ATTACHMENT 29

LTWP Environmental Screening Report

City of Iqaluit

Physical, Biological and Socioeconomic Screening Report

Long Term Water Project – Supply and Storage

September 2025

Physical, Biological and Socioeconomic Screening Report

Long Term Water Project – Supply and Storage

September 2025

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Acronyms and Abbreviations

ABA	Acid Base Accounting
AIA	Archaeological Impact Assessment
ANFO	Ammonium Nitrate Fuel Oil Explosive
AOA	Archaeological Overview Assessment
APEC	Areas of Potential Environmental Concern
AQHI	Air Quality Health Index
ASTM	American Society for Testing and Materials
ASTT	Arctic Small Tool Tradition
ATV	All Terrain Vehicle
BATEA	Best Available Technology Economically Achievable
BP	Before Present
BTEX	Benzene, Toluene, Ethylbenzene, And Xylene
CCME	Canadian Council of Ministers of Environment
CGS	Department Of Community And Government Services (Government Of Nunavut)
CIRNAC	Crown-Indigenous Relations And Northern Affairs Canada
CO	Carbon Monoxide
COSEWIC	Committee On The Status Of Endangered Wildlife In Canada
CSA	Canadian Standards Association
CWB	Community Well-Being Index
DFO	Department Of Fisheries And Oceans
DMAF	Disaster Mitigation and Adaption Fund
DNLUP	Draft Nunavut Land Use Plan
DR	Dimension Ratio
DS	Davis Strait
DTI	Desgagnés Transarctik Inc.
ECCC	Environment Canada And Climate Change Canada
eDNA	Environmental DNA
End	Endangered
ESA	Environmental Site Assessment

Ext	Extirpated
fps	Feet Per Second
GHG	Greenhouse Gases
GN	Government of Nunavut
Ha	Hectares
HDPE	High Density Polyethylene
HTO	Hunter And Trappers Organization
IBA	Important Bird Area
IES	Iqaluit Emergency Services
IPCC	Intergovernmental Panel on Climate Change
IQ	Inuit Qaujimajatuqangit
IUCN	International Union for Conservation of Nature
Km	Kilometer
LLDPE	Linear-Low Density Polyethylene
LTWP	Long Term Water Project
LQ	Lake Qikiqtalik
MAD	Mean Annual Discharge
Masl	Meters Above Sea Level
MBCA	*Migratory Birds Convention Act*
Mbgs	Meters Below Ground Surface
mm	Millimetre
MW	Megawatt
NEAS	Nunavut Eastern Arctic Shipping Inc.
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NO_2	Nitrogen Dioxide
NPC	Nunavut Planning Commission
NPR	Neutralization Potential Ratios
NSA	Noise Sensitive Area
NSSI	Nunavut Sealink and Supply Inc.
NTCL	Northern Transportation Company Limited

NWA	National Wildlife Areas
NWB	Nunavut Water Board
NWMB	Nunavut Wildlife Management Board
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PBSEIA	Physical, Biological And Socio-Economic Impact Assessment
PCBs	Polychlorinated Biphenyls
PHC	Petroleum Hydrocarbons
$PM_{2.5}$	Particulate Matter 2.5 microns
QEC	Qulliq Energy Corporation
QEP	Qualified Environmental Professional
QGH	Qikiqtani General Hospital
RCMP	Royal Canadian Mounted Police
RCP	Representative Concentration Pathway
ROW	Right of Way
RWO	Regional Wildlife Organizations
RWPS	Raw Water Pump Station
RWTM	Raw Water Transmission Main
SAR	Species At Risk
SARA	*Species At Risk Act*
SC	Special Concern
SCADA	Supervisory Control and Data Acquisition
SO_2	Sulphur Dioxide
SPMDD	Standard Proctor Maximum Dry Density
SS	Stainless Steel
SVEC	Socioeconomic Valued Ecosystem Component
TDS	Total Dissolved Solids
Thr	Threatened
TTI	Taqramut Transport Inc.
$\mu g/m^3$	Micrograms Per Cubic Meter
UNL	Unnamed Lake (Previous Name For Lake Qikiqtalik)

Unlocode	United Nations Code For Trade And Transport Location
USBM	United States Bureau of Mines
UST	Underground Storage Tank
VEC	Valued Ecosystem Component
VOCs	Volatile Organic Compounds
VSEC	Valued Socioeconomic Components
WTP	City Of Iqaluit Water Treatment Plant

Executive Summary

Arcadis Canada Inc. (Arcadis) was retained by the City of Iqaluit (City) to prepare a Physical, Biological and Socio-Economic Impact Assessment (PBSEIA) for the planned Long Term Water Program - Raw Water Supply and Storage Project (LTWP) in Iqaluit, Nunavut (NU).

The three main LTWP components discussed in this report are as follows:

- Two Raw Water Pump Stations (RWPS).
- Water Conveyance Pipeline.
- New Reservoir.

This PBSEIA is to serve as a supporting document for Project Screening with the Nunavut Impact Review Board (NIRB). The format of this PBSEIA follows the information requirements outlined in the *Proponent's Guide - NIRB Technical Guide Series* dated February 2020.

The key areas of the existing environment that are addressed in this document are as follows:

- Physical Environment:
    - Designated Environmental Areas.
    - Ground Stability.
    - Permafrost.
    - Hydrology / Limnology.
    - Water Quality.
    - Climate Conditions.
    - Eskers and Other Unique or Fragile Landscapes.
    - Surface and Bedrock Geology.
    - Sediment and Soil Quality.
    - Tidal Process and Bathymetry.
    - Air Quality.
    - Noise Levels.
- Biological Environment:
    - Terrestrial Vegetation.
    - Terrestrial Wildlife and Habitat.
    - Species at Risk and Migratory Birds.
    - Aquatic Species and Habitat.
- Socioeconomic Environment:

- Archaeological and Cultural Historic Site.
- Employment.
- Community Wellness.
- Community Infrastructure.
- Human Health.

An impact classification assessment with appropriate mitigation actions is provided for the construction and operation and maintenance phases of the LTWP. The classification categories include:

- P = Positive
- N = Negative and non-mitigable
- M = Negative and mitigable
- U = Unknown
- "-" = no impacts expected

The LTWP is expected to have an overall Positive environmental impact by ensuring a safe and reliable long-term drinking water supply for the City of Iqaluit. One Negative non-mitigable (N) impact was identified. While there is potential for some Negative impacts associated with both the construction and operational and maintenance phases of the LTWP, all potential Negative impacts can be reduced or eliminated except for one with the implementation of well-known and understood mitigation measures.

It is determined that there will be no resultant overall cumulative effects from the LTWP-S&S project.

1 Introduction

Arcadis Canada Inc. (Arcadis) was retained by the City of Iqaluit (City) to prepare a Physical, Biological and Socio-Economic Impact Assessment (PBSEIA or Screening Report) for the planned Long Term Water Program - Raw Water Supply and Storage Project (LTWP) in Iqaluit, Nunavut (NU). This PBSEIA is to serve as a support document for the submission of the Project Screening to the Nunavut Impact Review Board (NIRB).

The format of this PBSEIA follows the information requirements outlined in the *Proponent's Guide - NIRB Technical Guide Series* dated February 2020 so that information can be easily copied to the Proponent Portal of the NIRB Online Application.

The current design concept is included in the Project Description. The LTWP was reviewed by the Nunavut Planning Commission (NPC) and received a decision on April 23, 2025. That decision was based on the amendment of NPC File Nos 150099 for the 2023 LTWP geotechnical drilling program and 150359 for the 2024 geotechnical drilling program. Those activities had been previously reviewed by the NIRB, as File No. 24YN040. The mitigation measures provided in that review have been incorporated into this PBSEIA.

1.1 Project Background

Iqaluit, situated at the southern tip of Baffin Island in Frobisher Bay (63°45'N latitude and 68°31'W longitude), serves as the capital of the Nunavut Territory. Iqaluit has undergone rapid development and expansion. It serves as the administrative hub for the Nunavut Territory and hosts numerous federal and territorial government departments. Additionally, Iqaluit is evolving into a regional center for the territory, attracting various northern businesses and Inuit organizations that choose it as their operational headquarters. See Appendix A for a regional map showing the LTWP site.

Lake Geraldine serves as a water reservoir to meet the City's drinking water needs. Each year, during the spring and summer, Lake Geraldine is replenished by natural inflows originating from snowmelt and precipitation, including rain. Throughout the winter season the City utilizes water from the reservoir. Subsequently, the reservoir is replenished again in the spring. However, in instances where natural inflows or precipitation are insufficient Lake Geraldine may not reach its maximum capacity. This situation could potentially result in a shortage of available drinking water, as it has in the past.

The LTWP will be funded by the Federal government under the Disaster Mitigation and Adaptation Fund (DMAF) program. The approved budget for the Program is $214,070,600 which is to cover both the Supply and Storage Project, and the distribution system upgrades which are not part of this proposal.

1.2 Rationale for the Project

The City of Iqaluit is facing critical challenges with its drinking water supply due to its growing population and the impact of climate change. To address this pressing issue, the City proposes upgrades to the water supply and distribution infrastructure systems. This component of the City's LTWP is the Raw Water Supply and Storage Project (Project). The upgrades are anticipated to include pumping and conveying raw water from Lake Qikiqtalik (LQ) and

the Niaqunnguk River (Apex) to a newly constructed storage reservoir adjacent to Lake Geraldine. Water will be transferred from the new reservoir to Lake Geraldine through a service corridor under the proposed main dam. A separate direct pipeline will also be constructed between the Niaqunnguk (Apex) River and Lake Geraldine. The Project will primarily comprise three key aspects: (1) raw water extraction, (2) raw water conveyance, and (3) raw water storage. See figures 1 to 4 for details (Appendix A). Further information is provided in the Attachment B – Program Summary.

As noted above, based on current and future population needs, conditions exist for a potential shortage of available drinking water from Lake Geraldine. As described below, short term/temporary measures have been implemented to address this problem, however, a long-term solution is required. Further discussed are the alternatives considered, and a review of the studies undertaken to determine the water balance of the LTWP.

1.2.1 Niaqunguk (Apex) River Pumping

In July 2018, the City anticipated a potential water shortage for the upcoming winter, raising concerns about meeting the City's drinking water needs. The Nunavut Chief Medical Officer of Health declared this situation a Health Emergency and the Minister of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) recognized the emergency and determined that the City should take immediate action to add water to Lake Geraldine. Action was authorized under the special provisions of the *Nunavut Planning and Project Assessment Act* and *Waters and Surface Rights Tribunals Act*. Consequently, the City received an amended water license from the Nunavut Water Board (NWB) and a Department of Fisheries and Oceans (DFO) Fisheries Authorization on August 16, 2018, permitting the implementation of the program.

Two pumps were installed approximately one kilometer upstream of the bridge over the Niaqunguk (Apex) River on the Road to Nowhere. These pumps were equipped with screens to protect fish. Flexible hoses were then laid out overland, spanning approximately one kilometer to connect the Niaqunguk (Apex) River to Lake Geraldine. Pumping operations commenced on August 27, 2018, and continued until September 17, 2018, resulting in the filling of the reservoir. Approximately 194,000 m^3 of water was transferred from Niaqunnguk (Apex) River to Lake Geraldine.

1.2.2 Lake Qikiqtalik Pumping

The City applied for an emergency amendment to water license 3AM-IQA1626 in July 2018 to allow the supplementation of Lake Geraldine reservoir from the Niaqunnguk (Apex) River and Lake Qikiqtalik in 2019. The activities starting in 2019 included:

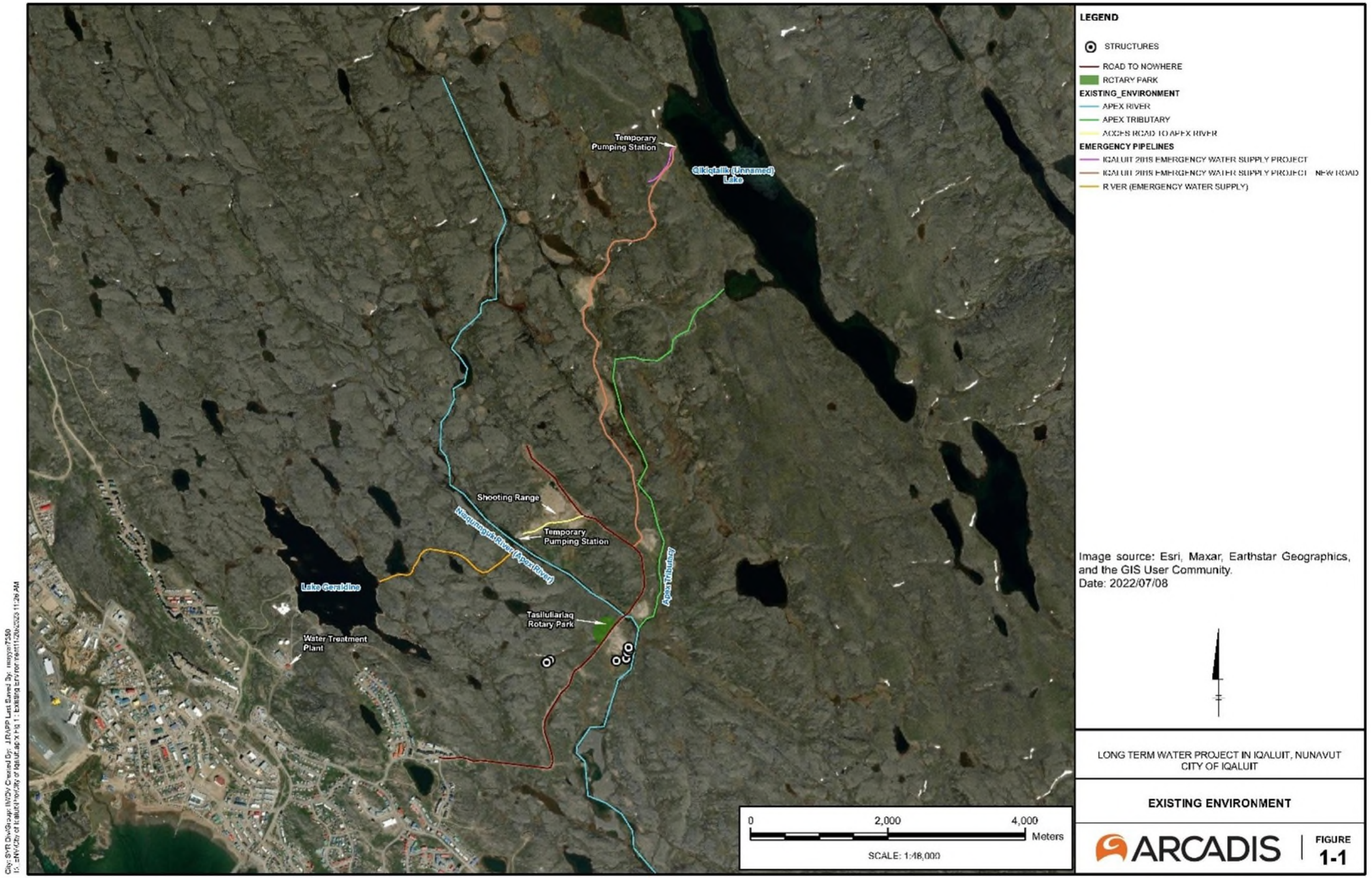
- Construction of an access road from the Road to Nowhere to Lake Qikiqtalik, including the installation of culverts.
- Construction of a semi-permanent pipeline from the Niaqunnguk (Apex) River to Lake Geraldine.
- Mobilization, operation, maintenance, and demobilization of equipment and infrastructure (excluding the semi-permanent pipeline) at the Niaqunnguk (Apex) River and the Lake Qikiqtalik pumping sites.
- Installation and operation of temporary pumps and a pipeline approximately 1.2 km long to transfer water from Lake Qikiqtalik to the Niaqunnguk (Apex) River.

- Temporary withdrawal of up to 700,000 m^3 of water from Lake Qikiqtalik from August 2019 to October 2019.
- Withdrawal of up to 700,000 m^3 of water from the Niaqunnguk (Apex) River.
- Increase in the total amount of water allowed to be withdrawn from Lake Geraldine, from 1,100,000 m^3/year to 2,000,000 m^3/year.
- Conducting research on the depth, waterflow, and water quality in Lake Qikiqtalik.

Given the challenges posed by a growing population the City recognizes the need for significant upgrades to its water supply and distribution infrastructure. The existing Lake Geraldine reservoir is inadequate to meet the increasing water demands and store the necessary volume required to support the City's current growth rate. As a result, additional water resources and storage capacity are essential to ensure a reliable and sustainable water supply for the community.

Figure 1-1 shows the locations of the existing drinking water supply sources. A larger figure is available in Appendix B.

Figure 1-1 *Existing Drinking Water Supply Sources*



1.2.3 Alternatives to the Project

The City and its consultants have engaged in an iterative process to identify the best solution to meet its current and future water supply needs. The alternatives for raw water supply for the Project included:

- Desalinization of sea water pumped from Frobisher Bay.
- Pumping water from the Sylvia Grinnell River to Lake Geraldine.
- Damming of the Niaqunnguk (Apex) River or other water courses.
- Extracting water from Lake Qikiqtalik by truck temporarily under emergency conditions.
- Extracting water from Niaqunnguk (Apex) River by a temporary pipeline under emergency conditions.
- Transferring water via a permanent pipeline from Lake Qikiqtalik to a New Reservoir to be constructed adjacent to Lake Geraldine.
- Transferring water via a permanent pipeline from Niaqunnguk (Apex) River via permanent pipelines to the New Reservoir and Lake Geraldine, to augment the Lake Qikiqtalik water source.
- Constructing a New Reservoir at Lake Qikiqtalik and a new water pipeline to transfer water to Lake Geraldine.

At the time of this submission, the City has undertaken two public consultation sessions in the form of open houses in the City of Iqaluit, those being:

- June 6-7, 2023.
- November 27–28, 2024.

Concerns raised during these consultation sessions were:

- Do not modify or construct in the Sylvia Grinnell River and its tributaries.
- Impacts on the environment, health, local community, Inuit lands, City development and safety.
- Funds to be spent appropriately by priority and ensuring both safeguarding and development of the water supply to Iqaluit.
- Contingency plans and mitigation concerning the raw water intake and water distribution aspects in the LTWP.
- Involvement with all stakeholder parties and licensing.
- Ensure no disturbances will occur to local water sources and lake bodies when drawing out raw water from Lake Qikiqtalik.
- To implement the upgrades as quickly as possible.
- Protection of hunting grounds and wildlife when considering design and construction activities.
- Ensure that the constructed works meet the long-term community needs, considering potential climate change impacts.

These comments were considered by the City and the design team. The evaluation of these alternatives and feedback from the public have resulted in the selection of the current LTWP design.

1.2.4 Water Balance Assumptions

Various water balance studies have been conducted to determine the reliability of Lake Qikiqtalik and Niaqunnguk (Apex) River as viable long term sources of water for the LTWP design. These are summarized below in chronological order.

2019: Nunami Stantec. Unnamed Lake (Lake Qikiqtalik) Data Collection Summary Memorandum

The memorandum summarizes the data collection efforts at Lake Qikiqtalik during the 2019 Emergency Water Supply Project, which aimed to enhance the water supply for Lake Geraldine Reservoir. The key points are as follows:

- Emergency Context: Due to a water supply shortage declared as an emergency by the Minister of Community and Government Services, the Lake Qikiqtalik studies were part of the emergency pumping project, exempting them from certain screening processes.
- Data Collection: Stantec conducted extensive site visits to Lake Qikiqtalik in 2019, gathering data on water levels, outlet flows, and water quality. This included downloading data from pressure transducers and a barologger, resulting in a dataset of annual water levels. Flow measurements were taken along the lake's outlet creek, and five surface water quality samples were analyzed.
- Fieldwork Timeline and Methods: Monitoring of water levels was performed from September 2018 to October 2019. Natural conditions were recorded until August 24, 2019, after which data were influenced by the pumping program. Water levels were measured using a staff gauge and pressure transducers, with corrections for atmospheric pressure. Data were validated against readings from the ECCC Iqaluit Climate Station.
- Elevation and Flow Measurements: Local benchmarks were set using real-time kinematic survey equipment to convert water level data into elevation data. There was a good correlation between transducer and staff gauge readings, except for discrepancies in the final ten days of pumping. Daily spot flow measurements at three locations, including the lake's outlet, assessed the impact on Niaqunnguk (Apex) River flows if the outflow was halted during pumping.

2021: Golder: Iqaluit Long Term Water Project - Water Balance Assessment for Unnamed Lake Modelling Report

The report analyzes the feasibility of using Lake Qikiqtalik as a long-term supplemental water source for Lake Geraldine, which is critical for Iqaluit's water supply but faces storage deficits during winter due to its frozen watershed. The study evaluates various water consumption scenarios and climate conditions, both historical and future, to determine if Lake Qikiqtalik can sustainably address these deficits. The key points are as follows:

- Conceptual Model Development: A hydrologic model was developed for Lake Qikiqtalik based on parameters from a previous model for Lake Geraldine, adapted to account for differences between the two lakes. The model focuses on pumping water from Lake Qikiqtalik to Lake Geraldine during the four weeks leading up to freeze-up to minimize winter storage deficits.

- Data and Simulation: Meteorological data from 2008–2017 served as the baseline for climate conditions, with gaps filled using interpolation. Climate change projections from the Intergovernmental Panel on Climate Change (IPCC) were incorporated using statistical downscaling and a weather generator approach to account for future scenarios. The model also simulated Lake Qikiqtalik' s outflow to the Niaqunnguk (Apex) River and analyzed impacts on river flow under varying pumping rates and climate conditions.
- Model Validation: Pressure transducers installed in Lake Qikiqtalik provided continuous data, while limited outflow data supported calibration. The model accounted for factors like ice formation, melt effects, and pumping rates based on Lake Geraldine's storage deficits before freeze-up.
- Results: The weather generator approach provided a range of predicted storage deficits for Lake Geraldine under high water consumption scenarios. Deficits ranged from a maximum of 1,306,165 m^3 to a minimum of 86,396 m^3, expressed as percentage probabilities of exceedance (0% for maximum deficit, 100% for minimum deficit).

The study presents Lake Qikiqtalik as a viable supplemental water source for Lake Geraldine, providing a detailed water balance model to support informed decision-making for Iqaluit's long-term water supply management.

2021: Nunami Stantec Limited's: Review of Golder Associates' Draft Report on Lake Qikiqtalik Water Balance Assessment

Nunami Stantec Limited performed a third-party review of Golder Associates' draft report on the water balance assessment for Lake Qikiqtalik. Recommendations were made to enhance decision-making through additional analyses. Key recommendations for additional analyses were as follows:

- Expanded Water Consumption Scenarios: Evaluate scenarios, specifically those with higher winter demand, to better understand water needs.
- Sensitivity Analysis for Catchment Uncertainty: Assess how variations in the catchment area of Lake Qikiqtalik impact model results.
- Focused Basin Modeling: Consider modeling the central basin alone, or in combination with the south basin, to address uncertainties in modeling the lake's five partially connected reservoirs.
- Pumping Scenarios: Conduct sensitivity analyses on different timing and duration scenarios for water pumping.
- Model Validation: Use lake level and outflow data to validate the Lake Qikiqtalik model.
- Environmental Effects Assessment: Run additional scenarios to assess environmental impacts, following Fisheries and Oceans Canada guidelines.
- Limnological Baseline Program: Develop a baseline program to study existing conditions and variability in water quality at different depths.
- Optimal Storage Capacity: Utilize the existing Geraldine Lake water balance model to determine the optimal storage capacity, considering current limitations for supplementation from additional sources.
- Progress on Recommendations: Basin Modeling : Tetra Tech combined some initially separate basins of Lake Qikiqtalik into a larger basin and modeled the outlet basin as a connected downstream basin. The connection between the outlet and primary basin serves as the control point for water elevations.

- Data Collection and Validation: Ongoing data collection includes water elevations for Lake Qikiqtalik, discharges from Niaqunnguk (Apex) River, and other tributaries. Additional data from Carleton University will be used for continuous validation and performance monitoring.

Conclusions were recommendations to enhance the assessment of Lake Qikiqtalik's water balance, focusing on improving model accuracy, evaluating additional scenarios, and ensuring environmental compliance. Progress has been made on some recommendations, with ongoing efforts to ensure robust data collection and model validation.

2025 : Tetra Tech: Lake Qikiqtalik Water Balance For Withdrawals Final Report

The Tetra Tech *Lake Qikiqtalik Water Balance For Withdrawals Final Report* (Tetra Tech 2025a) examines the water balance of Lake Qikiqtalik, focusing on how much water can be sustainably withdrawn while allowing the Lake to replenish itself (active storage). It builds upon previous findings in an Interim Report, incorporating new data such as recent measurements of water levels, flow rates, and hydrological factors like climate, rainfall, snowfall, snowmelt, and the Lake's physical and geological characteristics. Key findings include:

- Water Withdrawal Estimates: The study estimates a median annual volume of **1,681,000 m³** of water available for withdrawal. However, the mode (**1,284,184** m³/year) is recommended for planning purposes as the data has a significant right skew, which means the median value will not be conservative. Both values are an increase from the previous estimate of 719,000 m³/year, attributed to improved modeling techniques and updated data.
- Climate Change Impacts: While climate change effects on the Lake's water balance were discussed, they were not included in the modeling due to uncertainties about future climate conditions.
- Modeling Techniques: Various scenarios were simulated, including different precipitation and snowpack levels, to predict the Lake's response to hydrological conditions. Recommendations are based on available data, emphasizing the need for continued monitoring water levels at Lake Qikiqtalik to inform decision-making.
- Probability Distribution: Using Monte Carlo simulations based on the modeling techniques above, a probability distribution was developed. The critical values are the low percentiles, which represent low-flow years, and so reduced active storage. The 0th percentile was 767,189 m^3 and the 10th percentile was 1,114,609 m^3.

