Apex (Niaqunguk) River and Unnamed Lake for the purpose of supplementing the City's drinking water supply at Lake Geraldine. It also provides updated records of engagement.

PERSONS POTENTIALLY AFFECTED BY THIS UNDERTAKING

The proposed Apex River Water Withdrawal is located entirely within the municipal boundaries of the City of Iqaluit within the Qikiqtani Region of Nunavut. As such, residents and businesses of the City are potentially affected by the undertaking.

ENGAGEMENT APPROACH

The City has two primary means of engaging potentially affected persons and businesses:

- Face-to-face meetings
- Written exchanges through online media

Materials provided for engagement are communicated using non-technical language, and are provided in English, French and Inuktitut

ENGAGEMENT RECORD

Date	Communication	Response
2018 Nov 16	Email from City to Amaruq HTA inviting opportunity to meet with HTA to provide updates on work being done to supplement Lake Geraldine, including temporary pumping from Apex River	Response deferred to November 22
2018 Nov 22	Email follow up from City asking for opportunity to meet in December	See response Dec 19
2018 Nov 28	Email follow up from City asking for availability to meet in December 2018 or January 2019	See response Dec 19
2018 Dec 5	City distributes public service announcement including a call for comments on the City's proposed amendment to its water licence by December 14, 2018. Plain language summary is also posted to the City's website, Facebook and Twitter accounts.	Comments and questions received from two individuals.
2018 Dec 19	Email from Amaruq HTA proposing meeting in Iqaluit January 10, 2019.	Mutually accepted date of meeting to be confirmed; City proposes week of February 4-8
2018 Dec 19	City responds to comments and questions received during public comment period by email.	
2019 Feb 7	City representatives meet with Amaruq HTA Board members to provide updates on water supplementation studies and proposal to amend the water licence to allow withdrawal from the Apex until a permanent solution is identified.	See Record of Engagement.
2019 July 4	Information letter to HTA – ongoing and planned studies at Unnamed Lake	No response
2019 July 30	Meeting Rosanne D'Orazio (Qiqiktani Inuit Association) and Matthew Hamp (City of Iqaluit)	Information about ongoing and planned projects to be sent to QIA for information

City of Iqaluit Water Supply Options
Record of Meeting

Activity Information	
ROC Form Prepared By: Erica Bonhomme	**Date and Time of Communication:** Date: 2/7/2019 Time 1900 – 2100 h
Method of Communication: (One engagement per ROC form) In-Person☐ *Other (specify):* Amaruq Hunters and Trappers Association Board Meeting	
Location: Amaruq HTA Boardroom, Iqaluit	

Names of GNWT Project Representative(s)
Matthew Hamp, City of Iqaluit; Erica Bonhomme, Nunami Stantec

Stakeholder Name(s)	
Noah Alookie	HTO Member
Jeetaloo Kakee	HTO Member
Ben Kovic	HTO Member
Martha Kunuk	HTO Member
Pitseolak Alainga	HTO Chairman

Interpretation Inuktituk-English was provided by Innirvik Services Ltd.

Meeting Summary

Introductions:

Erica introduced the City of Iqaluit team and explained that the purpose of the meeting was to provide: (1) an update on studies for water supply options for the City; (2) to summarize the outcomes of the 2018 Niaqunguk water supply program; and (3) to describe the proposed 2019 Niaqunguk (Apex) water supply project.

Erica then proceeded with the presentation. Participants asked questions during the presentation.

Questions and Discussion

Question	Proponent Response
Why was the reservoir low last year?	There likely wasn't enough snowmelt and spring rainfall
Could you bring snow in from around? Push more snow into the reservoir?	You would need a lot of snow. It takes 10 cups of snow to make 1 cup of water.
Why is there not enough water now?	The City is growing and is predicted to continue growing .
What is the City doing about water?	The City has been fixing leaks in the water system and making its water treatment plant more efficient. It has also been helping residents and businesses conserve water.
How long do you need to pump into Lake Geraldine? In the future, and looking at the population growing, what is the longer term solution? Not just the next couple of years? Maybe could you open areas so that water can go into the lake all the time?	Right now, the City only has available what goes into Lake Geraldine, and is proposing to take water from Niaqunguk River in amounts that won't harm fish. This is 10% of the flow of the river before it freezes. The City would like to have other options, and we will describe those today.