In addition to this report, Tetra Tech previously prepared a Technical Memorandum analyzing flows within the Niaqunnguk (Apex) River. The findings suggest that, with updated water license amendments, the City can meet its water demands through combined withdrawals from Lake Qikiqtalik and the Niaqunnguk (Apex) River until approximately 2045. Further supplementation until 2050 may be possible with increased withdrawals from the Niaqunnguk (Apex) River, pending additional licensing amendments.

2025: Tetra Tech: Desktop Study of Discharge in Apex River

Tetra Tech assessed two water supply configurations involving withdrawals from the Niaqunnguk (Apex) River, with Configuration 2 incorporating runoff from a slightly larger basin compared to Configuration 1 at the current emergency pumping location. The study evaluated how increased withdrawal rates and supplementation from Lake Qikiqtalik could meet future water demands. The key findings are as follows:

- Withdrawal Scenarios and Timeframes: Increasing withdrawals from 10% to 20% above the license threshold (30% of Mean Annual Discharge, MAD) could allow the Niaqunnguk (Apex) River to meet water demands until 2041 for Configuration 1 and 2044 for Configuration 2. By supplementing with 1,300,000 m³/year from Lake Qikiqtalik, water supply could be extended beyond 2050 during average hydrological years. With the current 10% cap, Niaqunnguk (Apex) River can meet demands until 2030 or 2032, extendable to 2047 or 2048 with supplementation from Lake Qikiqtalik.
- Projected Water Deficits in 2050: Deficits vary, potentially reaching up to 2,132,830 m³ under Configuration 1 with a 10% withdrawal limit. Lake Qikiqtalik' s contribution of 1,300,000 m³/year could mitigate some shortfalls, but further adjustments may be necessary.
- Lake Qikiqtalik Contribution: Estimated to provide 1,300,000 m³ annually in average years, Lake Qikiqtalik could supplement the Niaqunnguk (Apex) River beyond 2050 if water license limitations are amended.
- Recommendations and Conclusion: Amend water licenses to permit withdrawals beyond 20% during the freshet season, conduct further hydrological assessments to determine specific licensing needs, and adopt adaptive license adjustments. Integrating Lake Qikiqtalik with these strategies could address long-term deficits and ensure reliable water resource management. Further studies are recommended to optimize resource use.

Extensive studies have evaluated the sustainability of Lake Qikiqtalik and Niaqunnguk (Apex) River as water sources, providing insights into water balance. Increasing withdrawal rates, especially during freshet seasons, is essential. Using both Lake Qikiqtalik and Niaqunnguk (Apex) River as water sources can meet water demands beyond 2050.

1.3 Project Description

The concept plans for the LTWP include 1,800,000 m^3 of additional freshwater storage capacity at a new reservoir adjacent to Lake Geraldine. The Niaqunnguk (Apex) River and Lake Qikiqtalik combined have a much larger catchment area than Lake Gerladine and will serve as water sources. The LTWP will withdraw water from both sources to meet Iqaluit's drinking water requirements. Lake Qikiqtalik' s active storage ranges from approximately 800,000 m^3 to approximately 3,200,000 m^3 annually. The active storage represents what is replenished annually, and so what can be pumped without draining the lake. At the pumping location, the Apex River flows range from approximately 8,012,069 m^3 to 12,426,873 m^3 annually, based on historical assessments (Terta Tech 2025b). Based on the limitations presented by Tetra Tech and others, this represents a theoretical allowable amount of 1,900,000 m^3 to 3,900,000 m^3. Any water withdrawn from either source will be transferred to a new reservoir with a storage capacity of 1,800,000 m^3. The system will be designed to be able to supply water to both the new reservoir and Lake Geraldine independently. Supply for the new reservoir will occur during the spring freshet and summer season when water is readily available.

No new water treatment facility will be needed for the LTWP. Water will continue to be treated for consumption at the existing City of Iqaluit Water Treatment plant.

The main permanent Project components to be constructed are:

- Lake Qikiqtalik Intake and Raw Water Pump Station (RWPS).

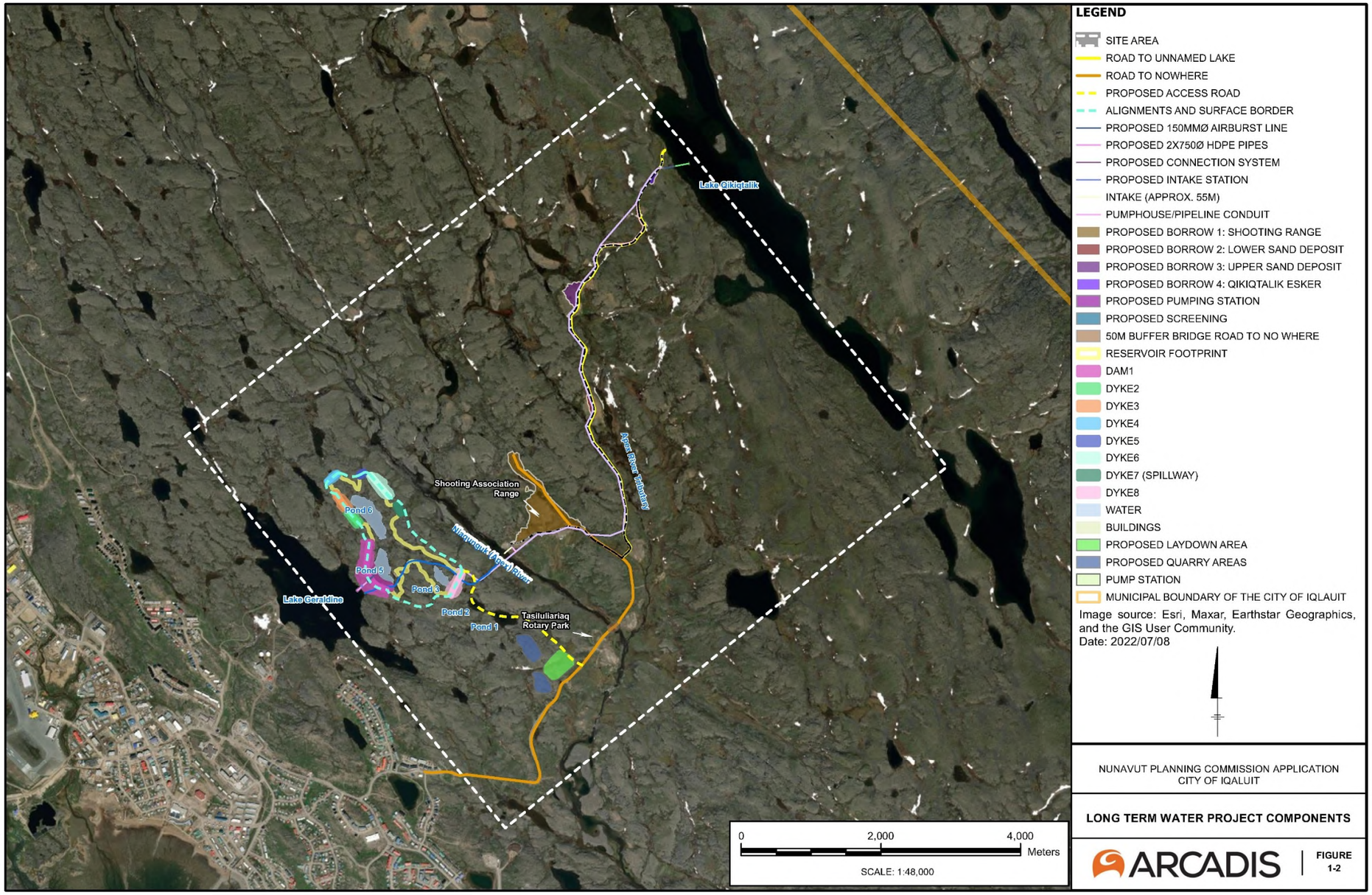
- New water conveyance pipeline from Lake Qikiqtalik to the new reservoir, including a discharge outfall at the new reservoir.
- Upgrading as required of the existing road and culverts located between Lake Qikiqtalik and the Road to Nowhere.
- Upgrades of the existing bridge crossing the Niaqunnguk (Apex) River for construction (if required).
- Niaqunnguk (Apex) River Intake and Raw Water Pump Station (RWPS).
- New conveyance pipeline from the Niaqunnguk (Apex) River RWPS to the new reservoir, including discharge outfall at the new reservoir and another in Lake Geraldine.
- Pipe bridge for river crossing at the Niaqunnguk (Apex) River for new water pipelines.
- New access road from the Road to Nowhere to the new reservoir requiring the dewatering and filling of three existing shallow ponds and a perimeter road around the new reservoir.
- Laydown areas near the RWPSs including access roads.
- Eight retention structures (one (1) dam and seven (7) dykes) creating the new reservoir with a perimeter road around the new reservoir.
- One spillway from the new reservoir into the Niaqunnguk (Apex) River.
- Access structure to the service corridor between the new reservoir and Lake Geraldine.
- Below grade service corridor with pipe connection and control valves between the new reservoir and Lake Geraldine including discharge outfall in Lake Geraldine.
- Electrical distribution line to the RWPS at Lake Qikiqtalik, the RWPS at the Niaqunnguk (Apex) River and the new reservoir.
- Backup power generators at both RWPSs and the reservoir access structure and service corridor.

See the attached Figure 1-2 and Appendix A for further details on the site location. Copies of selected drawings from the LTWP Preliminary Design Report (Arcadis 2024) are available in Appendix C.

Temporary structures and equipment to be used during the construction phase of the Project are as follows;

- Temporary concrete plant at each RWPS.
- Quarries for rock at the new reservoir and the construction laydown area, including access roads.
- Borrows for sand materials, including access roads.
- Fossil fuel-fired generators for temporary power until permanent power is available.
- Trailers and Sea-Cans to serve as office and storage space onsite and at the laydown areas.
- Portable chemical toilets and wash stations.

Figure 1-2 LTWP Project Components



1.4 Project Phases

The following project phases are considered in this PBSEIA:

- Construction.
- Operations.
- Decommissioning.

A brief description of the activities of each phase is provided below. The main LTWP components discussed in this report are organized as follows:

- Two RWPS and Intakes.
- Water Conveyance Pipeline.
- New Reservoir.

1.4.1 Construction

Construction activities may begin once the approvals from the regulatory agencies are received. Construction will take place from 2026 to 2029 as weather allows (i.e. Spring/Summer/Fall seasons). It is possible that some works could be conducted during the winter season, which will be determined when a Contractor is awarded the contract and would be resource and weather dependent.

The total estimated number of personnel onsite will depend on the phase of construction and will range from 30 during Year 1 when road building begins, to 120 during Year 3 when the pump station, dam and pipeline construction are all ongoing, with an average of approximately 65. The number of people involved is an estimate and may be subject to change once construction planning is further developed. See Section 1.5 for the Project Timeline.

During construction commercial flights to Iqaluit will be used to move workers from southern Canada, as required, when local workers are not available to complete the required tasks. Air transport will be used for staff and construction materials and equipment, although it is expected that most construction supply items will be shipped via sea. It is not expected that helicopters or private planes would be needed given the proximity of the Project to the City. Equipment and materials will be shipped to Iqaluit by sealift and transported to the Project area by truck. Ground transport will be from the City at the deep water port to the construction laydown areas, contractor work yards, or directly to site via the existing Road to Nowhere. The various types of construction and transportation equipment to be used in the Project construction are:

- Light utility vehicles and personal cars.
- Excavators of 30, 45, and 67 tons with breakers.
- Front-end loaders.
- Rock trucks.

- Bulldozers.
- Graders.
- Compactors.
- Tri-axle haulage trucks.
- Tractor-trailers with floats for transporting equipment.
- Boom cranes (40-ton cranes).
- Barges.
- Boats, and
- Air track drilling equipment.

The types of fuel used in the construction and operation of the Project will be diesel, gasoline, propane and oxyacetylene.

The Project is located within the municipal boundary of the City of Iqaluit. The next closest community is Niaqunnguk (Apex) which is approximately 5 km by road to the southeast of Iqaluit. On-site work camps will not be required for the construction of the Project. It is expected that workers will be housed in Iqaluit in existing facilities such as existing private (off-site) work camps, hotels and rented houses. Local services such as vehicle rentals, fuel supply, restaurants and groceries will be utilized to the greatest extent possible.

1.4.1.1 Raw Water Pump Stations and Intakes

There will be two raw water intakes, one at Lake Qikiqtalik, and one at the Niaqunnguk (Apex) River.

The intake at Lake Qikiqtalik will provide raw water to the pump station on the west shore of Lake Qikiqtalik. The intake will be a 750 mm High Density Polyethylene (HDPE) DR (Dimension Ratio) 11 pipe extending into Lake Qikiqtalik, into a minimum of 8 m water depth. The intake will be 4 m below the assumed 2 m of ice expected to be present during winter, as measured from the design low water level of 202.1 m.

The intake will have a screen that is sized in accordance with the Department of Fisheries and Oceans (DFO) *Freshwater Intake End-of-Pipe Fish Screen Guidelines* for the fish that may be present in Lake Qikiqtalik. Previous studies identified the presence of Arctic Char in Lake Qikiqtalik however, Ninespine Stickleback may also be present. Using a screen approach velocity of 0.11 m/s per the DFO guidelines, a screen with a clear area of 4.82 m^2 is required to prevent entrainment and impingement. The screen slot size will be no larger than 2.54 mm in accordance with the DFO guidelines.

The screen is fitted with an air scour system that will be operated by an air line running in parallel with the raw water line and connected to a compressor in the pump station. The air scour is designed to operate at programmed, adjustable intervals in winter to mitigate frazil ice or in bursts to control biofouling.

The raw water intake screen will be designed for a flow of 556 L/s with an inlet flow velocity of 0.11 m/s (0.36 fps). The screen is a “Tee” type, 914 mm (36 in.) in diameter, with an overall length of approximately 3.56 m (140 in.)

long with #69 wire screen providing a slot size of 2.54 mm (0.1 in.). The screen is equipped with a 750 mm (30 in.) flanged outlet and a 150 mm (6 in.) airburst connection. All material is 316 stainless steel (SS).

The intake at the Niaqunnguk (Apex) River has not yet been designed. However, preliminary review suggests it will be a “barrel” type screen, that will be capable of being raised out of water depth during the winter months for protection. The screen(s) will be located along the shoreline of the Apex River, in a channel type construction to allow installation of the screens, and gates for water control as needed. As per the LQ intake, the design will be in accordance with DFO requirements for screen size and velocity to minimize impacts to fish.

1.4.1.2 Water Conveyance

This project will have three main conveyance pipelines:

- Pipeline from Lake Qikiqtalik to the New Reservoir.
- Pipeline from Niaqunnguk (Apex) River to the New Reservoir and Lake Geraldine.
- Interconnection from New Reservoir to Lake Geraldine to facilitate filling Lake Geraldine.

These are summarized below.

A large portion of the water conveyance pipeline will follow the route of the emergency pipeline and access road constructed in 2018 and 2019 as it limits the impacts of the footprint by using already disturbed lands. Vegetation clearing and leveling will be required within the footprint of the water conveyance pipeline. The footprint is expected to be 4.9 meters at the base with 4 meters wide at the top with a slope at a 1:1 ratio. See Figure 1-3 for details for a typical pipeline cross section.

1.4.1.2.1 Conveyance Pipeline, Lake Qikiqtalik to New Reservoir

A 600 mm HDPE Raw Water Transmission Main (RWTM) is proposed, running from the Lake Qikiqtalik pump station to a valve chamber where it splits via a wye connection into two parallel 400 mm HDPE RWTMs.

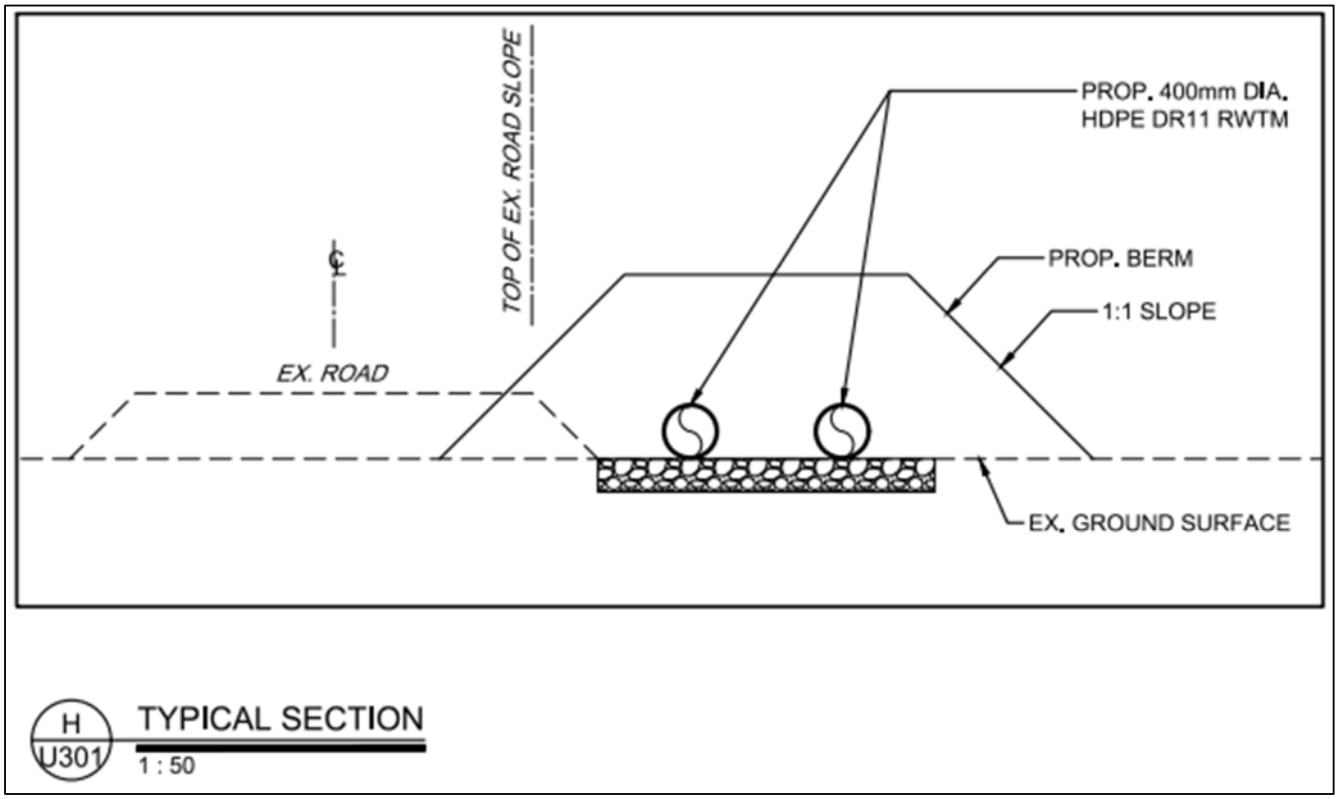
The pipes will follow the route of the existing roads where feasible. They will be laid on the existing ground that will be slightly sub-excavated following clearing and grubbing (if applicable), bedded, and covered/backfilled with selected material to construct a berm for protection. The depth of cover will be 1.0 m layer on top and extend 2.5 m on either side, in the form of a berm of sand, wrapped with geotextile, and crushed stone. A typical cross section is shown in Figure 1-3 below or in Appendix C for a larger drawing.

The total length of the 600 mm pipe is estimated to be approximately 65 meters, while each of the two parallel 400 mm pipes will have a total length of approximately 3.9 kilometers.

All pipe material will conform to *CSA B137.1* and ASTM *F714, D3035, D3350*. For fittings, adherence to ASTM D2683 or D3261 is mandated for molded fittings, while fabricated fittings will be manufactured from pipe of the same series as that used in the pipe system. Ductile iron gate valves will be used.

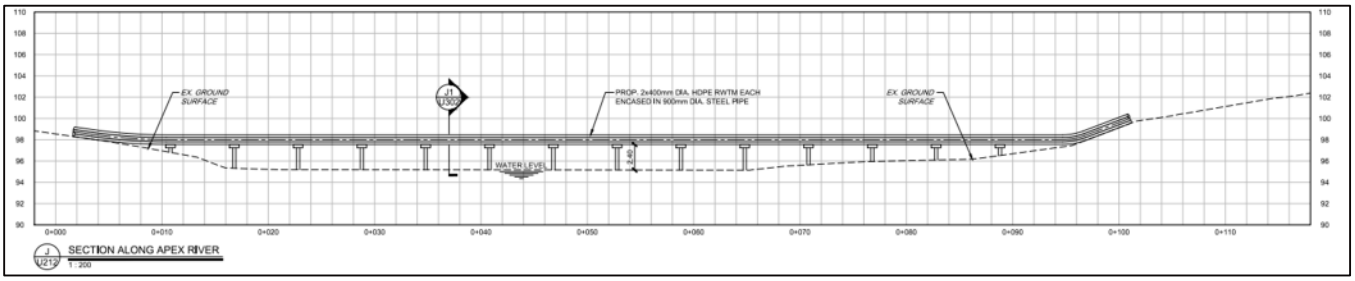
The pipeline will cross the Emergency Road and the Road to Nowhere at crossings under the road. The Emergency Road will likely need to be reinforced to allow for the passage of heavy equipment transporting construction materials.

Figure 1-3 Typical Water Pipeline Cross Section



A water crossing at the Niaqunnguk (Apex) River will be required. This will be done by raising the pipeline above the Niaqunnguk (Apex) River to an elevation of 98 meters above sea level (masl), or a maximum height of 2.4 m above the water level. The pipeline will be encased in a 900 mm diameter steel pipe. See Figure 1-4 for details or in Appendix C for a larger drawing.

Figure 1-4 Niaqunnguk (Apex) River Crossing



1.4.1.2.2 Conveyance Pipeline from Niaqunnguk (Apex) River to New Reservoir and Lake Geraldine.

The design of this portion of the conveyance pipeline is currently under preparation. This pipeline will be of the same material and design as the Lake Qikiqtalik portion of the water pipeline and will cross the Apex River on the same pipe bridge. This pipeline will terminate at the new reservoir and also will have a valve chamber allowing one of the two pipes to feed directly into Lake Geraldine, for operational flexibility.

1.4.1.2.3 Service Corridor, New Reservoir to Lake Geraldine

Two 750 mm HDPE pipes will be used to connect the reservoirs and will provide redundancy. To facilitate personnel access the two 750 mm pipes will be housed within a 3000 mm steel pipe with a thickness of 19 mm. Part of the bottom of the steel pipe will be filled with grout to provide a level surface, facilitating the placement of the pipes inside and allowing personnel access. This entire assembly will be positioned within a trench and encased with concrete to reinforce the steel pipe, ensuring it can effectively withstand both live and dead loads. The service corridor will be maintained at a minimum temperature to prevent freezing. Heat trace may be required on portions of the pipe (i.e., at entrance/exit), which will be further evaluated.

Manual isolation valves inside the service corridor will serve as backup and double isolation for maintenance purposes. Level monitoring will be provided for both Lake Geraldine and the new reservoir. Actuated valves will be used to control filling of Lake Geraldine based on the water level readings, with the goal to maintain the reservoir within a working range to be finalized with the City, but no greater than 111.3 m. Level monitoring and valve control will be similar to that of the pump station and will be accessible through the City's SCADA system.

A diffuser pipe arrangement will discharge water into Lake Geraldine and will be situated below expected freezing level to protect the pipe from being damaged. An intake structure in the new reservoir will be required to support the inlet location.

1.4.1.3 New Reservoir

A New Reservoir, to be located north of Lake Geraldine, will be part of the undertaking. It will have a capacity of 1,834,300 m^3.

The reservoir system will consist of eight retention structures in addition to peripheral services (e.g., access road and power lines). The characteristics of the proposed structures of the reservoir system are summarized in Table 1-1 below.

Table 1-1 Dam Structure Characteristics

Structure	Number	Max Height (m)	Approximate Length (m)
Dam	1	15.5	370
Dyke	2	8.5	100
Dyke	3	8.5	130
Dyke	4	7.5	90
Dyke	5	7.0	45
Dyke	6	13.5	190
Dyke (Spillway)	7	3.5	75
Dyke	8	12.5	170

Excavation of the New Reservoir area will be done using machinery and explosives. The New Reservoir will be excavated to 117 masl (±1.0m). While a large volume of material is required for the construction of the reservoir structures, some excess material is expected. These excess stockpiles will be stored at temporary staging areas close to the reservoir area during construction, then moved to the larger laydown area adjacent the Road to Nowhere for use in other City projects as necessary.

Formal construction specifications will be provided once design revisions have been made based on material parameters established by site-specific geotechnical investigation and sample laboratory analyses. The general description and requirements for the various fill zones to be used in reservoir structures are described below.

- Rock Fill: this material will form the bulk of the retention structures. Intended to be sourced primarily from the bedrock excavation of the reservoir itself, this will be produced onsite as run of mine material (i.e., blast rock with minimal material preparation). Material to be placed in 0.5 m lifts and compacted using heavy equipment tracks.
- Cushion 1: this will be a filter graded material (gravel and sand) designed to retain the subsequent bedding layers from the rock fill. May also be used as a surface course for access roads and laydown areas. Intended to be produced onsite from excavated bedrock, this material will be crushed and screened to achieve the filter grade required. Material to be placed in 300 mm vertical lifts and compacted at ±2% optimum moisture content using a smooth drum vibratory roller to 95% Standard Proctor Maximum Dry Density (SPMDD).
- Cushion 2: bedding material for the geosynthetic liner. This sandy material will be obtained from local borrow sources and screened as necessary to protect the geosynthetic liner according to the manufacturer's recommendations. Material to be placed in 300 mm vertical lifts and compacted at ±2% optimum moisture content using a smooth drum vibratory roller to 95% SPMDD.
- Geosynthetic Liner: The proposed liner is a linear-low density polyethylene (LLDPE) geomembrane, which is considered reasonably robust and appropriate for the level of settlement/deformation expected. The liner

will be protected on the downstream and upstream sides by the bedding material (Cushion 2) and sandwiched between layers of non-woven Terrafix 600R or equivalent geotextile.

- Riprap: will act as erosion control and protection from ice effects on the upstream slope and crests, and for the spillway. Material is to be placed using an excavator and tamped using the excavator bucket. The preparation of this material will be done as part of the material gradation work done concurrently with the preparation of the Cushion 1 material.

In addition to retention structures, the pipeline bedding and protection berm; construction access roads, ramps, and embankments; laydown areas; and the reservoir ring road will be required as part of the reservoir system construction. See

Figure 1-5 for the locations.

The main dam and the dykes will be built using materials excavated from the area of the two existing ponds (the reservoir footprint). A typical dam section is provided in

Figure 1-6. An HDPE geomembrane and non-woven geotextile will be incorporated into the structures. An outflow pipeline will be built from the main dam leading into LG. The conveyance pipe will reach approximately 60 to 80 m into Lake Geraldine and will end with a diffuser. Construction of a temporary coffer dam into Lake Geraldine below the New Reservoir dam will be required to construct the discharge. A coffer dam will be required to create a dry work area to lay the concrete forms and pipe. The pipe will be covered with excavated materials to create ballast to keep the pipe in place.

Figure 1-5 Material Sources, Access Road and Laydown Area Locations

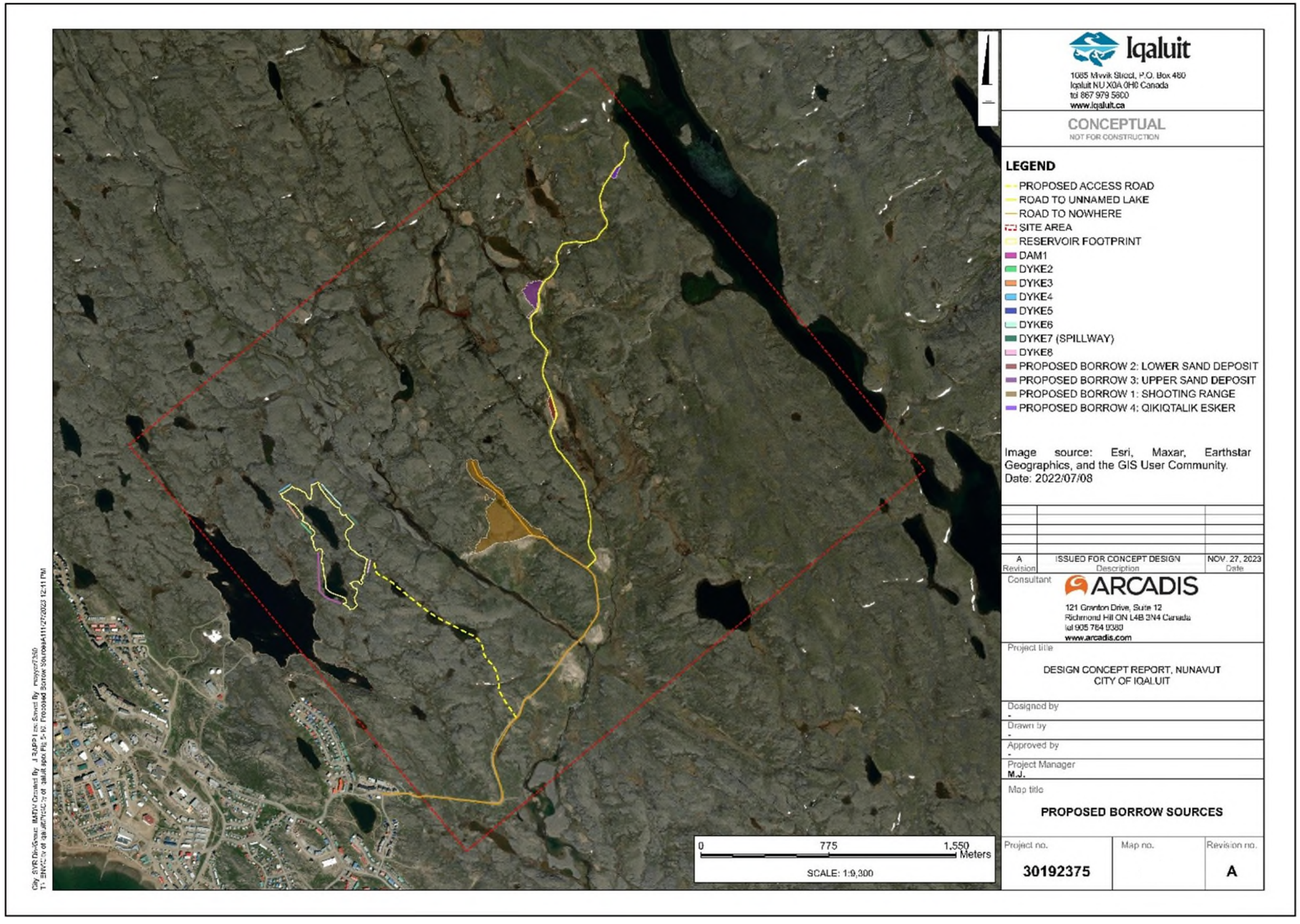
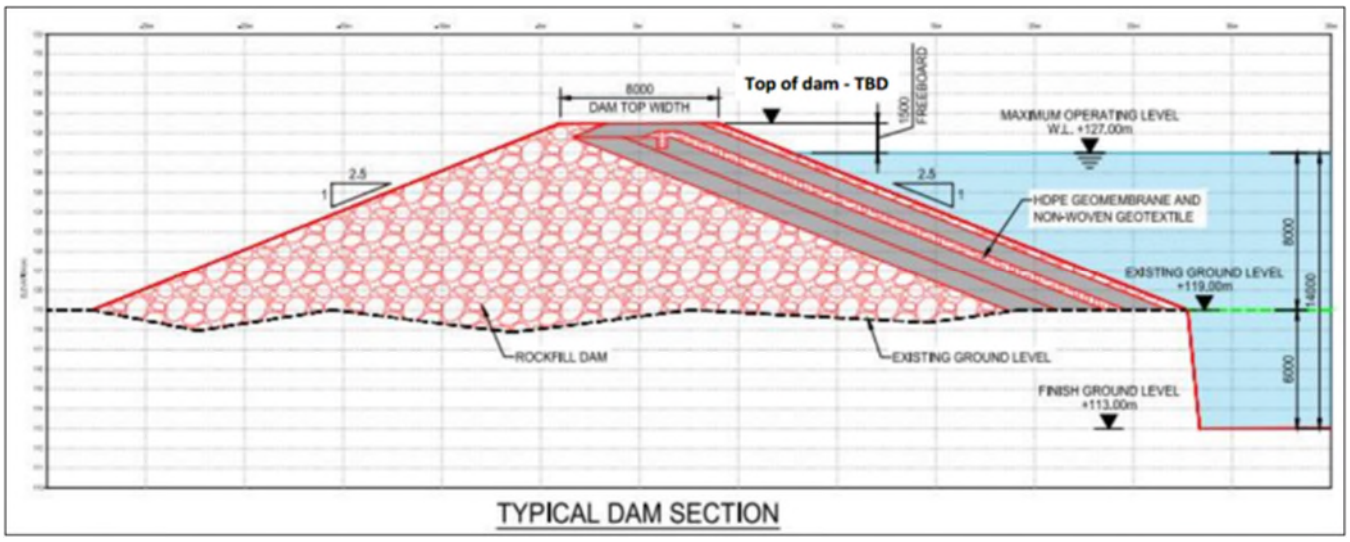


Figure 1-6 Typical Dam Section



1.4.1.3.1 New Reservoir Access

Initial construction works will focus on the staging and laydown area adjacent to the Road to Nowhere and the site access road. A small quarry required for aggregate to construct the initial access road will be required. This small quarry will only be used to level and construct the initial site access; once blasting and excavation begin in the reservoir footprint all rock fill and produced materials will be sourced from there.

A ring road to allow access around the rim of the reservoir area is planned across the tops of the proposed retaining structures and the spillway will have a mountable crossing inset along the crest to allow vehicle transit. Various temporary construction roads, staging areas and embankments will be constructed to allow equipment access to areas of the excavation floor, structure footprints, and surrounding areas.

Access roads and laydown areas will be constructed of excavation-run rock fill, with a surface course to protect vehicle tires as necessary. Material gradations will be the same as those proposed for the reservoir structures.

1.4.1.3.2 Dewatering of Existing Ponds

Dewatering of existing ponds will be required prior to the start of construction of the access road and new reservoir. As a part of access road construction, several small ponds will be dewatered and discharged to the drainage channels leading to the Niaqunnguk (Apex) River. Portable water pumps will be used. Drainage will follow existing flow channels for minimum disturbance to the existing drainage configuration of the terrain. These small ponds currently occupy the most level route to the reservoir area. Setbacks from the Niaqunnguk (Apex) River to the north and variable topography further south make this the most viable access route. The existing ponds inside the new reservoir footprint will similarly be dewatered in preparation for excavation and construction access to the area. Discharge is anticipated to be through the proposed spillway and through the existing drainage channel to the Niaqunnguk (Apex) River.

1.4.1.3.3 Blasting

The New Reservoir excavation limits will be well below the interpolated surface of competent bedrock, and blasting will be needed to reach the required depths. Surface blasting and excavation will also be required initially at a small quarry to achieve a viable access route to the reservoir site and to obtain the required material for the initial site access road construction.

A Blast Assessment Report has been prepared for the Project (Explotech 2025). Blasting will be conducted in a manner that limits the impact on adjacent infrastructure and on the surrounding rock mass (the integrity of the rock mass around the reservoir footprint is assumed to be such that grouting is not required). The blast program (i.e. number of lifts and spacing of blast holes) will be designed in such a manner so as to minimize the noise and vibration on the community and City infrastructure.

The use of ammonium nitrate fuel oil explosive (ANFO) will not be permitted. Detonation wires and shock tubes will be collected and removed following each blast.

Blasting will not occur in any standing water bodies, but it will occur in the footprint of the five ponds in the New Reservoir once they have been dewatered.

1.4.1.3.4 Dewatering Excavated Areas

Once the New Reservoir excavation is completed, any water that accumulates within the construction site due to precipitation, runoff, or seepage will be managed through a dewatering system to maintain safe and dry working conditions. Sump pits will be strategically located within the excavation area to act as collection points for accumulated water. Submersible pumps will be installed in these pits to remove water effectively. These pumps will be sized appropriately based on anticipated inflow rates to ensure continuous operation during peak conditions. Water removed from the excavation site will be pumped to a designated discharge location, such as a sedimentation basin or settling pond. The water will be collected for transfer offsite for disposal, likely the City of Iqaluit lagoon pond.

1.4.1.3.5 Quarry and Borrow Pits

As described above, excavated rock will be sourced initially from the small quarry adjacent the Road to Nowhere, and then from the reservoir excavation. Excavated rock will be transported to crushing stations, with stockpiles of the various produced aggregates stored in laydown areas constructed for that purpose. The initial crushing will occur in the laydown area adjacent the Road to Nowhere, with crushing activities moving closer to the reservoir excavation once suitable laydown areas can be constructed.

Bedding materials (i.e., cushion layers for the LLDPE liner) will be obtained from the previously used borrow areas along the Road to Nowhere/access to Lake Qikiqtalik. The proposed borrow areas are shown in Figure 1-2.

1.4.2 Operations

An Operation & Maintenance Plan will be created for the LTWP which will outline the operational requirements for all the project activities.

- RWPSs: Pumping and electrical equipment to be maintained according to equipment manufacturer. Water quality sampling at regular intervals and reporting to be undertaken as required by the regulatory agencies.
- Water Conveyance: Regular inspections of the water conveyance pipelines will take place with maintenance undertaken when needed.
- New Reservoir: Regular inspections of the structures will be undertaken, and preventative maintenance will be completed as needed.

1.4.3 Decommissioning

Given the complexity of the LTWP and its importance to the provision of water to the City of Iqaluit, it is likely that the LTWP will not be decommissioned at the end of its operational phase but will be modified to meet the future needs of the water supply system. Should a full decommissioning be required, it is likely that for each major component of the LTWP the following will occur:

- RWPS: Intake structures will be dismantled and the site equipment removed to be possibly re-used (depending on age) for other purposes or for disposal likely at the City of Iqaluit landfill.
- Water Conveyance Pipeline: Cover material removed and the pipeline recovered. The cover material will be laid back on the ground and leveled. It is also possible that the cover material can be reused for other activities elsewhere such as fill material or road building.
- New Reservoir: The New Reservoir may be drained in a controlled manner either into Lake Geraldine or into the Niaqunnguk (Apex) River. Once water levels allow, the earthen dams can be demolished, and the fill material reused elsewhere.

1.5 Project Timeline

The project timeline is presented in Table 1-2 below. This is subject to change based on the final construction schedule to be determined by the successful construction management firm to be contracted directly by the City.

Table 1-2 Project Timeline

Milestone	Start Date yyyy-mm-dd	End Date yyyy-mm-dd
Construction Phase	2026-06-01	2029-10-31
Year 1: Mobilization and road construction	2026-06-01	2026-11-01
Year 2: Reservoir excavation and pipeline construction	2027-05-01	2027-11-01
Year 3: Dam and berm construction and pipeline construction	2028-05-01	2028-11-01
Year 4: Pump station construction, site cleanup and reservoir filling	2029-05-01	2029-11-01
Operations Phase	2029-11-01	2129-11-01
Closure Phase (if applicable)	Not Applicable	Not Applicable
Post Closure Phase	Not Applicable	Not Applicable

The winter weather dictates the construction window for the year as it is expected that mechanical equipment will operate with difficulty from the months of November to April. Also, during the summer months there will be longer daylight periods which can allow for longer workdays at the site, if needed.

Included in this timeline are restricted periods identified for environmental protection for:

- Migratory birds.
- Fish spawning.
- Vegetation.
- Caribou migration.

1.6 Identification of Environmental Impacts

According to the NIRB Proponent's Guide (NIRB 2020), proponents must identify environmental impacts by type of environment, those being:

- Physical.
- Biological.
- Socioeconomic.

Section 3 of this report details these types of environments.

2 Existing Environment

This chapter describes the existing environment in the study area based on various sources:

- Literature review.
- Online aerial image software (Google Earth and ArcGIS Online).
- Works by other consultants hired by the City.
- Consultations undertaken to date with regulators and stakeholders.
- Site reconnaissance by Arcadis specialists September 18-22, 2023.
- Arcadis reports completed for the LTWP.

The key areas of the existing environment that will be addressed are as follows:

- Physical Environment:
  - Designated Environmental Areas.
  - Ground Stability.
  - Permafrost.
  - Hydrology / Limnology.
  - Water Quality.
  - Climate Conditions.
  - Eskers and Other Unique or Fragile Landscapes.
  - Surface and Bedrock Geology.
  - Sediment and Soil Quality.
  - Tidal Process and Bathymetry.
  - Air Quality.
  - Noise Levels.
- Biological Environment:
  - Terrestrial Vegetation.
  - Terrestrial Wildlife and Habitat.
  - Species at Risk and Migratory Birds.
  - Aquatic Species and Habitat.
- Socioeconomic Environment:
  - Archaeological and Cultural Historic Sites.

- Employment.
- Community Wellness.
- Community Infrastructure.
- Human Health.

2.1 Physical Environment

Please note that the description of the physical environment is intended to cover all components of a project, including roads/trails, marine routes, etc. that are in existence at present time.

2.1.1 Designated Environmental Areas and Special Places

Three territorial parks are located near Iqaluit, those being:

- Sylvia Grinnell Territorial Park.
- Katannilik Territorial Park.
- Qaummaarviit Territorial Park.

See

Figure 2-1 for details.

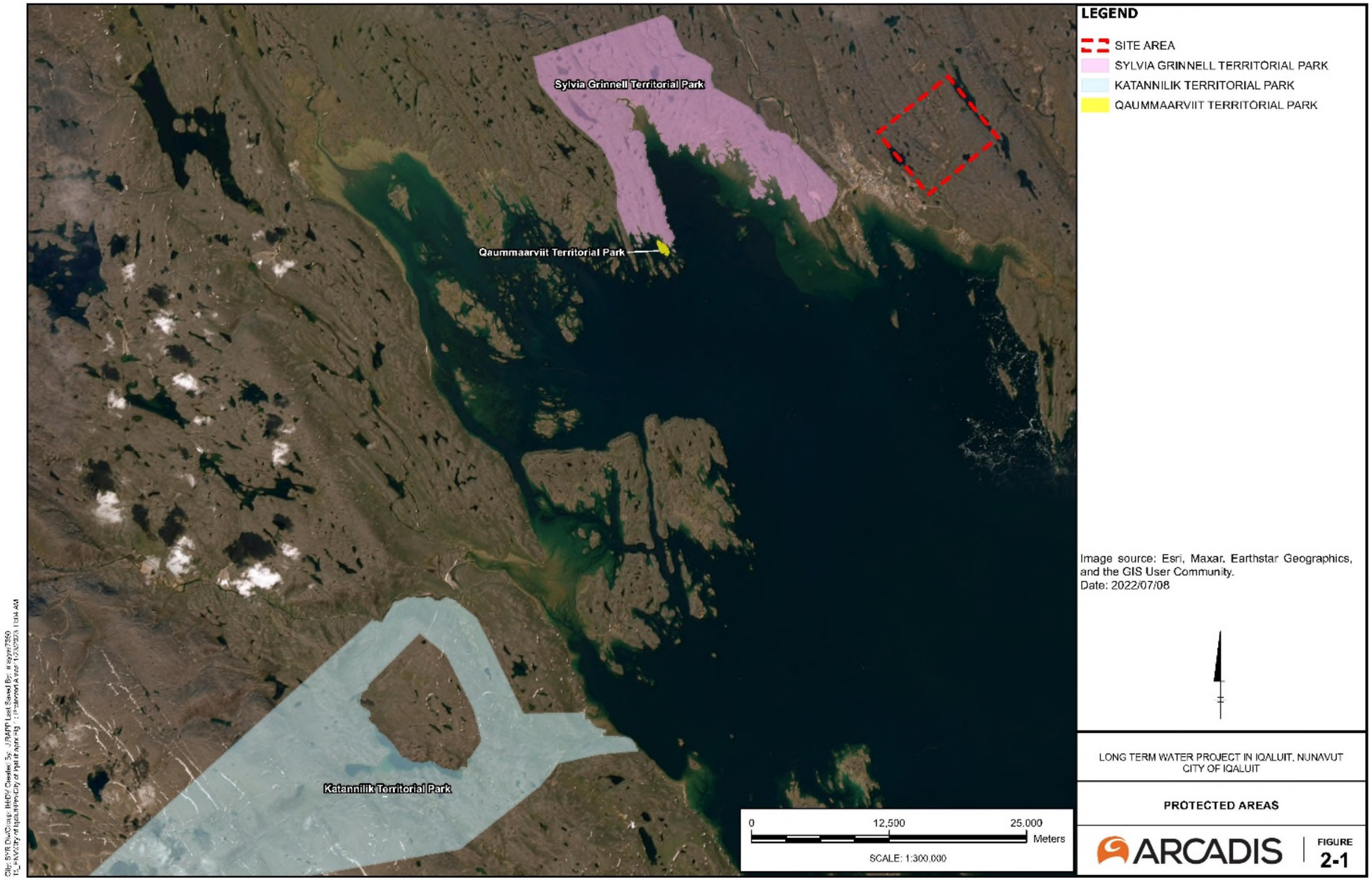
Sylvia Grinnell Territorial Park is the closest to the City of Iqaluit located approximately 3 km west of Lake Geraldine. This park protects the Sylvia Grinnell River, and the park is designated for conservation land use under the Draft Nunavut Land Use Plan (DNLUP). During the project pre-feasibility consultation stage the Sylvia Grinnell Territorial Park was identified as an area to be avoided both as a source of raw water and for use for the LTWP.

Katannilik Territorial Park is located approximately 26 km southwest of Iqaluit across Frobisher Bay on the Meta Incognita Peninsula. It is in an area known for its river system and waterfalls. The Soper River Valley provides shelter for winds which allows for growth of arctic wildflowers in the summer months. No project interactions are expected this far from the LTWP site.

Qaummaarviit Territorial Park is found on Qaummaarviit Island approximately 12 km southwest of Iqaluit. It is identified by its archeological significance as a settlement of the Thule people in the early 13th century. The Qaummaarviit Territorial Park has no land connection to the Sylvia Grinnell Territorial Park and is only accessible by boat or snowmobile in winter. No project interactions are expected this far from the LTWP site.

No other federal, territorial, or special places were identified in the LTWP area.

Figure 2-1 *Protected Areas*



2.1.2 Ground Stability

The LTWP site is composed of bedrock and soil cover in the area is minimal. Precambrian granite is very competent and is not likely to move. Areas where till is found may limit construction on slopes. Isolated erratics may be of minor concern in some areas where there is a potential for rock falls.

According to the Earthquakes Canada website, the Nunavut-Nunavik (northern Quebec) regions are among the most earthquake-prone zones in Canada. Table 2-1 summarizes relevant historical earthquakes within a 1000-kilometer radius of Iqaluit.

Table 2-1 Historical Earthquakes in the Region

Date	Location	Magnitude
Oct 2021	Qikiqtarjuaq	5.2
Jan 2018	Cape Dorset	3.8
Jan 2017	South of Resolute	5.8
Jul 2011	Hudson Strait (300 km south of Iqaluit)	4.2
Mar 2006	Puvirnituq, QC	4.1
Mar 1993	Clyde River	4.4
1989	Ungava Peninsula, Nunavik	6.3
1963	Baffin Island, Nunavut	6.1
1933	Pond Inlet, Baffin Bay	7.3

Arcadis (Arcadis 2025) prepared a Preliminary Geotechnical Investigation to inform the construction of the raw water and conveyance system. Seismic hazards were evaluated as part of the study. The Iqaluit area is historically an area of low seismic activity. No notable seismic activity has been reported in or around the entire Frobisher Bay area from 1627 – 2015, as best as can be determined (Arcadis 2025).

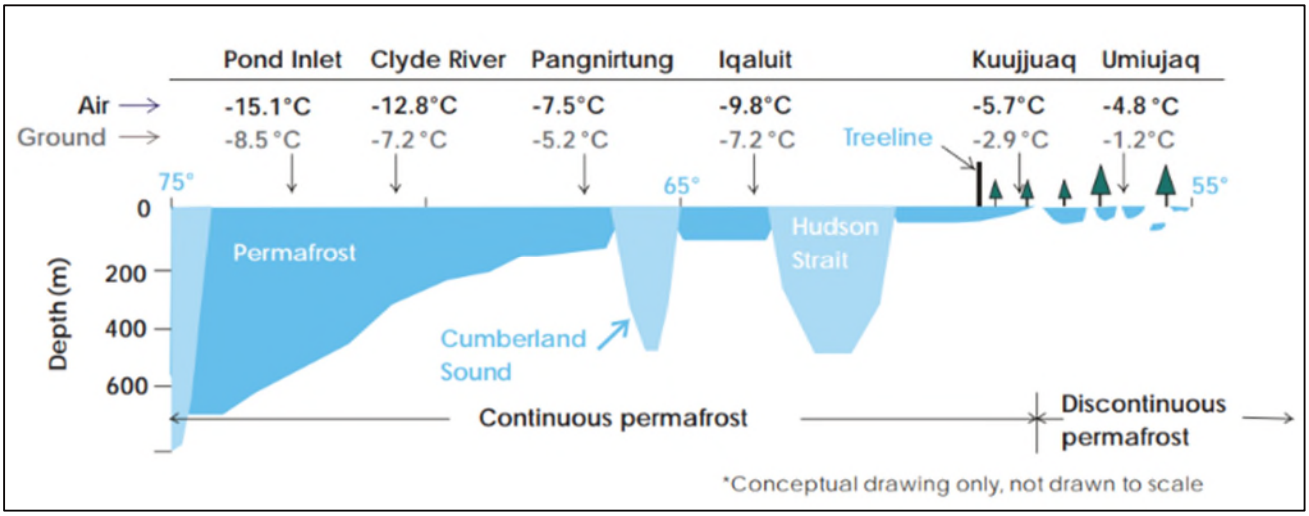
2.1.3 Permafrost

Iqaluit and southern Baffin Island are located within the continuous permafrost zone. As such, all exposed land will be underlain by permafrost. This is irrespective of the soil or bedrock type, understanding that permafrost is a thermal state. Only under deeper water bodies (typically greater than about 2 m water depth) will unfrozen (talik) conditions exist. Taliks, an area of unfrozen ground surrounded by permafrost, are likely to form in areas near or under waterbodies. The active layer in undisturbed ground will be typically 1 m to 2 m deep, reaching a maximum depth in late September (even as the ground surface starts to freeze back). The depth of this seasonal thawing will depend on the nature of the material (soil versus bedrock), water content and vegetation cover. Greater thawing is expected in dry soil or bedrock with no organic cover.