Question	Proponent Response
There are no fish in Niaqunguk River. Just small fish – in the lakes [downstream of the bridge]. We used to have a fishing derby there.	These are the small charr. (yes)
Is there enough water right now for the City?	With pumping from Niaqunguk like we did last year, there is enough to fill the reservoir before freeze-up. This needs to last all winter. With the current population, the City has enough water in the reservoir, even with emergencies like the fire last year.
Maybe we should think about whether the City can continue to grow? Until we have a system to support the growth, we should slow down the infrastructure growth.	Noted.
Maybe the hotels should be using less water. Not washing towels and sheets daily. With all the visitors, could this be done? I don't want to have to conserve water.	Noted.
The Grinnell River is a livelihood – Niaqunguk is not. The value of that resource is great. It is too valuable. The City will have to fight to show that the Grinnell system will not change, even if you only take 1% of the water. There are too many uncertainties about how it will change.	We have heard this clearly from the HTA in previous meetings. Right now the City is studying the Sylvia Grinnell River as an option. In case there are no other options. Nothing is being proposed to be built there right now.
Have you thought about blocking the [Niaqunguk] river and using it as a reservoir? You could also get energy from there. You could put a dam in this area [points to upper river]	That is an interesting idea.
The power corporation may have done some studies. We are going to keep running out of water each year.	We will look into what has been done in the past.
There are a lot of fish in that [Niaqunguk] river when the tide goes up. We'd like to see less environmental damage from this project – such as building a dam.	Noted.
Lake Geraldine will never have enough water until we find a way to fill it in the winter	Ultimately, yes, if the City keeps growing. If the City took more than the allowed 10% from the river, it could pump for longer from the Apex – after freeze-up
Will there be compensation for users, if there is a loss of fish? Who knows how the fish in the bay will be affected?	We have to do a lot of monitoring with this program and report to DFO.
You should look at taking water from Unnamed Lake. This would be much better that Sylvia Grinnell.	*City question: Does Unnamed Lake overflow every spring?*
We don't know much about Unnamed Lake. We don't really go there. But, during the full moon, the lake overflows, and the lakes around it overflow.	That is why we need to study it. It is like a bathtub. If we take more out of it than it is refilled by the tap, then we will eventually take all of the water out. We need to find out how much water goes into the lake (how much it "recharges") compared to what the City needs to take from it before we can say that it is a good source.
There are no fish in that lake. It is a "dead" lake. How do you study it?	Okay, that's helpful to know. The City will need to determine how much water is in the lake, by doing a survey of the depths all across the lake. Then we will measure how much flow goes out of the lake and how much the water level changes during the year.
For Unnamed Lake, there would have to be a road. Before, the City said it would be too costly to maintain a road.	Noted.
Could you build snow fences on the reservoir to catch more snow on the lake? It would build up the snow in March and April on the lake. Snow fences build up a lot of snow.	That's an interesting idea.
Could the firefighters use untreated water for firefighting?	Noted.

Question	Proponent Response
In regards to using Sylvia Grinnell, taking water out could gradually change the river. We don't know how the charr move. Maybe 1% doesn't mean much, but you would have to pump when there are absolutely no charr in the system. Anywhere. Especially when it's August or September and the water levels are low. Maybe even part of the river dries up.	That's a good point.
You would have to guarantee these things won't happen, otherwise, as Inuit, we won't talk about it. It's a park, it's a livelihood.	Noted. At this point, we are just studying the river.
We need to think more about the hunters. When there was a meeting about the brewery, we understood that we didn't have to approve it. They had to do studies. We'd like to discuss with the other hunters because we represent the other hunters too.	Noted.
What other communities rely on rivers for water? How are water intakes protected from ice?	Some communities use river water where there is no other winter option (the example of Inuvik NWT was provided). A water intake structure was described.
The HTA's direction is to not even touch the Sylvia Grinnell River. You can do studies, the fish go up river in September before it freezes, but you wont' get approval from us to take water from that river.	Noted.
The City should consult with the residents too. In stages such as planning, then answer questions, then how they are proceeding.	The City plans to do that. Right now, it is looking to pump from Niaqunguk while it looks at all of the options, including Unnamed Lake.
The HTA provides approval for the City to go ahead and apply to take water from Niaqunguk.	Noted, thank you.

Matthew indicated that the City plans to come to speak with the HTA as the planning for water supply continues, including providing updates on studies and options, and up to the point where the City will need to move ahead to implement one or more options.

Erica thanked the HTA for their input and the meeting adjourned at 2100 h.