The mean annual ground temperature (typically measured at 10 m to 15 m below ground surface) is likely in the order of -8°C.

Figure 2-2 shows how mean average air and ground temperatures influence permafrost depth under general conditions in the region of Iqaluit (GN-Env 2013).

Figure 2-2 Permafrost Thickness and Distribution by Latitude (°N) in Nunavut and Nunavik



A Preliminary Geotechnical Investigation was prepared by Arcadis (Arcadis 2025) to inform the construction of the raw water and conveyance system. One thermistor was installed under the footprint of the Main Dam in October 2024. The temperature data shows subzero temperatures are present to approximately 3.5 meters below ground surface (mbgs) while above freezing temperatures were measured at a depth of 4.0 and 4.5 mbgs.

The LTWP is in a zone of continuous permafrost that generally begins at a depth between 1 to mbgs. It is expected that the larger water bodies across the LTWP (including Lake Geraldine and Lake Qikiqtalik) serve as heat sinks and depress permafrost formation to greater depths in their immediate area. Taliks, areas of unfrozen ground surrounded by permafrost, are likely to form in areas near or under water bodies at the site.

2.1.4 Hydrology/ Limnology

This section is divided onto the following subsections:

- Watershed boundaries.
- Waterbodies.
- Groundwater, and
- Water Withdrawals and Storage.

2.1.4.1 Watershed Boundaries

The primary watersheds near Iqaluit include:

- Niaqunnguk (Apex) River Watershed.
- Sylvia Grinnell River Watershed, and
- Koojesse Inlet Watershed.

The Niaqunnguk (Apex) River Watershed is an important water source for Iqaluit, supplying the City with its drinking water. The watershed encompasses several lakes and streams with the Niaqunnguk (Apex) River serving as its main watercourse.

The Sylvia Grinnell River Watershed is another significant watershed near Iqaluit. It is characterized by a network of rivers, tributaries, and wetlands.

The Koojesse Inlet Watershed is located northeast of Iqaluit and is an important marine ecosystem. This watershed encompasses coastal areas, marine habitats, and estuaries.

2.1.4.2 Waterbodies

The named waterbodies within the LTWP project area are:

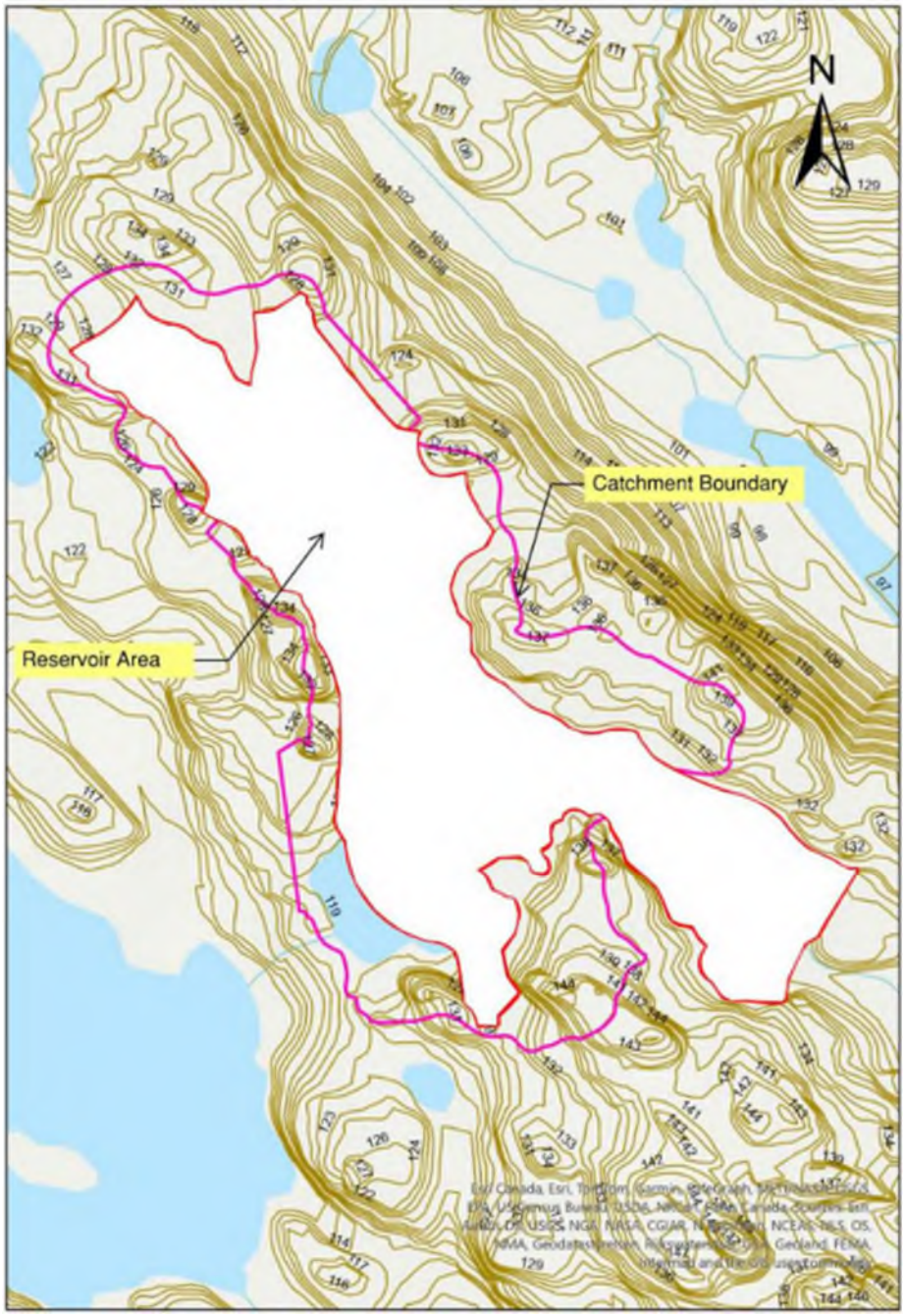
- Lake Geraldine.
- Niaqunnguk (Apex) River and its tributaries.
- Lake Qikiqtalik.

See

Figure 1-1 for the locations of these waterbodies. Included, though not named, are the two lakes forming the New Reservoir.

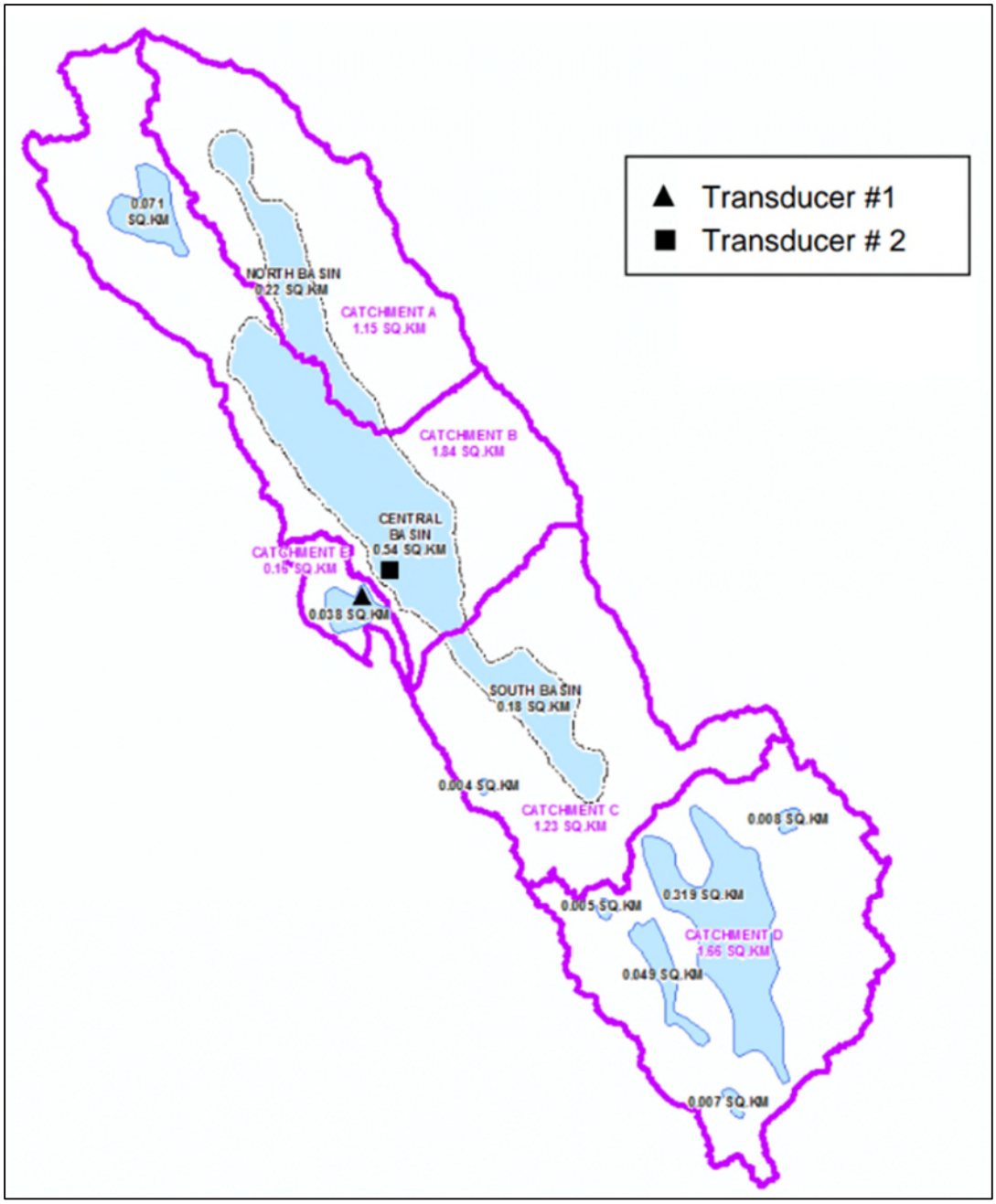
Watershed boundaries of the Lake Qikiqtalik and the New Reservoir have been delineated by Arcadis (2024) and discussed below. The New Reservoir will be northeast of the City of Iqaluit, to be located to the east of Lake Geraldine. It is composed mostly of impervious bedrock. The topography in the catchment is moderate to rugged with elevations ranging from 119 to 144 masl. The catchment is a confined area with no surface inflow to the reservoir. The source of water to the New Reservoir is precipitation including snow melt. The catchment area is 297.7 ha. The catchment boundary is shown in Figure 2-3.

Figure 2-3 New Reservoir Catchment (Arcadis, 2024a)



Delineation of the watershed of the Lake Qikiqtalik was undertaken by Golder (2021). The total catchment area of Lake Qikiqtalik was determined to be 748 ha (7.48 km^2) with five sub-catchments identified. These are delineated in Figure 2-4.

Figure 2-4 Sub-Catchment Delineation of the Lake Qikiqtalik Watershed and Monitoring Locations (Golder 2021)



2.1.4.3 Groundwater

Given the presence of bedrock and permafrost at the LTWP, groundwater flow is not expected to be significant. Groundwater would only be anticipated to flow during seasonal thaw conditions within the active permafrost layer. It is most likely that groundwater will flow out of the New Reservoir area in the direction of higher to lower elevations either towards Lake Geraldine or the Niaqunnguk (Apex) River.

Groundwater conditions at the LTWP were investigated using the twelve (12) monitoring wells installed between February and March 2024 (Arcadis 2025). Water level measurements indicate that groundwater, when present, is between 0.4 and 2.8 mbgs. Groundwater was detected in four of the 12 wells in August 2024 and 7 of the 12 wells in October 2024, indicating the presence and fluctuation of the active layer (permafrost). The groundwater chemistry results are presented in Table 2-2 below.

Table 2-2 Groundwater Chemistry Results

Arcadis Sample ID	MW2023-4	MW2023-5
Sampling Date	5 October 2024	5 October 2024
pH	7.45	7.23
Dissolved Sulphate (mg/L)	1.2	1.6
Dissolved Chloride (mg/L)	<1.0	<1.0

Acid Rock Drainage testing was also undertaken at four (4) borehole locations using Acid Base Accounting (ABA) and shake flask testing from bedrock chip samples (Arcadis 2025). The neutralization potential ratios (NPRs) of the four bedrock samples analyzed ranged between 4.35 and 19.58. NPRs were calculated by dividing the neutralization potential result by the acid generation potential result for each sample. The pH of the four samples ranged between 8.05 and 8.55. No samples analyzed showed potential for acid generation.

2.1.4.4 Water Withdrawals and Storage

This subsection summarizes the current and future projected water withdrawals and storage requirements for the City.

The City is currently permitted to withdrawal water from Lake Geraldine as its principal source of drinking water and water from the Niaqunnguk (Apex) River under certain flow conditions. The withdrawal of water is regulated in Nunavut by the Nunavut Water Board (NWB) and the City holds a Type A Water License with the NWB dated June 2016 (Licence No. 3AM-IQA1626). This licence identifies the quantity of water is to not exceed as 1,100,000 m^3 annually. A later Amendment No. 4 was granted in September 2019 allowing for:

- Withdrawal from Lake Geraldine up to 2,000,000 m^3 annually, and
- Withdrawal from Niaqunguk (Apex) River up to a total of 500,000 m^3 annually.

Conditions of Amendment No. 4 require that withdrawal from the Niaqunguk (Apex) River only occurs when the natural flow of the Niaqunguk (Apex) River is above 30% of the mean annual discharge (MAD) and the withdrawals will not exceed 10% of the instantaneous flow of the Niaqunguk (Apex) River (at 0.143 m^3/s and 0.156 m^3/s). This water license is for the monitoring station IQA-10 located upstream of the Confluence of the Lake Qikiqtalik tributary and Niaqunnguk (Apex) River. Also in place is a requirement that, should the DFO request that withdrawals are to stop due to effects on fish and fish habitat, the activity must cease until DFO indicates withdrawals can resume. Amendment No. 4 also indicates that during the periods of withdrawal from the Niaqunguk (Apex) River flow volumes must be monitored and an annual report submitted to the NWB.

In 2024, the City received permission from DFO to withdraw water at a rate from 10% to 20% of instantaneous discharge when flow of the Niaqunnguk (Apex) River is greater than 0.156 m^3/s (DFO 2024) . The DFO's review is

to determine whether withdrawals will harm fish and their habitat, alter habits of SARA protected species or introduce invasive species into water bodies.

To determine the volumes of water available for withdrawal meeting the licence requirements in the Niaqunnguk (Apex) River, Tetra Tech undertook an assessment of the annual discharge rates to determine the Niaqunnguk (Apex) River to determine the flow limits required in NWB License No. 3AM-IQA1626 (Tetra Tech 2024). Three sampling points were identified in the Niaqunnguk (Apex) River. See Table 2-3 for details.

Table 2-3 Mean Annual Discharge Rates - Niaqunnguk (Apex) River

ID	Location	Mean Annual Discharge (m^3/s)	30% Mean Annual Discharge (m^3/s)
10U002	Niaqunnguk (Apex) River at Apex	0.545	0.164
---	Niaqunnguk (Apex) Confluence	0.483	0.145
10U015	Niaqunnguk (Apex) River 1 km Above Bridge to Nowhere	0.407	0.122

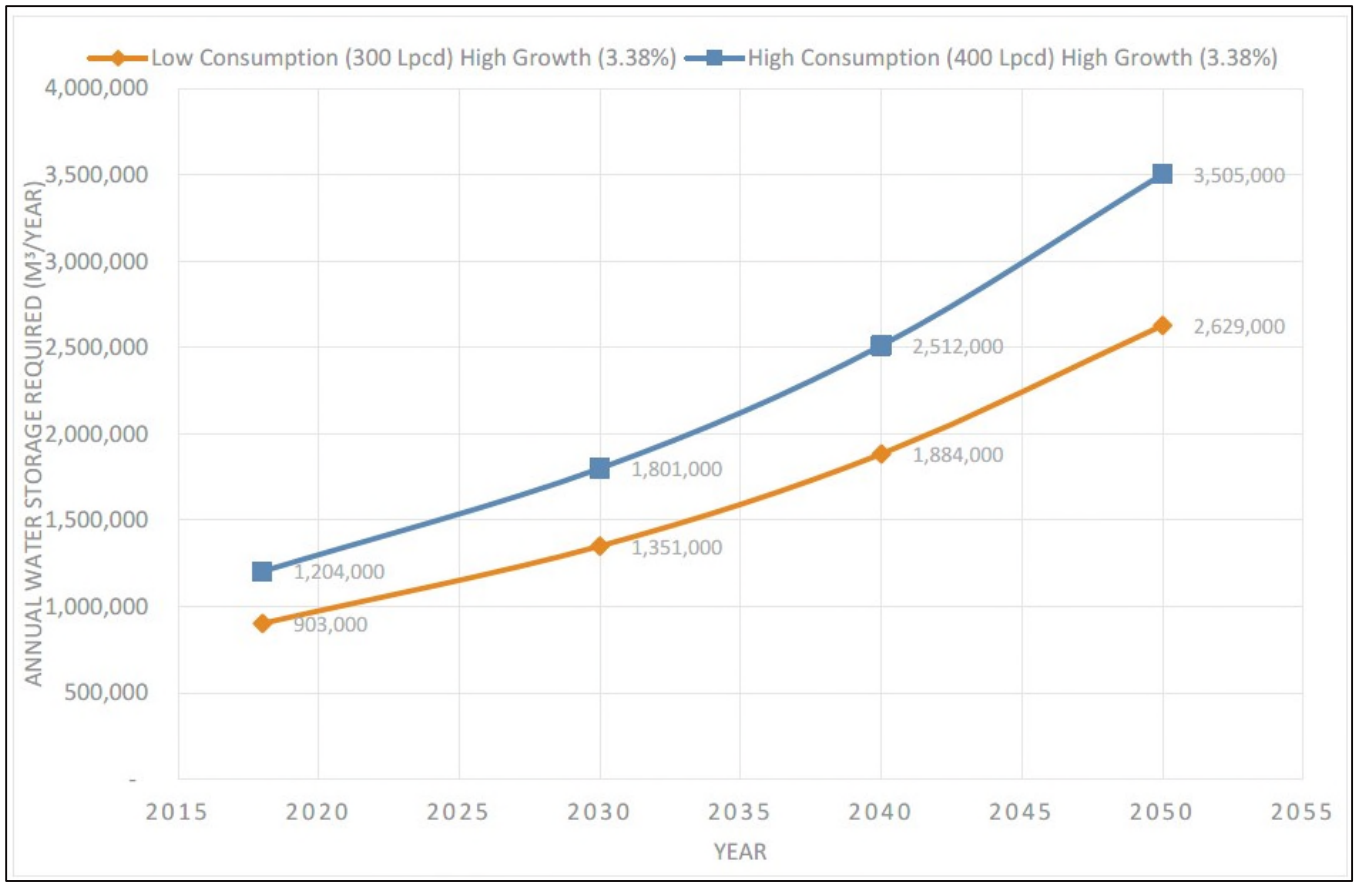
The monitoring location 10U015 is the approximate location of the Niaqunnguk (Apex) River pumping program.

A study was undertaken by EXP Service Inc. (EXP, 2020) to determine if the Lake Geraldine Reservoir can meet the future water demands of the City of Iqaluit. Their conclusions were as follows:

- The current storage capacity of Lake Geraldine Reservoir has been established to be:
  - Total volume within the Lake Geraldine Reservoir at capacity: 179,300 m^3
  - Inaccessible Volume due to geometry (year-round) - 112,500 m^3
  - Inaccessible Volume due to Ice (winter months) - 585,000 m^3
  - Total Volume of accessible Water (winter months) - 1,095,500 m^3
- The current storage capacity of Lake Geraldine Reservoir is insufficient to meet the future water demands of Iqaluit's growing population. Assumptions include:
  - Population Growth: Iqaluit's high growth rate projected at 3.38% annually through 2050.
  - Water Demand: Per capita water demand estimated at 400 L/day.
  - Ice Depth: Estimated water storage loss of 1.9 m due to ice during the 244-day over-winter period, when no reservoir replenishment occurs.

EXP proposes two scenarios for future water consumption, a high population growth low water consumption scenario and a high population – high water consumption scenario. Those are compared in Figure 2-5 below.

Figure 2-5 Projected Annual Water Storage Required for Low and High Consumption Rates (EXP, 2020)



Based on the projections above, EXP recommends that an additional storage requirement of 1,247,500 m³ for the over-winter period and 1,824,500 m³ annually be considered for project planning to meet demands of the City up to 2050. The Table 2-4 below summarizes the additional water storage requirement projections proposed by EXP.

Table 2-4 Water Storage Projections (EXP, 2020)

Water Requirement	Current (m^3)	2030 (m^3)	2040 (m^3)	2050 (m^3)
Total Volume of accessible Water Storage during Over-Winter Period	1,095,500	+108,500	+584,000	+1,247,500
Total Volume of accessible Water during Summer months	1,680,500	+120,500	+831,500	+1,824,500

2.1.5 Water Quality

In 2019, the City of Iqaluit conducted water quality sampling as part of the Lake Qikiqtalik to Niaqunnguk (Apex) Apex River Water Withdrawal program. The primary aim of these monitoring activities was to verify the suitability of the water quality in the Lake Qikiqtalik, which served as a source of drinking water, before transferring it to Lake

Geraldine. The purpose of this assessment was to ensure that the water obtained from the Lake Qikiqtalik met the required standards for safe and reliable drinking water supply for the community.

The sampling parameters, their dates and locations are provided in Table 2-5.

Table 2-5 Lake Qikiqtalik Sample Location Summary Table (Stantec 2019)

Location ID	Parameters Sampled	Date Sampled	Latitude	Longitude
SW19-01	General Chemistry, benzene/ toluene/ ethylbenzene/ xylene (BTEX) and Petroleum Hydrocarbons (PHCs), Metals, and Microbiology	July 4, 2019 and September 12, 2019 (BTEX, PHC, and mercury)	63.781474	-68.45223
SW19-02	General Chemistry, BTEX and PHCs, Metals, and Microbiology	July 4, 2019 and September 12, 2019 (BTEX, PHC, and mercury)	63.77787	-68.44533
SW19-03	General Chemistry, BTEX and PHCs, Metals, and Microbiology	July 4, 2019 and September 12, 2019 (BTEX, PHC, and mercury)	63.77353	-68.43791
SW19-04	General Chemistry, BTEX and PHCs, Metals, and Microbiology	July 4, 2019 and September 12, 2019 (BTEX, PHC, and mercury)	63.77522	-68.44123
SW19-05	General Chemistry, BTEX and Petroleum Hydrocarbons, Metals, and Microbiology	July 4, 2019 and September 12, 2019 (BTEX, PHC, and mercury)	63.77502	-68.44905

Stantec's 2019 report on the water quality sampling program conducted at Lake Qikiqtalik draws the following conclusions:

- The water quality at Lake Qikiqtalik is deemed satisfactory, as indicated by the analytical results reported.
- The levels of BTEX (benzene, toluene, ethylbenzene, and xylene) and PHC (petroleum hydrocarbons) were below the laboratory detection limits.
- The presence of total coliforms and E. coli bacteria in the water was reported to be at 0 colony forming units (cfu) per 100 milliliters, signifying absence of these bacteria in the samples.

Additionally, water quality parameters were measured at all of the waterbodies to be impacted by the Project during the Ecological Surveying done by Arcadis in July 2024. This included Lake Qikiqtalik, LG, Niaqunnguk (Apex) River, and the 5 ponds located in the footprints of the Access Road and New Reservoir. Averages obtained for each waterbody are shown in Table 2-6. The sampling parameters were those typically used to determine ecological potential and not for contaminants.

Table 2-6 Water Quality Summary Data by Waterbody (Arcadis, 2024a)

Waterbody	Temperature (ºC)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)
Lake Qikiqtalik	8.10	7.71	4.63	11.34	0.048
Lake Geraldine	8.39	7.06	3.18	11.47	0.035
Pond 1	14.65	8.02	0.00	12.09	0.033
Pond 2	14.67	7.87	0.63	12.22	0.036
Pond 3	15.56	7.54	0.50	10.55	0.038
Pond 5	10.96	7.54	2.67	13.68	0.028
Pond 6	10.56	7.09	1.07	13.07	0.033
Apex River	7.80	7.42	1.00	15.04	0.046

2.1.6 Climate Conditions

This section is divided onto the following subsections:

- Current climate conditions, and
- Impacts of climate change.

2.1.6.1 Current Climate Conditions

The climate in Iqaluit is classified as a tundra climate, characterized by consistently low temperatures throughout the year. According to the Köppen and Geiger classification, this climate is designated as an "ET" polar tundra climate. In Iqaluit, the average temperature is -9.3 °C, with peak temperatures reaching around 8.2 °C in July and dropping to a typical low of -27.5 °C in February (EC, 2023). Throughout the year, there is a variation of approximately 35 °C in average temperatures.

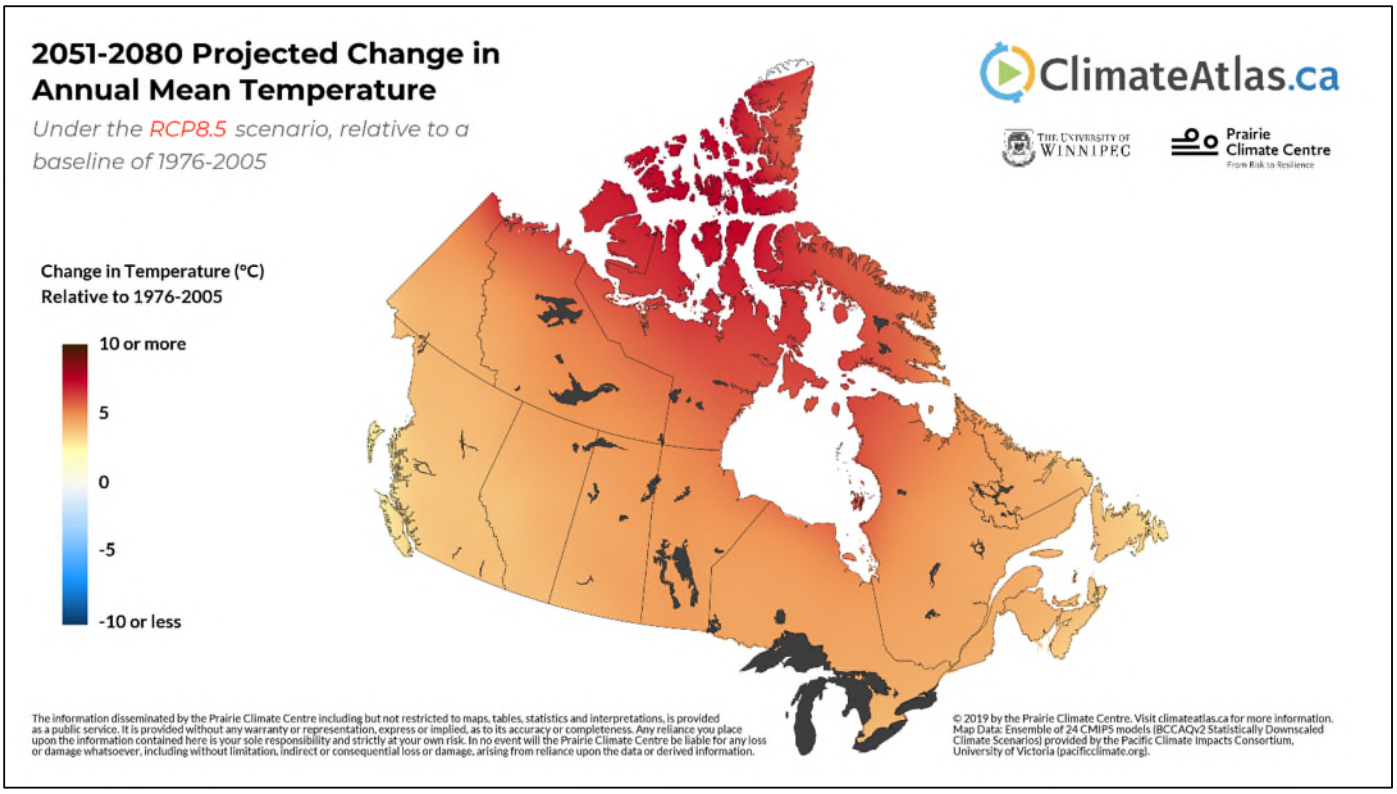
The annual average precipitation in Iqaluit is approximately 361 mm (EC, 2023). The highest precipitation typically occurs in August, with just over 60 mm, while the winter months (December, January, February, March) average around 20 mm. The difference in precipitation between the driest and wettest months is approximately 40 mm. Most of the limited rainfall in Iqaluit occurs between June and early September.

In Nunavut, cool temperatures mean that snow cover persists until June, and the sea ice does not completely break up and melt away until the middle of July. At the summer solstice, the sun shines for 21 hours in Iqaluit with a few hours of twilight around midnight and on the shortest day, the sun rises and sets within four hours (NRC, 2020).

2.1.6.2 Impacts of Climate Change

According to Canada's Changing Climate Report (Government of Canada, 2019), "warming across Canada has been about twice the global average". This is attributable to a combination of factors, including Canada's large land mass and the fact that much of it is located at northern latitudes. At these latitudes, various feedback mechanisms involving snow/ice albedo, the ocean, clouds, and the atmosphere exacerbate global warming and result in temperatures rising at approximately twice the rate of the rest of the planet. (Government of Canada, 2019). This phenomenon can be seen in Figure 2-6, which summarizes the projected change in annual mean temperature by the end of the century assuming a high emission scenario – Representative Concentration Pathway (RCP) 8.5, and clearly shows increased warming at northern latitudes.

Figure 2-6 Projected Change in Annual Mean Temperature in Canada by the end of the Century



A high-level overview of the expected climate trends for Iqaluit is shown in Figure 2-7 (assuming a low carbon scenario, i.e., RCP4.5) and Figure 2-8 (assuming a high carbon scenario, i.e. RCP8.5). These figures are extracted from Iqaluit's Climate Atlas Report (Climate Atlas of Canada, 2019).

Based on these data, the trends below are anticipated in the Precipitation, Air Temperature and Permafrost of the LTWP.

Figure 2-7 Climate Change Projections for Iqaluit under a Low Carbon Scenario - RCP4.5

RCP 4.5: Low Carbon climate future

GHG emissions much reduced

Variable	Period	1976-2005	2021-2050			2051-2080		
		Mean	Low	Mean	High	Low	Mean	High
Precipitation (mm)	annual	450	401	497	611	412	525	643
Precipitation (mm)	spring	82	54	88	127	54	93	134
Precipitation (mm)	summer	162	113	178	250	112	182	262
Precipitation (mm)	fall	130	94	143	200	99	151	209
Precipitation (mm)	winter	77	55	89	130	59	100	151
Mean Temperature (°C)	annual	-9.2	-8.6	-6.9	-4.8	-7.3	-5.4	-3.2
Mean Temperature (°C)	spring	-13.6	-14.3	-11.7	-8.8	-13.1	-10.3	-6.7
Mean Temperature (°C)	summer	5.8	5.6	7.4	9.5	6.1	8.3	10.7
Mean Temperature (°C)	fall	-4.9	-4.8	-2.8	-0.8	-3.6	-1.6	0.4
Mean Temperature (°C)	winter	-24.4	-24.5	-20.6	-16.2	-22.1	-18.1	-13.6
Tropical Nights	annual	0	0	0	0	0	0	0
Very hot days (+30°C)	annual	0	0	0	0	0	0	0
Very cold days (-30°C)	annual	57	8	31	52	1	18	37
Date of Last Spring Frost	annual	June 21	May 29	June 11	June 27	May 22	June 7	June 23
Date of First Fall Frost	annual	Sep. 7	Aug. 30	Sep. 17	Oct. 4	Sep. 6	Sep. 22	Oct. 11
Frost-Free Season (days)	annual	74	69	95	116	77	104	127

Figure 2-8 Climate Change Projections for Iqaluit under a High Carbon Scenario - RCP8.5

RCP 8.5: High Carbon climate future

GHG emissions continue to increase at current rates

Variable	Period	1976-2005	2021-2050			2051-2080		
		Mean	Low	Mean	High	Low	Mean	High
Precipitation (mm)	annual	450	399	504	617	454	563	688
Precipitation (mm)	spring	82	53	89	128	60	99	143
Precipitation (mm)	summer	162	103	178	258	118	191	270
Precipitation (mm)	fall	129	95	145	201	108	163	224
Precipitation (mm)	winter	77	56	93	136	68	110	159
Mean Temperature (°C)	annual	-9.2	-8	-6.4	-4.5	-5.5	-3.5	-1
Mean Temperature (°C)	spring	-13.6	-13.7	-11.2	-8.5	-11.7	-8.7	-4.4
Mean Temperature (°C)	summer	5.8	5.8	7.6	9.6	7	9.6	12.5
Mean Temperature (°C)	fall	-4.9	-4.3	-2.3	-0.4	-2.3	0	2.3
Mean Temperature (°C)	winter	-24.3	-23.6	-19.9	-15.5	-19	-15.1	-10.5
Tropical Nights	annual	0	0	0	0	0	0	0
Very hot days (+30°C)	annual	0	0	0	0	0	0	0
Very cold days (-30°C)	annual	56	7	26	46	0	7	19
Date of Last Spring Frost	annual	June 21	May 28	June 10	June 25	May 16	June 1	June 14
Date of First Fall Frost	annual	Sep. 7	Sep. 2	Sep. 20	Oct. 8	Sep. 15	Oct. 1	Oct. 22
Frost-Free Season (days)	annual	74	74	98	120	95	118	141

2.1.6.3 Precipitation

Climate change is projected to bring increased precipitation due to higher evaporation rates and moisture in the atmosphere and the mean annual precipitation values are expected to increase under both scenarios. The most pronounced increase is seen in the end of century projections under RCP8.5 (25% increase versus 16% under RCP4.5). While the increase of precipitation trends is observed across all seasons in both scenarios (meaning an increase of both rain and snow is expected) the rain-to-snow ratio may shift potentially impacting ecosystems and traditional activities.

2.1.6.4 Temperature

Mean temperatures across all seasons are expected to increase in both scenarios: In the wintertime, the mean temperature is expected to increase from -24°C to -18.1°C (RCP4.5) or -15.1°C (RCP8.5) by end of century. A similar decreasing trend is observed with the number of very cold days (days with temperature below -30°C). This warming will result in a longer frost-free season which is expected to increase from 74 days to 104 (RCP4.5) or 118 (RCP8.5) by end of century, reducing ice formation and resulting in impacts to the local flora and fauna.

In the summer, the mean temperature is expected to increase from 5.8°C to 8.3°C (RCP4.5) or 9.6°C (RCP8.5) by the end of the century. Associated with this increase in average conditions will be a higher occurrence of hot days for which the region is not well adapted.

2.1.6.5 Permafrost

Permafrost depth is influenced by air temperature. Permafrost thaws when it is exposed to temperatures above freezing for an extended period. Once thawed, the ground may lose its stability and cohesion resulting in subsidence, sinking or collapse at steeper slopes. Also, as permafrost melts, greenhouse gases (GHGs), primarily carbon dioxide and methane formed from the decomposition of previously frozen organic matter, will be released into the atmosphere.

Golder Associates (2021) undertook an analysis to determine the effects of climate change on the Lake Qikiqtalik water balance. Their conclusion was that climate change is likely to result in a longer open water period allowing for more recharge and more consumption prior to the freeze-up. Their assumption is that pumping from Lake Qikiqtalik might occur up to four weeks longer than current conditions.

2.1.7 Eskers and Other Unique or Fragile Landscapes

There is a presumed esker west of Lake Qikiqtalik. It is likely that the sands and fines present were deposited due to glaciofluvial processes in the past. Air photos of this area show local abundance of sands and fines. These deposits have been borrowed for use as fill material for the construction of the Emergency Road. Geotechnical test pitting would need to be undertaken to confirm if this is an esker and its extent.

Based on the observations made during the site reconnaissance of September 2023, there were no clear observations of ground, slope, or rock instability in the LWTP area.

Thermokarsts are likely to be seen near the waterbodies and in soil cover, however, none were observed in the vicinity of Lake Qikiqtalik, Niaqunnguk (Apex) River and the two lakes of the New Reservoir during the September 2023 reconnaissance visit. Geotechnical surveys of the infrastructure will validate the presence of thermokarsts.

Ice lenses typically form in areas where soils and sediments have accumulated. No ice lenses were observed during the site reconnaissance of September 2023. Ice lenses are not expected to form as there is minimal soil cover at the LTWP site, at the wetland areas or areas with drift (a coating of soil).

2.1.8 Surface and Bedrock Geology

The LTWP is situated in the Middle Arctic tundra Ecoregion, within the Northern Arctic Ecozone of the Everett Mountains, a subrange of the Arctic Cordillera. The LTWP is situated upslope from Frobisher Bay at sea level. The topography in the area is rolling and ridged and reaches altitudes of no greater than 250 masl.

A review of Canadian Geoscience Map 64 indicates that the surficial geology at the site consists of a till veneer containing sand, gravel, cobbles, and boulders in a silty sand matrix; 0.0 – 2.0 metres thick (Arcadis 2025). Over the New Reservoir area, the surficial geology is >40% till, <60% rock ledges, knobs, and rubble. The bedrock topography is evident, and very minor colluvium (including talus, colluvial fans, and solifluction lobes) is theoretically present among washed-till boulder fields. The majority of the site is intact and frost riven outcrop with a discontinuous cover of rubble, boulders, gravel, and sand; all of which has been glacially scoured.

Through, approximately the central portion of the site, generally along the Niaqunnguk (Apex) River basin, the till veneer becomes a thicker till blanket of similar composition 1 – 10 m thick, with instances of glaciofluvial outwash deposits including stratified gravel and sand, proglacial floodplains, channeled deltas, terraces, and fans. The till blanket can mask bedrock structure, appears in end moraines, and is affected by periglacial processes such as solifluction lobes, frost boils, and sorted patterns. The till blanket is reportedly also susceptible to thaw slumping on slopes or in excavations. Adjacent to, and intermittent within, the till blanket are areas of glaciofluvial subaerial outwash containing stratified gravel and sand which may be up to 30 m thick. These areas may contain ice wedges and massive ice bodies.

As noted, bedrock topography is evident across the site. A review of the Geological Survey of Canada Map 1860A indicates that bedrock conditions at the site consist of intrusive igneous rock, further classified as an undivided granitoid (consist predominantly of quartz, plagioclase, and alkali feldspar) from the Paleoproterozoic Cumberland batholith (2100 – 1800 million years ago).

2.1.9 Soil Quality and Sediment

2.1.9.1 Soil Quality

The surficial soils around Iqaluit are predominantly composed of a mixture of till, glaciofluvial deposits, and organic materials. Due to the region's location in the Canadian Arctic, the soils are influenced by a cold and polar climate. Negligible chemical weathering and plant action in the arctic environment contribute to poor soil profile development. The presence of permafrost, which is permanently frozen ground, significantly affects the soil characteristics. The surficial soils are often shallow, with some areas having a thin layer of organic materials on top of the rocky terrain.

Organic materials, such as peat and moss, are important for supporting vegetation in this harsh environment. The soil is generally poorly drained, as the frozen ground restricts water movement.

The Preliminary Geotechnical Investigation Report (Arcadis 2025) identified the following types of native soils at the LTWP site:

- Native overburden was encountered at 18 of the 22 air-rotary borehole locations. Cobbles/boulders were typically covered in vegetation (moss) at surface.
- Glaciofluvial Deposits (Sand) Sand soils were encountered in test pits advanced at the potential borrow sources. Soils encountered were predominantly sand, with some minor variation, and the exception of one sample, which was predominantly silt.
- No organic soils were encountered at borehole locations.
- At several locations in the boulder fields a layer of moss was present, but only on the upper surface of boulders/cobbles and less than 10 cm.

Arcadis undertook an Enhanced Phase 1 Environmental Assessment for the LTWP in 2023. Soil samples were collected at four areas of potential environmental concern (APECs); those being:

- The Iqaluit shooting range.
- A historical fuel spill near the Road to Nowhere on the south side of the site.
- The Niaqunnguk (Apex) pumping station, and
- The interim pumping station at Lake Qikiqtalik.

Results indicate that soil depth is generally very shallow to no more than 20 cm depth. All soil samples were submitted for laboratory analysis of:

- Benzene, toluene, ethylbenzene, xylenes (BTEX),
- Petroleum hydrocarbon (PHC) fractions F1 to F4, and
- Metals.

No detectable concentrations of BTEX and PHC F1 to F4 were reported in any of the soil samples collected. Metals were detected at varying concentrations in the soil samples; however, all concentrations were below applicable criteria. One of three samples collected near the firing range revealed levels of lead likely caused by spent ammunition. No contaminated soil was detected within the LTWP area.

2.1.9.2 Sediment

During the Arcadis site reconnaissance of 2023 observations were made of the presence of sediments near the LTWP waterbodies. Sediment deposits were not observed from the shorelines of Lake Geraldine of the two lakes forming the New Reservoir. At Lake Qikiqtalik, there did not appear to be significant accumulations of sediment deposited. The presumed esker west of Lake Qikiqtalik is composed of glaciofluvial deposits and these areas had previously been borrowed for materials.

The Niaqunnguk (Apex) River riverbed has deposits of sediments which vegetation has covered. The area where the temporary pumps are located was likely dredged and sediment disturbed and removed.

Geotechnical drilling in and around the Niaqunnguk (Apex) River was undertaken in 2025. In general, the site soils consisted of surficial cobbles and boulders mixed and underlain by sand containing additional frequent cobbles and boulders, with pockets of apparently pure ice and ice rich soils at depth down to bedrock. The river and underlying soil were frozen at the time of the investigation. See Table 2-7 below for details.

Table 2-7 Niaqunnguk (Apex) River Borehole Drilling Results

Location	Total Depth (mbg)	Stratigraphy Thickness (m)	Depth to Inferred bedrock (m)
		Sand With Silt To Silty Sand With Frequent Boulders And Pure Ice	
APEX2025-01	13.7	0.0-12.5	12.5
APEX2025-02	9.1	0.0-7.3	7.3
APEX2025-03	9.1	0.0-7.0	7.0
APEX2025-04	11.0	0.0-7.9	7.9
APEX2025-05	9.1	0.0-2.4	2.4

Locations APEX2025-02, APEX2025-03 and APEX2025-04 are located in the Niaqunnguk (Apex) River while APEX2025-01 and APEX2025-05 are on the shore.

2.1.10 Tidal Processes and Bathymetry

2.1.10.1 Tidal Processes

Iqaluit is located at the northern edge of Frobisher Bay which is characterized by semidiurnal tides with two high tides and two low tides occurring approximately within a 24-hour period. The average tidal range in Frobisher Bay is 7.8 m. Frobisher Bay also experiences occasional larger tidal ranges, with the maximum recorded tidal range reaching 11.7 m.

Lake Geraldine's flow is regulated by the operation of Lake Geraldine Dam, with the spillway at an elevation of 113 meters and is located approximately 2 km upstream from Frobisher Bay. The Niaqunnguk (Apex) River bridge located in the community of Apex has an elevation of approximately 15 m which does not allow for tides to crest past this point, As a result the tides of Frobisher Bay do not reach Lake Geraldine or upstream to the Niaqunnguk (Apex) River .

2.1.10.2 Bathymetry

Bathymetric surveys were undertaken of Lake Geraldine and Lake Qikiqtalik by Tetra Tech in 2019 (Tetra Tech 2019). The resulting mapping is presented in Figure 2-9 and Figure 2-10 below. These images include the sodar collection tracks. Areas in the images where no depth appears were too shallow to sample (<0.3 m).

Figure 2-9 Bathymetric Depths Results - Lake Geraldine

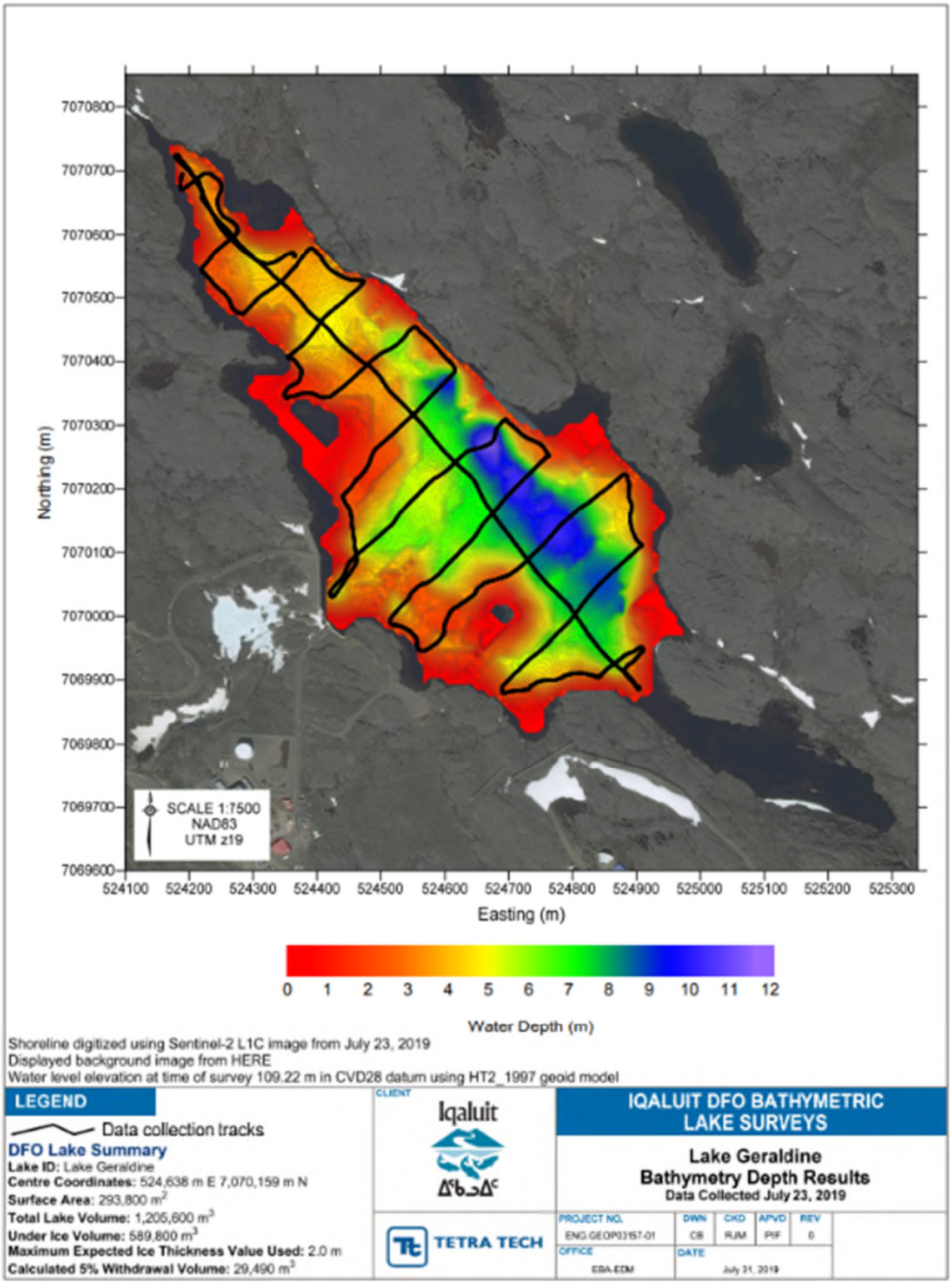
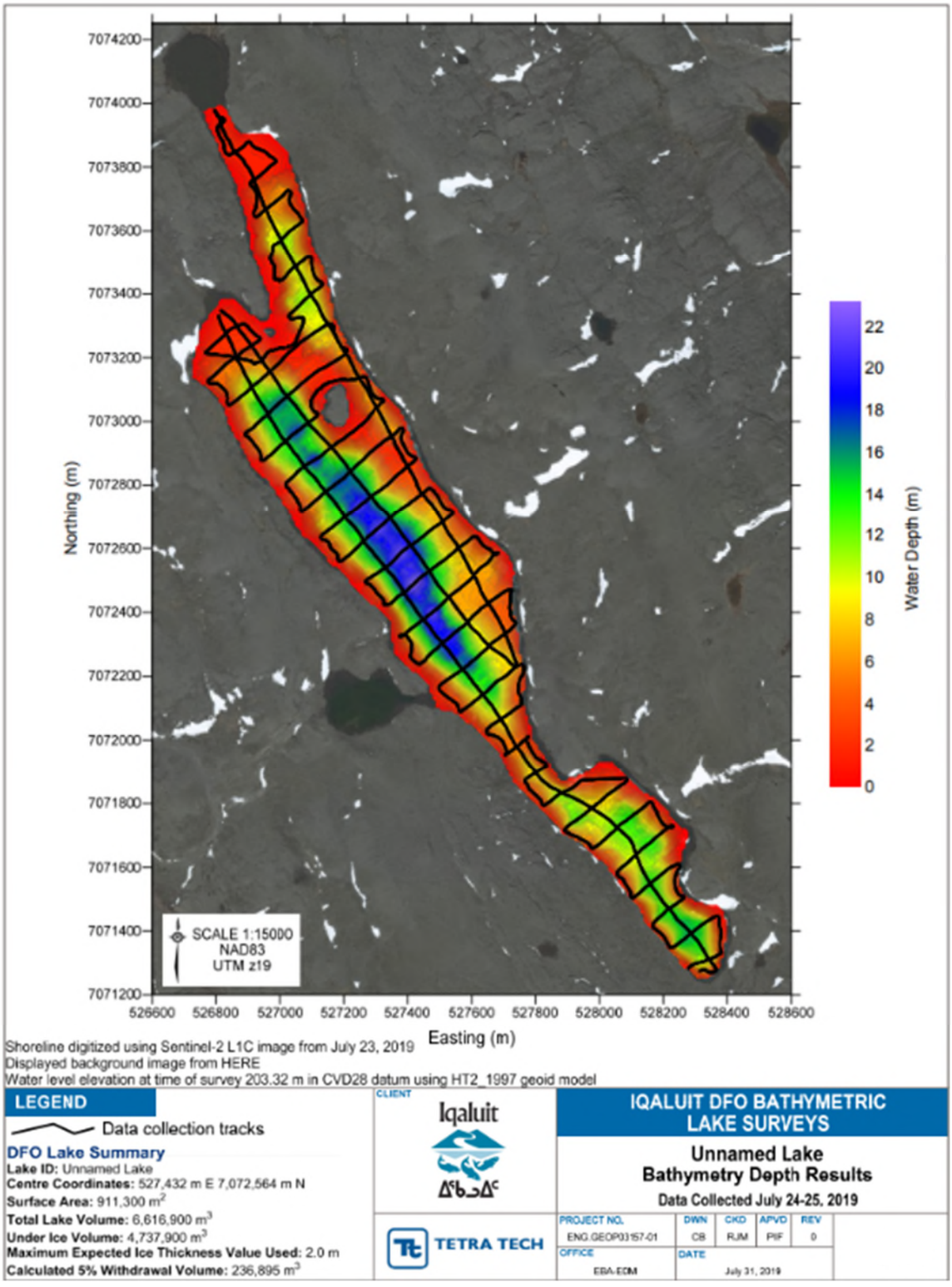


Figure 2-10 Bathymetric Depth Results - Lake Qikiqtalik



Included in the figures is information of the waterbodies required by the *DFO Protocol for Winter Withdrawal in the Northwest Territories*. See Table 2-8 for details.

Table 2-8 Comparison of Bathymetric Conditions

Land Use Type	Lake Geraldine	Lake Qikiqtalik
Lake ID	Lake Geraldine	Unnamed Lake
Centre Coordinates	524,638 m E, 7,070,159 m N	527,432 m E, 7,072,564 m N
Surface Area (m^2)	293,800	911,300
Total Lake Volume (m^3)	1,205,600	6,616,900
Under Ice Volume (m^3)	589,800	4,737,900
Max Expected Ice Thickness Value Used (m)	2.0	2.0
Calculated 5% withdrawal volume (m^3)	29,490	236,895

No bathymetric surveys of the Niaqunnguk (Apex) River are available. The Niaqunnguk (Apex) River was surveyed by Arcadis as part of the fish habitat eDNA assessment at four (4) intervals below the Road to Nowhere Bridge. The average channel width at this location was 26.6 meters, with a maximum width of 34 meters and a maximum depth of 0.8 meters. Generally, the Niaqunnguk (Apex) River is shallow and freezes solid in the winter.

There are five unnamed ponds located within the footprint of the proposed New Reservoir and the proposed Access Road footprint. These isolated waterbodies are primarily formed by snowmelt and rainwater collecting in permafrost depressions. The ponds substrate mainly comprises cobbles and boulders, gravel, and sand. The total pond area is approximately 74,000 m^2; however, the total pond volume is unknown. No bathymetric surveys of the five ponds are available.

2.1.11 Air Quality

Air quality is often thought of as a ‘big city’ concern or being associated with major industrial complexes, however, activities taking place in Iqaluit can also have an impact on ambient air quality conditions. Local sources of air contaminants in the City, can be stationary, mobile or diffuse, non-point sources and include activities such as heating homes and buildings, generating electricity through the burning of diesel fuel and operating vehicles and heavy equipment. Windblown dust from unpaved community roads can also be a source of suspended particulate matter during the months of spring and summer. Any activity pertaining to mineral exploration and extraction can also contribute to particulate emissions. Given the project’s scope and its potential impact on air quality, existing background air quality conditions in the study area need to be characterized as a baseline with the evaluation of historical air quality monitoring data. However, neither the City of Iqaluit nor the Government of Nunavut has established an air quality monitoring program that would report typical concentration of criteria air contaminants that might be used to estimate the current/existing air quality. Currently, Environment Canada reports Air Quality Health Index (AQHI) forecasts without any measured observations. The typical AQHI forecasts for the City and the Region appear to be reported at “Low Risk”.

Having said that, in screening the existing air quality condition, Arcadis referred to a historical study related to an ambient air quality monitoring program that was setup by Health Canada in response to a landfill fire incident in 2014. Health Canada monitored air quality conditions at four (4) locations setup throughout the City for a period between June 14 to September 22, 2014. Following the monitoring, a report titled “Air Pollution Concentrations in Iqaluit, Nunavut (June 14 – Sept 22, 2014) was issued by Water and Air Quality Bureau, Health Canada, dated September 22, 2014.

The report indicated that the criteria air pollution concentrations Particulate Matter 2.5 microns ($PM_{2.5}$), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Ozone (O_3) and Carbon Monoxide (CO) in Iqaluit were low since air monitoring began and did not require an emergency response or pose a threat to the public health. All 24-hour average concentrations were observed below available health standards; SO_2 was present at concentrations below the method detection limit and were not reported. $PM_{2.5}$-associated metals were low and were not presented either. Occasional peaks in hourly average $PM_{2.5}$ concentrations were observed when the wind blew from the landfill site and reached values as high as 85 µg/m^3. For comparison, between July 8 and 9, hourly average peaks in ambient $PM_{2.5}$ in areas impacted by forest fires in the Northwest Territories reached 170 µg/m^3 with 24-hour average values exceeding 100 µg/m^3. The median hourly-average $PM_{2.5}$ value in Iqaluit was noted at 2.14 µg/m^3 during the monitoring period. Median 24-hour average concentrations of volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) in Iqaluit have also been low throughout the monitoring period and were below Health Canada Reference concentrations. Ambient VOC and PAH concentrations in Iqaluit did not pose an unacceptable risk to health. Similarly, ambient Polychlorinated biphenyls (PCB) concentrations were well below applicable guidelines and did not pose an unacceptable risk to health.

Given the reference to this historical dataset and the forecasts typically provided by Environment Canada, qualitatively the City enjoys a safe and clean air quality. Furthermore, the *Environmental Guideline for Ambient Air Quality* (the Guideline) establishes standards for common air contaminants in ambient air throughout Nunavut. Numeric standards for fine particulate matter, total suspended particulate, NO_2, SO_2 and ground level ozone are adopted under the Guideline. These standards are typically applied for sources of air quality contaminants as part of managing air quality objectives in the region and are established at levels intended to protect human health and the surrounding environment.

2.1.12 Noise Levels

A review of the surrounding environment indicated that the areas are generally undisturbed lands, however, the City of Iqaluit is located to the southwest side of the LTWP site. A residential community located on the south side of Lake Geraldine, along Road to Nowhere and Annuit Street, is zoned as Low Density Residential and Medium Density Residential, and it is the closest Noise Sensitive Area (NSA) to the LTWP site. The Iqaluit International Airport is situated to the northwest of the City. The existing sources of noise in the vicinity of this community which form the ambient include transportation noise from road traffic and aircraft flyovers, and stationary sources of noise from commercial, institutional and industrial activities. There are currently no existing permanent sources of noise within the LTWP site.

The shooting range at the Road to Nowhere is the only permitted place to use firearms in the City of Iqaluit and is a source of intermittent noise. Gunfire was heard at the time of the site reconnaissance in September 2023.

The City of Iqaluit controls noise by means of Noise By-law #599, which is amended by By-laws #739 and #879. The Noise By-law contains a list of provisions that must be followed to prohibit noise disturbance to the public in the City.

2.1.13 Other Physical Valued Ecosystem Components

No other physical Valued Ecosystem Components (VEC) as determined through community consultation and/or literature review were identified. This section may get updates as further information is collected in the LTWP development.

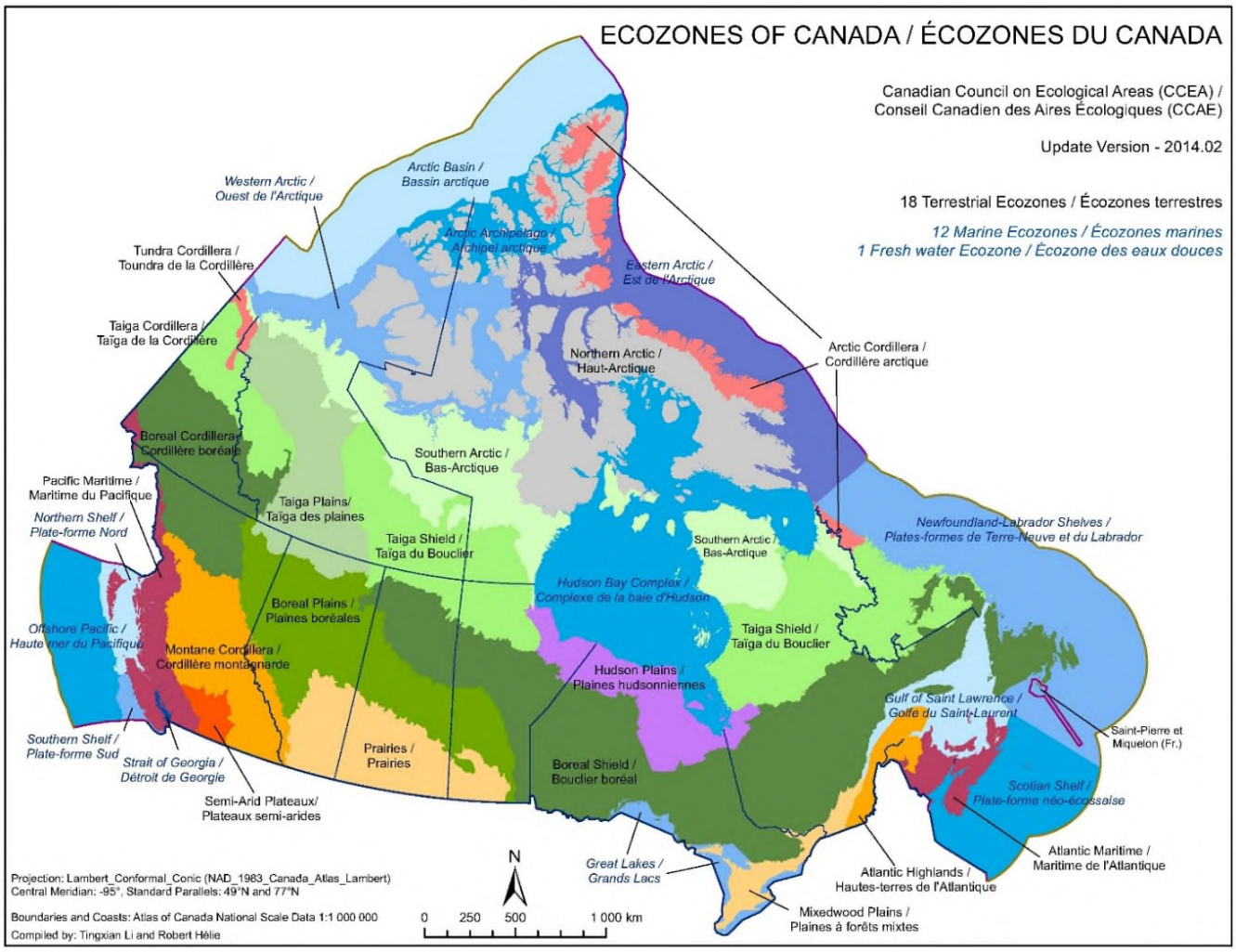
2.2 Biological Environment

2.2.1 Terrestrial Vegetation

The LTWP is in Ecoregion 28 – Meta Incognita Peninsula within the Tundra Biome and the Northern Arctic Ecozone (Figure 2-11) (CCEA-CCAE ,2014, EFC, 2023). The Meta Incognita Peninsula Ecoregion comprises coastal uplands along Frobisher Bay, including the City of Iqaluit and Hudson Strait, and inland areas to and including Amadjuak Lake (EFC, 2023). The ecoregion is underlain by continuous permafrost of low to medium ice content and is classified as having a low arctic ecoclimate (EFC, 2023).

The ecoregion is an ecologically significant area characterized by low growing dwarf shrubs, flowering plants, sedges, mosses and lichen resulting in a distinct Arctic tundra biome (Hik *et al*., 2006). These plants have evolved various strategies to adapt to nutrient poor, shallow soil and low temperature conditions including shallow root systems and the ability to synthesize at low temperatures. Dominant plant species include Arctic willow (*Salix arctica*), Arctic cotton grass (*Eriophorum scheuzeri*) and Arctic poppy (*Papaver radicatum*). On slopes, cushion plants, sedges, and forbs form a discontinuous cover. Sedges and mosses dominate the moist slopes, especially those associated with snowbanks (Tarnocai and Zoltai, 1988). Vegetation plays a crucial role in stabilizing soil, preventing erosion and contributing to the overall biodiversity of the ecosystem and providing habitat and food for wildlife (Dormann *et al*., 2007).

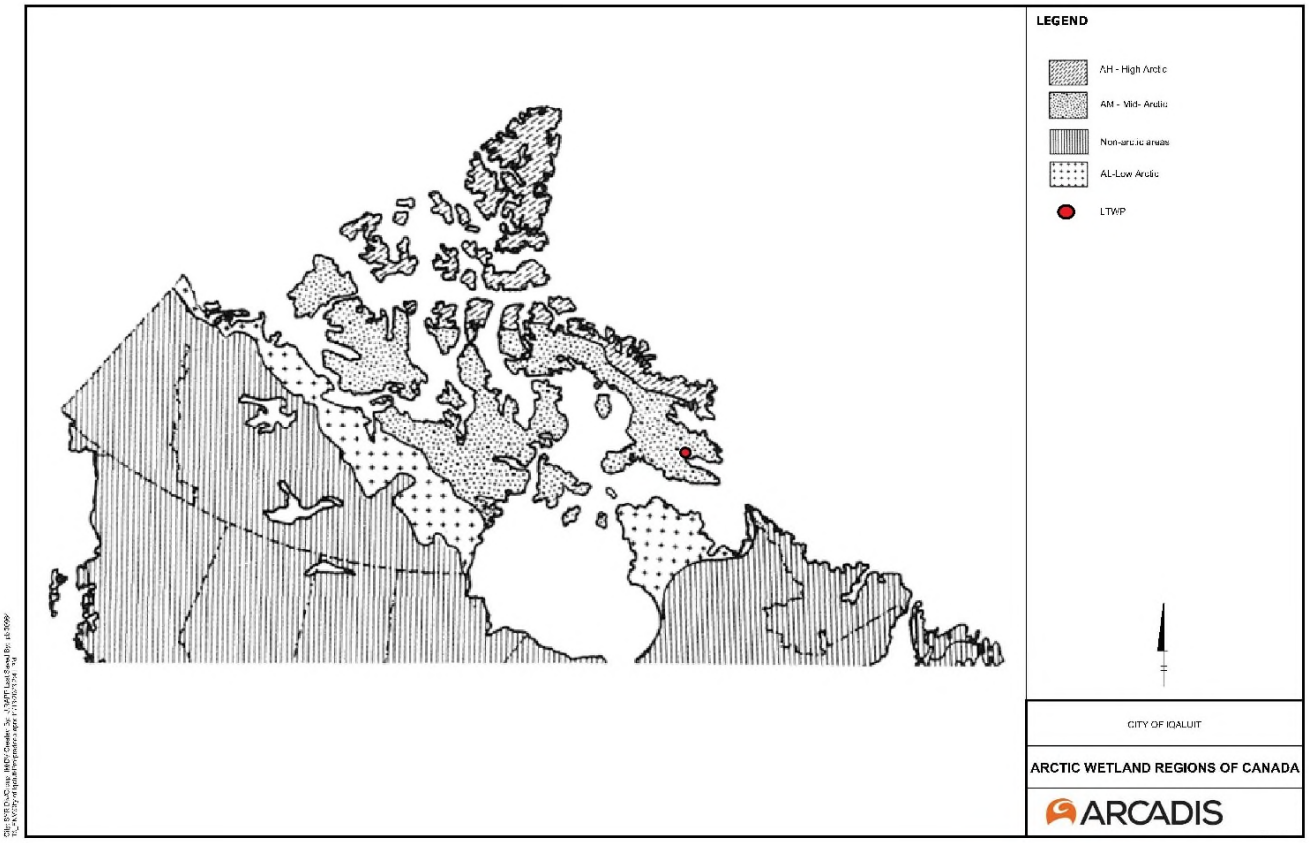
Figure 2-11 Ecozones of Canada



Source: CCEA-CCAE (2014)

The LTWP is in the Mid-Arctic Wetland Region. This wetland region covers some of the Canadian arctic islands (Banks, Victoria, southern Prince of Wales and Somerset), a large part of southern and northwestern Baffin Island and the northern and north-central Keewatin District (Tarnocai and Zoltai, 1988).

Figure 2-12 Arctic Wetland Regions of Canada



Source: Tarnocai and Zoltai (1988)

The wetlands are characterized by a continuous cover of sedges, cotton grass and mosses. In the Mid-Arctic Wetland Region, low centre lowland polygon fens are the most common type of wetland, while high-centre lowland polygon bogs are rare unless they are in eroding forms. Some small horizontal fens can also be found, particularly in depressions and on seepage slopes near snowbanks. These fens often have elevated peat mounds, and the vegetation cover consists of sedges and cotton grass, along with various moss species, including Sphagnum spp. These Sphagnum mosses are commonly found on rocks submerged in the fens and in some cases, they emerge to form peat mounds due to ice accumulation in the peat. These can be up to 50 cm higher than the fen surface and resemble an arctic version of palsa. Lichen, *Sphagnum* and other mosses, ericaceous shrubs and dwarf birch cover the peat mounds. In contrast, the high-centre polygons are commonly eroded by wind and are usually devoid of vegetation cover.

2.2.1.1 Reconnaissance Visit (2023) and Terrestrial Field Program (2024)

Arcadis' Senior Biologist Dr. Barbara Hard completed a reconnaissance visit from September 19 to 21, 2023 to identify natural features and assist project engineers in the determination of the location of the RWPS, the New Reservoir, and the route for the pipeline.

The reconnaissance visit was completed by walking the entire proposed route from Lake Qikiqtalik to Lake Geraldine along the existing emergency access road to the Road to Nowhere, across the Niaqunnguk (Apex) River

and along the existing emergency water pipeline that runs from the Niaqunnguk (Apex) River to Lake Geraldine. The temperature varied between 1 °C and 5 °C and the weather was sunny (September 19) and overcast and foggy (September 20 and 21).

Arcadis' staff Biologists Dr. Barbara Hard and Kelcey Bonnell completed a terrestrial field program from July 15 to 20, 2024, to identify and assess the landscape within the footprint of the LTWP. Field surveys to determine the presence of mammal and bird species including SAR, identify vegetation species and assess the quality of available habitat were completed by walking the entire proposed LTWP area along the proposed access road route, along the current and proposed pipeline routes, along the Road to Nowhere, throughout all proposed borrow pits, quarries, and laydown areas, and within the proposed New Reservoir area. The temperature ranged from 5 °C to 15 °C, and the weather was variable; cloudy with sunny breaks (July 15 and July 20), partly cloudy (July 16), light rain with moderate wind (July 17), rain with strong wind (July 18), and mostly cloudy (July 19).

Vegetation typical of the Arctic tundra biome was identified during the reconnaissance visit in 2023 and the terrestrial field program in 2024, including low-growing dwarf shrubs, flowering plants, sedges, mosses, and lichen. Dominant species include white heather (*Cassiope tetragona*), Arctic willow (*Salix arctica*), saxifrage (*Saxifraga* spp.), Arctic cotton grass (*Eriophorum scheuzeri*), crowberry (*Empetrum nigrum* subs*. hermaphroditum*) and Arctic poppy (*Papaver radicatum*). No plant Species at Risk (SAR) were observed. A list of all terrestrial plant species observed within the LTWP can be found in Table 2-9.

Table 2-9 Terrestrial Plant Species observed at the LTWP

Common Name	Scientific Name
Vascular Plants	
Alpine Bistort	*Bistorta vivipara*
Alpine Fescue	*Festuca brachyphylla*
Alpine Milk Vetch	*Astragalus alpinus*
Arctic Bladder-Campion	*Melandrium affine*
Arctic Cotton Grass	*Eriophorum scheuchzeri*
Arctic Poppy	*Papaver radicatum*
Arctic Thrift	*Armeria maritima* subsp*. sibirica*
Arctic Willow	*Salix arctica*
Bitter Cress	*Cardamine pratensis*
Black Bearberry	*Arctostaphylos alpina*
Bog Bilberry (Blueberry)	*Vaccinium uliginosum*
Chestnut Rush	*Juncus castaneus*
Common Cotton Grass	*Eriophorum angustifolium*
Crowberry	*Empetrum nigrum* subs*. hermaphroditum*
Dwarf Birch	*Betula glandulosa*
Dwarf Fireweed	*Chamerion latifolium*
False Asphodel	*Tofieldia pusilla*
Flame Lousewort	*Pedicularis flammea*
Golden Saxifrage	*Chrysosplenium tetrandrum*
Grass	*Poa* spp*.*
Hairy Lousewort	*Pedicularis hirsuta*

Common Name	Scientific Name
Horsetail	*Equisetum arvense*
Labrador Tea	*Rhododendron groenlandicum*
Lapland Rosebay	*Rhododendron lapponicum*
Large-flowered Wintergreen	*Pyrola grandiflora*
Lingonberry (Rock Cranberry)	*Vaccinium vitis-idaea*
Moss Campion	*Silene acaulis*
Mountain Avens	*Dryas integrifolia*
Mountain Cranberry	*Vaccinium vitis-idaea* subsp. *minor*
Mouse-ear Chickweed	*Cerastium arvense*
Net-vein Willow	*Salix reticulata*
Northern Clubmoss	*Lycopodium annotinum*
Northern Willow	*Salix arctophila*
Purple Bladder-Campion	*Melandrium apetalum*
Purple Mountain Saxifrage	*Saxifraga oppositifolia*
Red Bearberry	*Arctostaphylos rubra*
Sea Thrift	*Armeria maritima*
Sedges	*Carex* spp.
Snowbed Willow	*Salix herbacea*
Tufted Saxifrage	*Saxifraga cespitos*
White Heather (Arctic Bell Heather)	*Cassiope tetragona*
Yellow Marsh Saxifrage	*Saxifraga hirculus*
Yellow Oxytrope	*Oxytropis maydelliana*
Mosses	
Arctic Moss	*Calliergon gianteum*
Peat Moss	*Sphagnum* sp.
Woolly Fringe-Moss	*Racomitrium lanuginosum*
Lichen	
Alpine Bloodspot Lichen	*Ophioparma ventosa*
Arctic Butterfinger Lichen	*Dactylina arctica*
Boreal Pixie-cup Lichen	*Cladonia boreali*
Fine Rockwool Lichen	*Pseudephebe pubescens*
Fringed Rocktribe Lichen	*Umbilicaria cylindrica*
Peppered Rock Tripe	*Umbilicaria deustra*
Reindeer Lichen	*Cladonia rangiferina*
Rock Tripe	*Umbilicaria sp.*
Rosette lichen	*Physcia* spp.
Snow Lichen	*Stereocaulon spathuliferum*
Star-tipped Reindeer Lichen	*Cladonia stelaris*
Sunburst Lichen	*Arctoparmelia centrifuga*
Orange Wall Lichen	*Xanthoria* sp.
Whiteworm Lichen	*Thamniola vermicularis*

2.2.2 Terrestrial Wildlife and Habitat

A review of existing literature was undertaken to determine the terrestrial wildlife species present, their habitat requirements and any critical habitat.

Based on this review, it was determined that 10 species of terrestrial mammal could occur on or adjacent to the LTWP. Table 2-10 provides a list of these species and their habitat requirements. It should be noted that during the reconnaissance visit (September 19th to 21st, 2023) and terrestrial and aquatic field program (July 15th to 20th, 2024), no mammals were observed.

Table 2-10 Terrestrial Wildlife Species with the Potential to Occur on the LTWP or Directly Adjacent to the LTWP

Common Name	Scientific Name	Description and Habitat Requirements
Arctic hare	*Lepus arcticus*	Large hare known to inhabit the Arctic tundra on northern hill slopes in the winter and low plains during the summer. In winter they have white coats, and their ears are tipped with black. In summer their coats range in colour from gray to brown. They tend to be solitary or in family groups. Feed on twigs, roots of arctic willow, crowberry and in some instances meat. Found throughout Nunavut.
Arctic fox	*Alopex lagopus*	Small fox found throughout the Arctic tundra. Live in dens dug in slopes near rivers, lakes or on higher areas free of permafrost. They are solitary except during breeding season. Females mature at 9 months and bear young once a year. Litter size is usually between 5 and 8 pups. Feed primarily on lemmings and voles. Will also eat Arctic hare and ptarmigan. Fluctuations in lemming populations have been shown to impact fox reproduction. Found throughout Nunavut.
Arctic wolf	*Canis lupus arctos*	Subspecies of grey wolf inhabits the High Arctic tundra. Colour varies from white to black and can be shades of grey, cream, brown and orange, black. Wolves are highly social and have a hierarchical pack structure. Packs travel, hunt, breed and raise young together. They feed on caribou and muskox as well as hares, foxes, rodents, fish, birds, and eggs. Found throughout Nunavut.
Caribou Barren-ground population Baffin Island subpopulation	*Rangifer tarandus*	See Section 3.3.1.1.
Brown lemming	*Lemmus trimucronatus*	Small reddish-brown rodent that inhabits Arctic tundra or subarctic tundra above the tree line. Non-migratory species that live underground in colonies in wet areas covered in grasses and sedges. They can also be found along streams and lakes. Feed mainly on tundra grass, sedge, moss, bark, berries, lichens, and roots. Range includes southern Baffin region, northern Kivalliq region and southwestern Kitikmeot region.

Common Name	Scientific Name	Description and Habitat Requirements
Ermine	*Mustela erminea*	Short-tailed weasel considered a habitat generalist. Habitat is determined by the presence of prey species, primarily lemmings. Ermine use other small mammal burrows as well as rock piles. Found in fields, meadows, riverbanks, parklands, and tundra.
Peary land collared lemming	*Dicrostonyx groenlandicus*	A small rodent that averages 13 to 16 cm in length and inhabits the Arctic tundra. Its coat changes seasonally; white in the winter and grey or brown in the summer. This lemming is the only rodent who has a completely white coat in the winter. This species of lemming creates burrows up to 6 m in length that will lead to a nest. Nests are made of grasses and are found below the snow or inside a snowbank. Breeding season is from March to September with an average litter of 4-5. They reproduce 2 to 3 times a year. Diet consists primarily of dwarf willow leaves and forbs, although it can also include sedges, berries, buds, and twigs. Found throughout the Baffin region.
Polar bear	*Ursus maritimus*	See Section 3.3.1.2.
Red fox	*Vulpes vulpes*	Larger than the Arctic fox Live close to lakeshores, rivers, open areas, and the tundra. Home ranges are between 5 and 35 km^2. Breeding occurs between February and March. Omnivore that preys on small mammals during the winter such as moles, shrews, muskrats, voles, and mice as well as hares. Summer diet includes birds' eggs, insects as well as grasses and berries. Found throughout Baffin Island.
Wolverine	*Gulo gulo*	See Section 3.3.1.2

Sources: Advisian, 2017; GN, 2023a-h

National Wildlife Areas (NWA) have been established through the Wildlife Area Regulations of the *Canada Wildlife Act*. They have been created and are managed to promote wildlife conservation and research on federally owned lands. NWAs contain nationally significant habitat for both animals and plants. There are five NWAs in Nunavut. The LTWP is not in or adjacent to any of these NWAs.

2.2.3 Species at Risk and Migratory Birds

2.2.3.1 Species at Risk

The conservation of wildlife in Nunavut is shared by the federal and territorial governments, the Nunavut Wildlife Management Board (NWMB), the Regional Wildlife Organizations (RWOs) and community Hunters and Trappers Organizations (HTOs). Migratory birds, aquatic species and terrestrial species found on federal lands are within the purview of the Federal Government. All other species are within the purview of the Government of Nunavut. The NWMB is responsible for wildlife management in the Nunavut Settlement Area as outlined in Article 5 of the *Nunavut Agreement.* Section 5.2.33 and 5.2.34 of the *Nunavut Agreement* outlines the primary functions of the NWMB with respect to SAR. These functions include approval of designation of rare (Special Concern), Threatened and Endangered species, approval of management and protection plans for wildlife such as recovery documents,

approval of the establishment, disestablishment, and changes to Conservation Area boundaries as well as approval of management and protection plans of specific wildlife habitats including Conservation Areas, Territorial Parks, and National Parks (GC, 2021; GN, 2003).

The Nunavut *Wildlife Act* is a framework that manages wildlife and their respective habitat in Nunavut. This includes the conservation, protection, and recovery of SAR. The *Act* outlines the process for designating SAR in the territory, including provisions for interim and emergency listings and for the recovery of listed species. There are no species as yet listed under the *Act* in Nunavut (GC, 2021; GN, 2003).

Federal designations of SAR listed under Schedule 1 of *Species at Risk Act* (*SARA*) from 2002 (as amended) which provide for the protection of wildlife and plant species and their critical habitat across Canada. Section 33 of the SARA prohibits damaging or destroying the residence of a listed threatened, endangered, or extirpated species. SARA defines residence as: “a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating” (SARA, 2002).

Species designated as special concern are not protected to the same degree as Schedule 1 species; however, they were included in the desktop assessment for due diligence purposes.

Based on a background review of several databases and the reconnaissance visit, Arcadis compiled a list of SAR that could potentially occur on or near the LTWP, SAR ranges and habitat preferences were examined in relation to the LTWP. The likelihood for SAR or SAR habitat presence is indicated as low, moderate, and high. SAR identified to potentially occur on or in the vicinity of the LTWP are shown in Figure 2-11.

Table 2-11 Federally Listed Terrestrial SAR with the Potential to Occur on the LTWP or Directly Adjacent to the LTWP

Common Name	Scientific Name	SARA Status	Likelihood of Occurrence
Birds			
Harlequin Duck (Eastern Population)	*Histrionicus histrionicus*	SC	Moderate to High
Red Knot	*Calidris canutus rufa*	END	Moderate to High
Red-necked Phalarope	*Phalaropus lobatus*	SC	Moderate to High
Mammals			
Barren-ground Caribou	*Rangifer tarandus*	Listed by COSEWIC as threatened in 2017. Under consideration for uplisting to threatened under SARA	High
Polar Bear	*Ursus maritimus*	SC	High
Wolverine	*Gulo gulo*	SC	High

Source: COSEWIC, 2007, 2013, 2014a, 2014b, 2016, 2017, 2018

Legend:

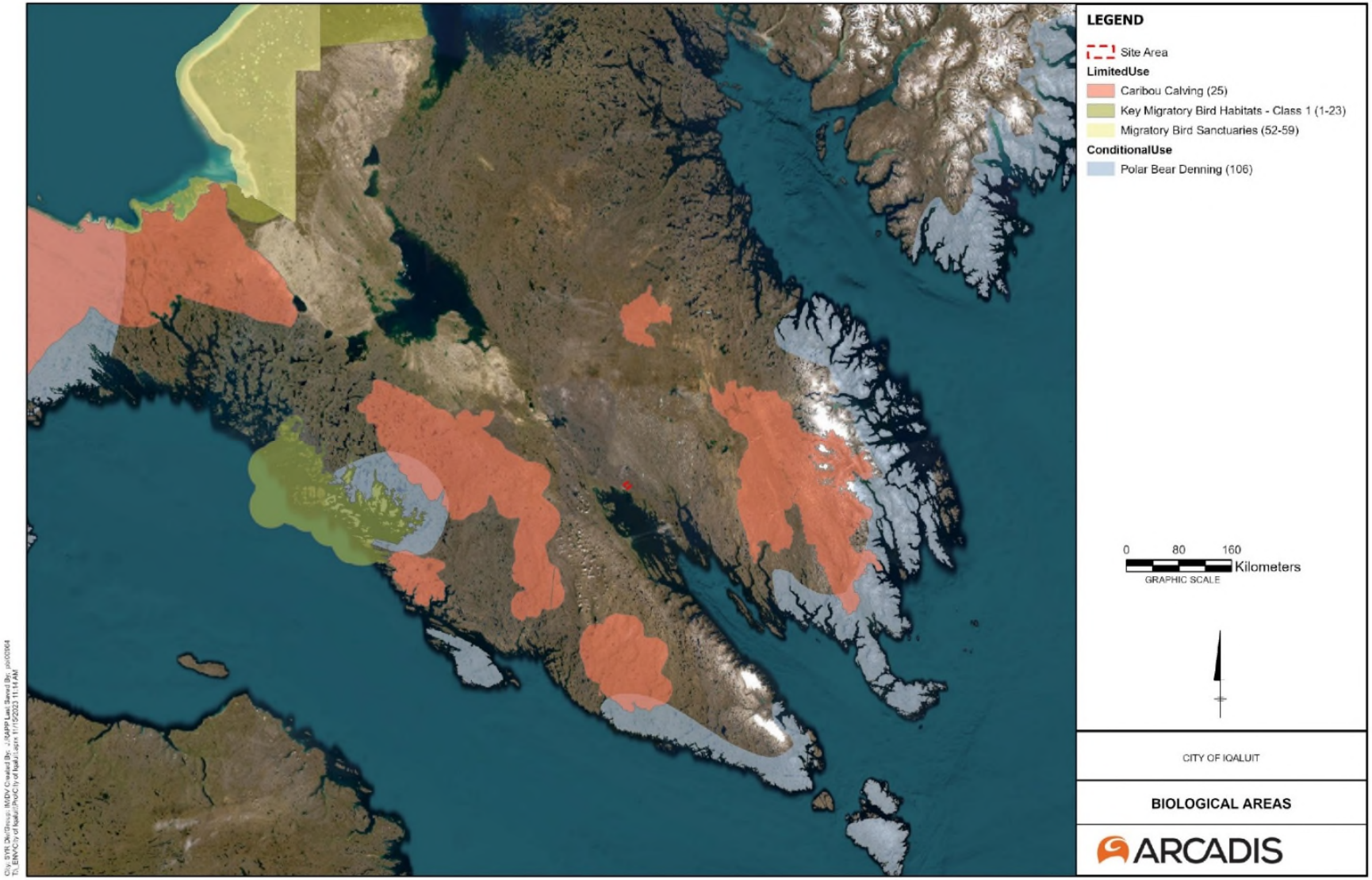
SARA: Species at Risk Act
END: Endangered
THR: Threatened
SC: Special Concern

Of the terrestrial SAR included in the table above, six are federally listed SAR and one SAR, barren-ground caribou (*Rangifer tarandus*), is under consideration for uplisting to threatened. Of these species, four species, harlequin duck (*Histrionicus histrionicus*), red-necked phalarope (*Phalaropus lobatus*), polar bear (*Ursus maritimus*) and wolverine (*Gulo gulo*), are listed as special concern and one species, red knot (*Calidris canutus rufa*), is listed as endangered species (GC, 2023a; SARA, 2002). No critical habitat is recorded for the LTWP (GC, 2023b).

The three bird species were determined to have a moderate to high likelihood of occurrence while the three mammal species were determined to have a high likelihood of occurrence on the LTWP.

For the purposes of this report, a more detailed description of those SAR that have a high likelihood of occurrence on the LWTP is provided below.

Figure 2-13 Biological Areas



Source: 2021 DNLUP INTERACTIVE MAP A: Land Use Designations

2.2.3.2 Barren-Ground Caribou

All caribou belong to a single species with three subspecies in Canada: Peary caribou, barren-ground and woodland caribou. The barren-ground caribou are distributed throughout the arctic and subarctic and are found throughout most of Baffin Island, including the LTWP. Barren-ground caribou are considered a “keystone” species as they play a significant ecological and cultural role for people of the North (COSEWIC, 2016; GC, 2021).

Barren-ground caribou are the only ungulates found on Baffin Island. There are three subpopulations within the Baffin Island population, South Baffin, North Baffin, and Northeast Baffin. The herd size was estimated at 4,652 individuals in 2014. The South Baffin subpopulations range includes Iqaluit and the LTWP.

Barren-ground caribou, dark brown with a creamy white neck, mane and underbelly, inhabit the barren land or tundra. They require a large range to accommodate changes in snow cover, plant growth and predation. They migrate yearly and gather in large groups on common calving grounds in the spring. They return to the same calving grounds every year. Calving occurs in areas with minimal exposure to predators, with maximum nutrition such as high rocky areas and open tundra. During the winter, barren-ground caribou migrate to shallow snow-covered areas while in the summer they are found in cool, damp, windy habitats where they can easily forage and avoid insects. In the summer, they feed mainly on grasses, sedges and shrubs, and lichens during the winter months (COSEWIC, 2016; GC, 2021).

A letter dated September 22, 2022, from the Minister of Environment and Climate Change Canada (ECCC) to the Acting Chairperson of the NWMB, confirmed an agreement to accept the proposed listing of the barren-ground population of caribou as threatened under SARA. The NWMB was consulted by ECCC under the Nunavut Land Claims Agreement Article 5 decision making process (NWRB, 2022).

Harvested Caribou Locations (1998-2001) in the Iqaluit Deep Sea Harbour Baseline Report showed caribou harvested between 1998 and 2001. During that time period, large numbers of caribou were harvested in the vicinity of Iqaluit. However, Inuit Qaujimajatuqangit (IQ) information collected by Advision in 2016 indicated that caribou, although observed near Iqaluit in 2006, may have moved north and their population might have declined. It was also reported by Inuit Field Technicians that caribou are not often seen near Iqaluit and that hunters are travelling further north in order to hunt (Advisian, 2017). The caribou calving grounds mapped in the 2023 Recommended Nunavut Land Use Plan show that the calving grounds are not located on or adjacent to the LTWP (NPC, 2023). See

Figure 2-13 for mapping purposes. Migration routes to and from the calving grounds are not provided in this document.

During the terrestrial field program (July 15 to 20, 2024), bones of barren-ground caribou were observed throughout the LTWP. The bones were weathered, covered in moss, and had been left untouched for many years. Based on conversations with locals during the terrestrial field program, barren-ground caribou herds have not been seen in the Iqaluit area and around the LTWP for over 16 years. No live caribou were observed within the LTWP area during the 2023 or 2024 field visits.

2.2.3.3 Polar Bear

Polar bear is an apex predator distributed throughout the Canadian Arctic. It is considered a “sentinel species” for both environmental contaminants and climate change, as well as an “indicator species” for Arctic marine ecosystem change. The distribution of the polar bear is strongly associated with the loss and changes to the distribution, temporal duration, and quality of sea-ice (COSEWIC, 2018; GC, 2021; PBTC, 2022).

Polar bears have both a marine (sea-ice) and terrestrial portion to their life cycle. The ecoregions of the polar bear are based on ice habitat. Most Baffin Island polar bears are located within the “Seasonal Ice Ecoregion”. In this ecoregion, the sea-ice melts completely in summer and the bears move to land. Polar bears are carnivorous and are found in greater numbers on the sea-ice over the continental shelves and shallow (<300 m) basins, as prey occur in higher density than over deeper waters. Prey species are primarily seals, ringed seal (*Pusa hispida*), bearded seal (*Erignathus barbatus*) harp seal (*Pagophilus groenlandicus*) and harbour seal (*Phoca vitulina*), as well as walrus (*Odobenus rosmarus*), beluga (*Delphinapterus leucas*), and narwhal (*Monodon monoceros*). Polar bears will travel hundreds of kilometres over land in order to forage for seals. Polar bears will also feed on vegetation, berries, eggs and birds (COSEWIC, 2018; GC; 2021; PBTC, 2022).

Breeding occurs between March and June. Pregnant females excavate snow dens during the autumn or early winter on land and occasionally on multi-year ice. The dens are usually less than 25 km from coastline. Litters are typically 1 to 2 cubs and are born between November and January (COSEWIC, 2018; GC, 2021).

There are 14 Canadian subpopulations or management units. The Davis Strait (DS) subpopulation is delineated in Canada within the Labrador Sea, eastern Hudson Strait, Davis Strait south of Cape Dyer, and along a portion of southwest Greenland. The range of the DS subpopulation extends through the LTWP. The Polar Bear Technical Committee (PBTC) annual report to Polar Bear Administrative Committee (PBAC) provides available scientific information and Technical Ecological Knowledge (TEK) on the 14 subpopulations. Between 2017-2018 the DS subpopulation was estimated to be 2,015 individuals (COSEWIC, 2018; GC; 2021; PBTC, 2022).

The polar bear was listed as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1991 and listed on Schedule 1 of SARA in 2011. Polar bears are not listed in Nunavut under the *Nunavut Wildlife Act* (2015). The polar bear was listed as a globally Vulnerable species under the International Union for Conservation of Nature (IUCN) Red List in 2015 (IUCN, 2023).

Several designated polar bear denning sites have been identified in the 2023 Recommended Nunavut Land Use Plan. See

Figure 2-13 for mapping purposes. These denning sites are not within or adjacent to the LTWP boundaries (NPC, 2023). Occasional sightings of polar bear in Iqaluit have been made in recent years (CBC, 2017; CBC, 2016; Nunatsiaq News, 2022). IQ also reported that polar bears have been recently observed in Iqaluit (Advisian, 2017). Polar bear may move through the LTWP during the summer months, but it would be unlikely for these bears to be on the LTWP for extended periods. No polar bears were observed in the LTWP area during the 2023 or 2024 field visits.

2.2.3.4 Wolverine

Wolverine is a wide-ranging medium-sized solitary mammal, that is both scavenger and predator. The wolverine is the largest terrestrial member of the weasel family. Wolverines are potential indicators of ecological integrity as they require large, connected, and intact ecosystems. Potential threats to wolverine populations include habitat loss, habitat fragmentation, as well as ungulate (caribou) population declines, an important food source (COSEWIC, 2014b; GC, 2021).

Wolverines are found in both treed and treeless habitats, such as the tundra, at all elevations. They prefer ecologically intact areas where prey species, and other carnivore species that provide ungulate carrion. Wolverines follow migrating caribou and scavenge carcasses left by other carnivores. Wolverines will travel long distances in search of food. Home ranges are between 50 and 400 km^2 for females and between 230 and 1580 km^2 for males. Fresh prey is consumed in higher quantities during the summer months, while carrion and cached food is consumed during the winter months. Prey species might also include rodents and hares (COSEWIC, 2014b; GC, 2021).

Wolverines are limited by food availability, suitable natal and maternal den sites, and rendezvous sites. Wolverines have very specific den requirements. Isolated maternity dens are found under snow covered rocks, along eskers, caves, and snow tunnels. They breed between March and April and give birth every other year to a litter of up to 4 pups (Advisian, 2017; COSEWIC, 2014b; GC, 2021).

The wolverine was listed as a species of Special Concern by the COSEWIC in 2014 and listed on Schedule 1 of SARA in 2018. Wolverines are not listed in Nunavut under the Nunavut *Wildlife Act* (2015). The wolverine is listed globally as a Least Concern under the IUCN Red List in 2015 (IUCN, 2023; SARA, 2023).

Wolverines have the potential to move through the LTWP. No wolverines or denning sites were observed in the LTWP area during the 2023 or 2024 field visits.

2.2.3.5 Migratory Birds

Migratory birds are protected in Canada under the federal *Migratory Bird Convention Act* (*MBCA*) from 1994 (as amended). This *Act* protects migratory birds, as well as their eggs and nests. Under the *Act*, it is prohibited to disturb or harass migratory birds and destroy their eggs, fledglings, or nests (GC, 1994).

Migratory Bird Sanctuaries have been established and managed under the authority of the MBCA and the Migratory Bird Sanctuary Regulations to protect migratory birds and their nests, eggs, and habitat. There are 8 sanctuaries in the Nunavut Settlement Area. The LTWP is not located within or adjacent to any Migratory Bird Sanctuaries (NPC, 2023). See

Figure 2-13 for mapping purposes.

Key Migratory Bird Habitat sites have been identified in the 2023 Recommended Nunavut Land Use Plan. See

Figure 2-13 for mapping purposes. The LTWP is not located within or adjacent to any of the identified Key Migratory Bird Habitat Class 1 sites. Class 1 sites are limited use areas within which incompatible uses are prohibited such as mineral exploration and production, oil and gas exploration and production, quarries, hydro-electrical and related infrastructure, wind turbines over 15 m in height and related infrastructure as well as linear infrastructure (NPC, 2023).

Important Bird Areas (IBA) are discrete sites that have been established to support specific groups of birds: threatened birds, large groups of birds, and birds restricted by range or by habitat. The LTWP is not located within an Important Bird Area (IBA). An IBA, Markham Bay Eider Colony (NU101) is located approximately 130 km to the southwest of Iqaluit and the LTWP. This IBA is situated on the southern coast of Baffin Island in eastern Nunavut. The site is located on the southeastern tip of a large island in Markham Bay (IBA Canada, 2023). This IBA supports a large common eider (*Somateria mollissima*) colony consisting of approximately 2,200 nests. Other birds, observed in this IBA, during the breeding season included long-tailed duck (*Clangula hyemalis*), king eider (*Somateria spectabilis*), glaucous gull (*Larus hyperboreus*), Thayers gull (*Larus thayeri*), black guillemot (*Cepphus grille*), and snow bunting (*Plectrophenax nivalis*) (IBA Canada, 2023).

Based on a background review of several databases and the 2023 and 2024 field visits, Arcadis compiled a list of 42 breeding birds whose ranges overlap the LTWP and are shown in Table 2-12. The LTWP provides breeding, nesting, roosting, foraging, and migratory staging for many species of bird.

Table 2-12 Bird Species with the Potential to Occur on the LTWP or Directly Adjacent to the LTWP

Common Name	Scientific Name
American Golden Plover	*Pluvialis dominica*
American Pipit	*Anthus rubescens*
Arctic Tern	*Sterna paradisaea*
Black Guillemot	*Cepphus grille*
Cackling Goose	*Branta hutchinsii*
Canada Goose	*Branta canadensis*
Common Eider	*Somateria mollissima*
Common Loon	*Gavia immer*
Common Raven	*Corvus corax*
Common Redpoll	*Acanthis flammea*
Glaucous Gull	*Larus hyperboreus*
Gyrfalcon	*Falco rusticolus*
Harlequin Duck	*Histrionicus histrionicus*
Herring Gull	*Larus argentatus*
Hoary Redpoll	*Acanthis hornemanni*
Horned Lark	Eremophila alpestris
Iceland Gull	*Larus glaucoides*
King Eider	*Somateria spectabilis*
Lapland Longspur	*Calcarius lapponicus*
Long-tailed Duck	*Clangula hyemalis*
Long-tailed Jaeger	*Stercorarius longicaudus*
Northern Fulmer	*Fulmarus glacialis*
Northern Pintail	*Anas acuta*
Northern Wheatear	*Oenanthe oenanthe*
Pacific Loon	*Gavia pacifica*

Common Name	Scientific Name
Peregrine Falcon	*Falco peregrinus*
Purple Sandpiper	*Calidris maritima*
Razorbill	*Alca torda*
Red-breasted Merganser	*Mergus serrator*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicarius*
Red-throated Loon	*Gavia stellata*
Rock Ptarmigan	*Lagopus muta*
Ross's Goose	*Anser rossii*
Ruddy Turnstone	*Arenaria interpres*
Rough-legged Hawk	*Buteo lagopus*
Semipalmated Plover	*Charadrius semipalmatus*
Snow Bunting	*Plectrophenax nivalis*
Snowy Owl	*Bubo scandiacus*
Thick-billed Murre	*Uria lomvia*
Tundra Swan	*Cygnus columbianus*
White-rumped Sandpiper	*White-rumped Sandpiper*

Sources: eBird, 2023; Cornell Lab of Ornithology, 2023; iNaturalist, 2023; Latour, P.B., *et al.*, 2008)

During the reconnaissance visit (September 19 to 21, 2023), three species of bird were observed, common raven (*Corvus corax*), Canada goose (*Branta canadensis*) and snow bunting (*Plectrophenax nivalis*). During the terrestrial field program (July 15 to 20, 2024), five species of bird were observed, American pipit (*Anthus rubescens*), gull (*Larus* sp.), horned lark (*Eremophila alpestris*), common raven and snow bunting. Common raven is a year-round resident, whereas the majority of breeding birds are migratory, including American pipit, Canada goose, horned lark and snow bunting.

The LTWP is within Nesting Zone N10 (Arctic Plains and Mountains, Bird Conservation Region 3) (ECCC, 2023). The nesting period for breeding birds in N10 is between May 17 and August 19 with the highest percentage of birds actively nesting (61 to 100 percent) between June 8 and July 22. Within the species used to determine the nesting period, 38 are known to nest in open habitat present at the LTWP (ECCC, 2023).

2.2.4 Aquatic Species and Habitat

In order to assess and mitigate potential project-related impacts on the recipient waterbodies, a description of the current aquatic communities and habitats has been prepared for obtaining permits under the *Fisheries Act* and the NIRB. This description is based on an analysis of existing scientific and technical literature, as well as traditional knowledge. It primarily focuses on Lake Qikiqtalik, Niaqunnguk (Apex) River, the two lakes that constitute the New Reservoir and Lake Geraldine. The primary objective of this review was to determine whether the existing environment supports aquatic species and critical habitats that may be influenced by the LTWP. Additionally, anecdotal information obtained during site visits has been integrated into the review.

2.2.4.1 Fisheries of Baffin Island

Richardson *et al.* (2001) provided a list of fish species present in freshwater habitat in Nunavut (Table 2-13). Although none of these species are classified as SAR, many of these species are used as sustenance species in northern communities (Reist *et al*. 2006).

Table 2-13 List of Fish Species Occurring in Freshwaters in Nunavut

Common Name	Scientific Name
CODS	**GADIDAE**
Burbot	*Lota lota* (Linnaeus, 1758)
CARPS and MINNOWS	**CYPRINIDAE**
Lake chub	*Couesius plumbeus (Agassiz, 1850)*
PERCHES	**PERCIDAE**
Walleye	*Stizostedion vitreum* (Mitvhill, 1818)
PIKES	**ESOCIDAE**
Northern pike	*Esox lucius* (Linnaeus, 1758)
SCULPINS	**COTTIDAE**
Fourhorn sculpin	*Myoxocephalus quadricornis* (Linnaeus, 1758)
Slimy sculpin	*Cottus cognatus* (Richardson, 1836)
Spoonhead sculpin	*Cottus ricei* (Nelson, 1876)
SMELTS	**OSMERIDAE**
Rainbow smelt	*Osmerus mordax* (Mitchill, 1846)
STICKLEBACKS	**GASTEROSTEIDAE**
Ninespine stickleback	*Pungitius pungitius* (Linnaeus, 1758)
Threespine stickleback	*Gasterosteus aculeatus* (Linnaeus, 1758)
SUCKERS	**CATOSTOMIDAE**
Longnose sucker	*Catostomus ollowing* (Forster, 1753)
White sucker	*Catostomus commersoni* (Lacepede, 1803)
TROUTS	**SALMONIDAE**
Arctic char	*Salvelinus alpinus* (Linnaeus, 1758)
Arctic cisco	*Coregonus autumnalis* (Pallas, 1776)
Arctic grayling	*Thymallus arcticus* (Pallas, 1776)
Broad whitefish	*Coregonus nasus* (Pallas, 1776)
Lake cisco (lake herring)	*Coregonus artedi* (Le Sueur, 1818)
Lake trout	*Salvelinus namaycush* (Walbaum, 1792)
Lake whitefish	*Coregonus clupeaformis* (Mitchill, 1818)
Least cisco	*Coregonus sardinella* (Valenciennes, 1848)
Round whitefish	*Prosopium cylindraceum* (Pallas, 1784)
TROUT-PERCHES	**PERCOPSIDAE**
Trout-perch	*Percopsis omiscomaycus* (Walbaum, 1792)

While this list is accurate for the mainland of Nunavut, the fish community of Baffin Island is much more restricted due in part to its high latitude and in part because it is an island. The Baffin Island freshwater fish community is much less diverse and consists of Arctic char (*Salvelinus alpinus*), ninespine stickleback (*Pungitius pungitius*), threespine stickleback (*Gasterosteus aculeatus*) and arctic grayling (*Thymallus arcticus*).

2.2.4.2 Arctic Char

Arctic char is a highly valued sportfish, subsistence fish and traditional Inuit fish on Baffin Island and across Nunavut. Arctic char exhibits many different life history traits across their arctic distribution and are the most northerly distributed fish in Canada. Different populations show diverse localized adaptations to their environment and have evolved an impressive interspecific biodiversity. Nunami Stantec speculated that this intrinsic genetic diversity may contribute to the difficulty in obtaining positive environmental DNA (eDNA) results when comparing eDNA metabarcode data to available databases.

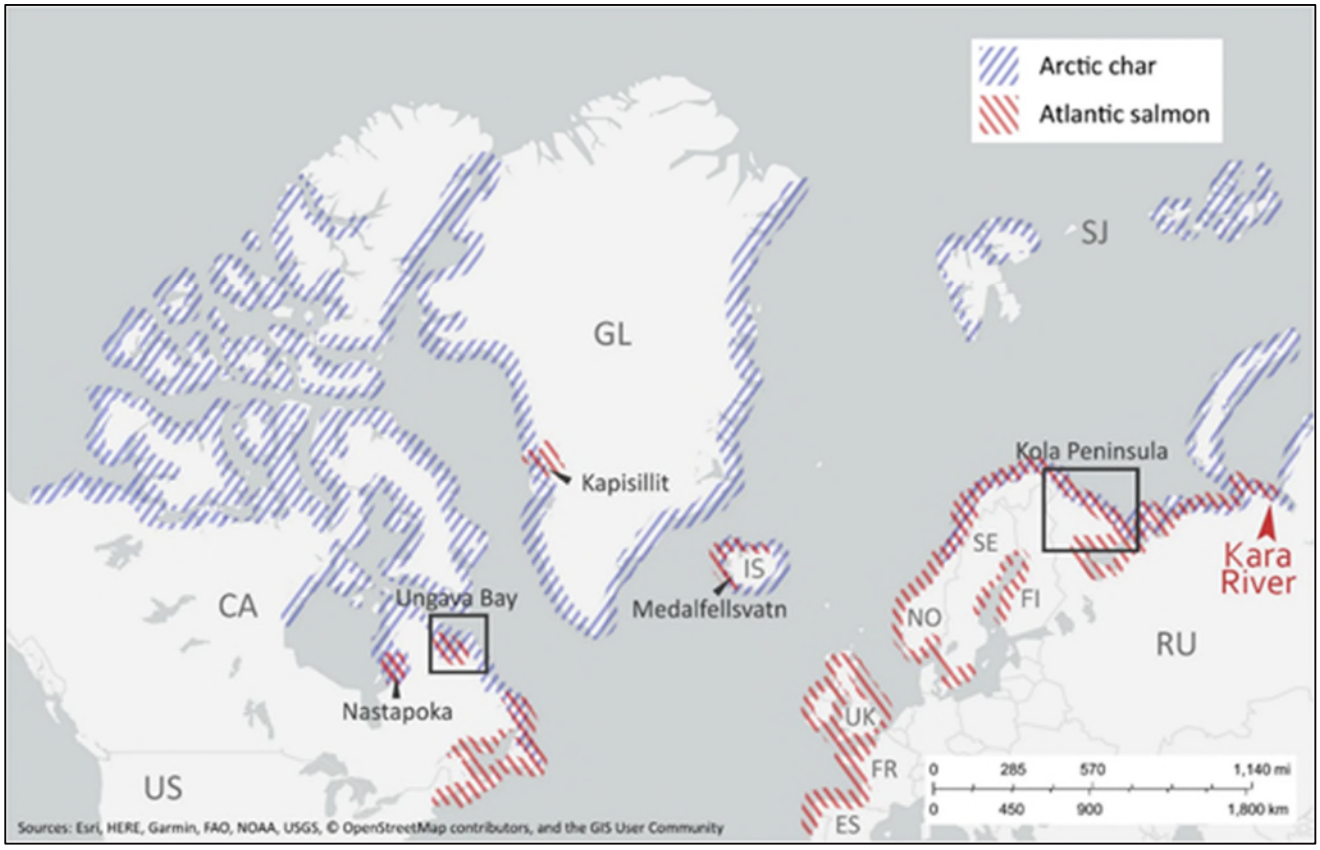
Arctic char can exist as both wholly freshwater (landlocked) populations and anadromous (sea run) populations and there are examples were both populations exist in the same waterbody or drainage system. There is some evidence that in these cases, there may only be one population where smaller individuals mature and complete their entire life cycle in freshwater, while larger individuals become anadromous. The size divergence in the population may be related to food supply where larger fish shift from a largely zooplankton/invertebrate diet to a piscivorous diet.

Arctic char generally are lake-spawners, spawning in the fall over shallow gravel/cobble/boulder shoals. Eggs overwinter under the ice and hatch around the time of ice out. Riverine spawning populations do exist. Anadromous populations spend their early life history in freshwater before migrating to the marine environment in the spring, spending one to several years in the ocean and returning in the fall to spawn in their native stream/lake. Juvenile arctic char may spend 1 to 8 years in freshwater before migrating to sea (Evans *et al.* 2001, Richardson *et al.* 2002).

Because of their preference for shallow spawning habitat, Arctic char may be susceptible to mortality from lake drawdowns or reductions in streamflow and eggs/fry may be susceptible to entrainment in shallow water intakes.

Like many arctic species, arctic char are susceptible to the effects of climate change. One unexpected change is the northward migration of Atlantic salmon (*Salmo salar*) (see Figure 2-14). In areas where the two species overlap, Atlantic salmon may outcompete arctic char and there is evidence that this northward migration is occurring.

Figure 2-14 Northern Distribution of Arctic Char and Atlantic Salmon



2.2.4.3 Lake Qikiqtalik

A fish community and habitat investigation of Lake Qikiqtalik was completed by WSP in 2021. In 2019, Tetra Tech completed a bathymetric survey of the lake. Relevant statistics of the lake are as follows: Surface area: 911,300 m^2; Volume: 6,616,900 m^3; Under Ice Volume: 4,616,900 m^3; Shoreline Length: 9,350 m. The lake is connected to the river via a small stream.

A study conducted by Nunami Stantec (2019) revealed that the levels of metals and total dissolved solids (TDS) in the collected samples were low, with no VOCs detected. The water quality in the lake met the Canadian Council of Ministers of Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999). Consequently, the lake is considered potentially suitable for supporting aquatic life and local fish species.

An Iqaluit resident reported the presence of arctic char and ninespine stickleback in Lake Qikiqtalik (WSP, 2021). It is worth noting that anecdotal and limited traditional knowledge information collected indicated that there has been no fishing activity in the lake.

WSP conducted assessments of fish and fish habitat in Lake Qikiqtalik in both 2020 and 2021 (WSP, 2021). Their shoreline observations suggested that some parts of the lake could potentially serve as grounds and juvenile rearing habitat for arctic char. However, eDNA analyses of four samples collected from various locations and depths in the lake detected very little fish DNA. The 12S rRNA marker, commonly used for freshwater fish detection, did not yield

any positive identifications. Additional analysis of the COI gene detected a small amount of fish DNA in one sample, allowing identification only down to the genus *Salvelinus* (char or trout). Moreover, the COI gene analysis identified small amounts of arthropod DNA in each sample, which could not be identified at lower taxonomic levels.

Based on the presence of suitable habitat, the information provided by the local resident, and the limited *Salvelinus* DNA found using the COI gene, it can be suggested that arctic char are present in the lake, albeit in low abundance.

eNA testing during the Arcadis ecological surveying conducted from July 15 to 19, 2024 at Lake Qikiqtalik showed positive fish detections at sample transects LQ-4 and LQ-5, each yielding n=1/8 positive eDNA detection. The limited number of positive detections suggests the presence of fish, but with a potentially low abundance in the lake.

2.2.4.4 Niaqunnguk (Apex) River

The Niaqunnguk (Apex) River is effectively isolated from fish passage from Frobisher Bay by a 2 m high waterfall barrier near Koojesse Inlet, making it unlikely that the river can support anadromous Arctic char. However, it is known to support a resident population of land-locked Arctic char, even though no recognized fishery exists on the river (Anecdotal Information).

In 2016, Nunami Stantec (2017) conducted a comprehensive assessment of fish and fish habitat in the Niaquanguk River. The studies concluded that the river offers favorable rearing and spawning conditions, including overwintering habitat, for a resident adfluvial population of arctic char. This suitability is attributed to the presence of complex habitat features such as riffles with gravel and cobbles, which support the production of aquatic invertebrates, deep pools and runs, wide impounded areas and lakes, as well as cascade/step pool habitats. The surveys conducted during this assessment also captured several arctic char (including 2 adults), confirming the presence of a resident Arctic char population in the river. It is worth noting that no stickleback were captured during the surveys, despite the existence of suitable habitat. This absence is most likely due to the higher gradient sections of the river that were sampled, which may limit fish access (Nunami Stantec 2017).

eDNA testing during the Arcadis ecological surveying conducted from July 15 to 19, 2024 of the Niaqunnguk (Apex) River produced a positive detection with an eDNA result of n=2/8. Some surveyed locations upstream exhibited shallow areas and sections where the streambed became dispersed, which could affect habitat availability but did not hinder the detection of fish presence in the lower reaches of the river at the Road to Nowhere bridge crossing.

2.2.4.5 Lake Geraldine

Although Lake Geraldine possesses habitat suitable for supporting stickleback or land-locked arctic char, there is currently no documented presence of fish in the lake (Anecdotal Information). A survey conducted by Nunami Stantec (2017) did not yield any captured fish, though it is worth noting that the sampling effort may not be sufficient to definitively determine the absence or presence of fish. Arctic char was captured in the drainage channel below the Lake Geraldine Dam.

While the Stantec Nunami report and anecdotal information suggest that the likelihood of fish presence in the lake is low, the need for further surveys is apparent to arrive at a more conclusive conclusion.

eDNA testing during the Arcadis ecological surveying conducted from July 15 to 19, 2024 of Lake Geraldine showed no fish presence, with an eDNA result of n=0/8 for all four sample transect locations.

2.2.4.6 New Reservoir Lakes

Anecdotal information suggests a very low probability of fish being present in the two lakes that will comprise the New Reservoir. eDNA testing during the Arcadis ecological surveying conducted from July 15 to 19, 2024 of Pond 1, Pond 2, Pond 3, Pond 5 and Pond 6 all showed negative results for fish presence, strongly suggesting there are no fish species inhabiting these waterbodies.

2.2.5 Other Biological Valued Ecosystem Components

No other biological VECs as determined through community consultation and/or literature review were identified. This section may be updated as further information is collected in the LTWP development.

2.3 Socioeconomic Environment

This section outlines the socio-economic baseline of the City of Iqaluit.

The LTWP is located within the municipal boundary of Iqaluit. The 2021 Census listed the population of the City of Iqaluit, Nunavut's largest community, as 7,429. Arviat is the second largest community with a population of approximately 2,864. Iqaluit encompasses an area of about 52 km^2 and shows a population density of 144 people per km^2. The average and median age in Iqaluit is approximately 32 years of age (Statistics Canada, 2023).

According to the 2021 census, 52.1 per cent of Iqaluit's population is Inuit (Newbery, 2023).

From the 2016 Census Data as summarized by the City of Iqaluit, Iqaluit has the highest population of Inuit (3900) of all Canadian communities over 5000 people. English and Inuktitut are spoken regularly in Iqaluit. While 92% of people speak English, only 45% identify it as their mother tongue. Another 46% identify Inuktitut as their mother tongue (City of Iqaluit, date unknown-a).

2.3.1 Archaeological and Cultural Historic Sites

An Archaeological Overview Assessment (AOA) and an Archaeological Impact Assessment (AIA) were completed by AECOM in 2023 as part of the City of Iqaluit Long-Term Water Project. The AIA investigation was focused within a 100 m radius of the preliminary proposed Project area which includes Pipeline Option 1, Pipeline Option 2, Eastern Access Road, Western Access Road, and the New Reservoir. These options are briefly outlined below.

- Pipeline Option 1 runs west from Lake Qikiqtalik and then southwest around a smaller lake to cross the Niaqunnguk (Apex) River and on to Lake Geraldine. It has a total right of way (ROW) of 4.23 km.
- Pipeline Option 2 runs south from Lake Qikiqtalik into a shallow valley, crossing an unnamed tributary of the Niaqunnguk (Apex) River before passing the Iqaluit shooting range and crossing the Niaqunnguk (Apex) River and on to Lake Geraldine. It has a total ROW of 3.44 km.
- The Eastern Access Road runs from the Road to Nowhere Park north along the west side of the Niaqunnguk (Apex) River where it joins up with Pipeline Option 2. It is approximately 1 km in length.
- The Western Access Road runs from Oajisarvik Road to the east and southeast where it crosses Pipeline Option 1 before reaching the location of the New Reservoir. It is approximately 1.85 km in length.

- The New Reservoir is located immediately northeast of Lake Geraldine and is approximately 27.89 ha in size.

These reports were provided to Arcadis and the information summarized below.

2.3.1.1 Pre-Contact History

The southern two thirds of Baffin Island have been historically occupied by the Baffin Inuit. There was noted to be seven separate regional populations of Baffin Inuit which through mutual use of the hunting territory formed a larger territorial band. Historical subsistence hunting included marine, terrestrial, avian, and freshwater game. Tools and weapons were constructed of metal, bone, antler, and stone and consisted of single-curve bows and breathing-hole harpoons. The movements of the Baffin Inuit were very much influenced by the seasons and included the use of kayaks, umiaks and dogsleds. Housing was also influenced by the season and included snow houses in the winter and houses made of skins in the warmer seasons.

2.3.1.2 Post-Contact History

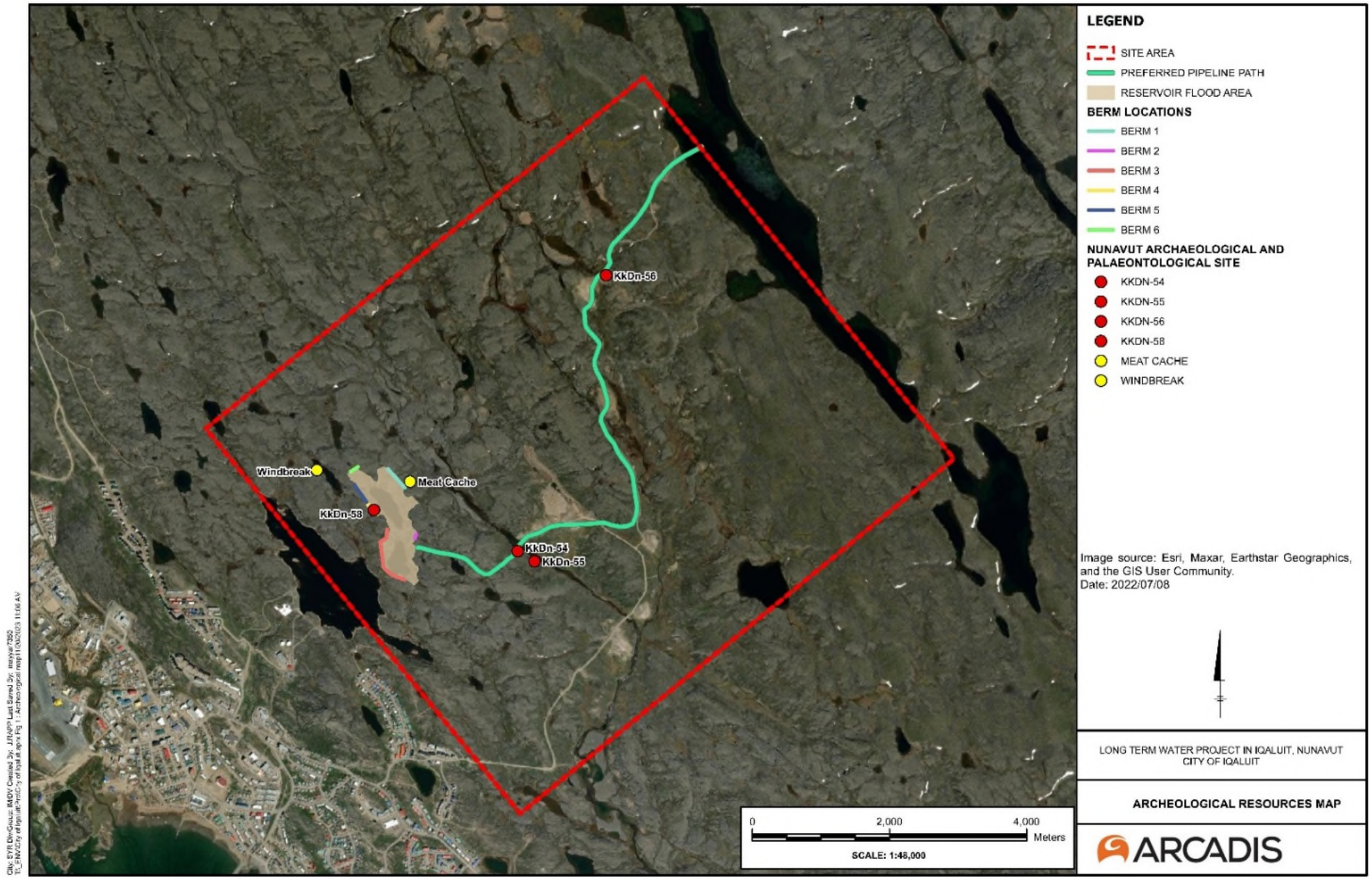
As part of the Frobisher Expedition, Europeans first visited Baffin Island and made contact with the Baffin Inuit in the 16th Century. John Davis was the next to explore Baffin Island in 1587. Davis Strait is named after him. European whale hunting in the area became more pronounced in the 1700s and in the 1850s the first whaling stations were erected in Cumberland Sound and Davis Strait. By 1910 European fur trappers were the prominent industry in the area. In the 1940s, what is now Iqaluit, became home to the first US Air Force Base (Chystal Two base) which provided a stopover for planes during World War II. The presence of this base and its runway gave rise to a larger surrounding community.

Archaeological research in the area started in the late 1940s. Since then, 85 sites have been identified within a 10 km radius of the LTWP. Of the 85 sites, 35 are undetermined, 36 are prehistoric, 13 are historic indigenous, and one is contemporary. Of these 85 sites, four archaeologically significant sites and two contemporary sites were within the area of the LTWP.

See for locations of the archeologically significant sites.

Figure 2-15 for locations of the archeologically significant sites.

Figure 2-15 Archeologically Significant Sites



Archaeological Sites:

- KkDn-54 is a single stone meat cache approximately 130 cm by 180 cm consisting of 45 stones. No faunal remains or other culturally significant features exist within the cache. It is located approximately 40 m northeast of the proposed Eastern Access Road along the Niaqunnguk (Apex) River.
- KkDn-55 consists of two stone cairns containing 20+ stones on a slightly raised beach. The cairns are approximately 3 m apart from each other and are around 150 cm to 180 cm in diameter each. KkDn-55 is located to the southeast of KkDn-54 along the Niaqunnguk (Apex) River and is approximately 45 m northeast of the proposed Eastern Access Road.
- KkDn-56 is a campsite consisting of a tent ring and hearth which may have been recently disturbed by activity on a nearby ATV trail. This site is in between Pipeline Option 1 and 2 on a ridge east of the access road to Lake Qikiqtalik.
- KkDn-58 is a single stone cairn consisting of 10 boulders and is 1.25 m in diameter. Archaeologists are unsure of the exact age of the feature. However, the presence of a large amount of moss on the stones suggests that it is prehistoric in age. No faunal remains or other culturally significant features exist within or around the cairn. KkDn-58 is located within the proposed footprint of the New Reservoir.

Contemporary Land Use Sites:

- One contemporary land use site was noted within the buffer for the New Reservoir to the north. It consists of a stone meat cache which currently contains remnants of caribou such as ribs and vertebrae.
- A wind break was noted within the buffer between Pipeline Option 1 and the New Reservoir, north of the intersection between Pipeline Option 1 and the Western Access Road.

No paleontological resources were identified in the reports provided by AECOM.

An updated Archeological Impact Assessment and Mitigation (AIA) report was completed by AECOM in 2025 (AECOM, 2025) under NU Class 2 Permit 2024-052A. The AIA covered areas of the LTWP not included in the 2023 survey, such as the sections of the pipeline right of way, access road, borrow areas, and laydown area. It also involved revisiting previously recorded sites KkDn-54, KkDn-55, KkDn-56, and KkDn-58, with mitigation efforts at KkDn-54 and KkDn-58 due to their anticipated impact from the LTWP. Following the AIA, the City of Iqaluit has met the current program requirements for identifying and mitigating potential impacts on archaeological resources associated with LTWP development.

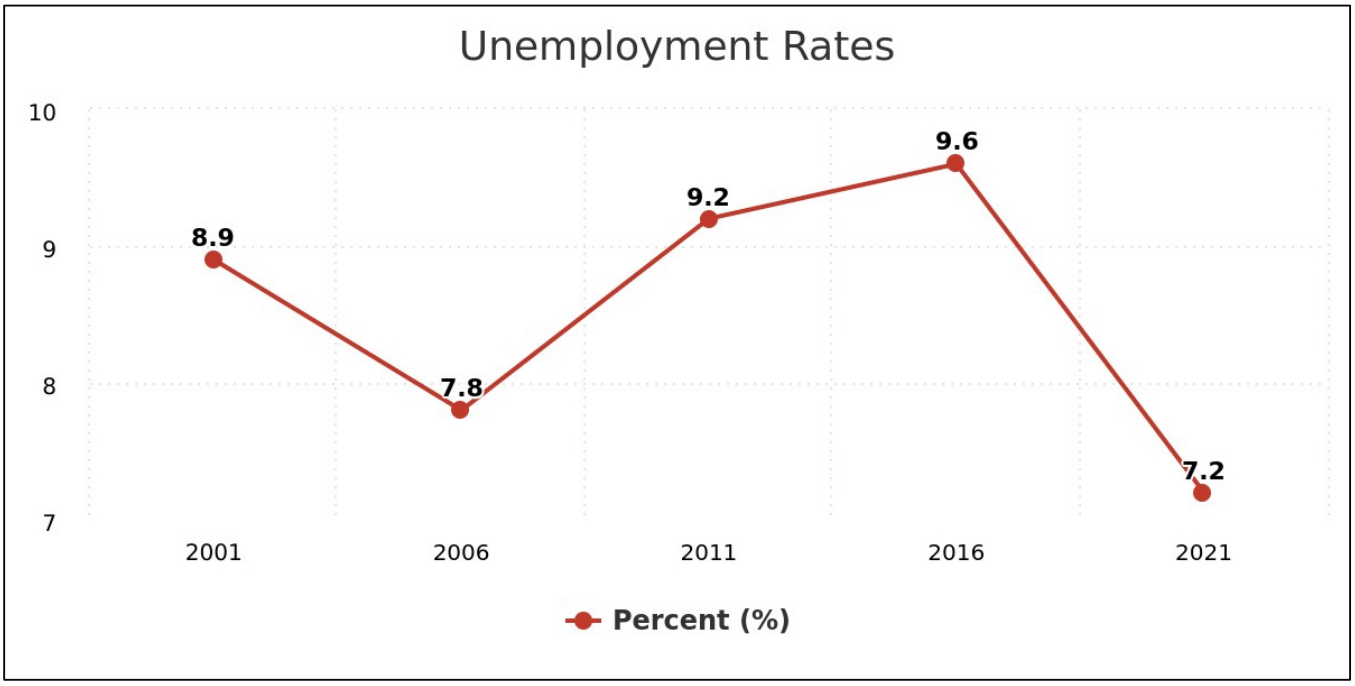
2.3.2 Employment

The total employment rate in Iqaluit, as of December 2021, is 70.5% and represents a labour force of about 4,155 people. The labour force is well distributed across sectors, though the census shows that most of the labour force have occupations within the Business & Finance, Education, Law & Government, Sales & Service and Trades & Transport sectors.

An important decrease in the unemployment rate is observed between 2016 and 2021 census data, with a drop from 9.6% to 7.2%, respectively. Data from the last 20 years shows that unemployment is at an all-time low as depicted in Figure 2-16 below (Townfolio, 2022). In fact, according to Statistics Canada's data as seasonally

adjusted for Canada's Employment Insurance Program, the forecasted unemployment in the Region of Iqaluit for the period from November 2023 to December 2023, show a rate of 6.7% (Government of Canada, 2023).

Figure 2-16 Unemployment Rates in the City of Iqaluit from 2001 to 2021



2.3.3 Community Wellness

2.3.3.1 Land and Resource Use

The area east of Iqaluit is serviced by the Road to Nowhere and is accessible by vehicle. The Tasiluliariaq Rotary Park is located near the Niaqunnguk (Apex) River bridge. The municipal shooting range is the one permitted and regulated area assigned by the City of Iqaluit. Access to the Emergency Road is gated by the City.

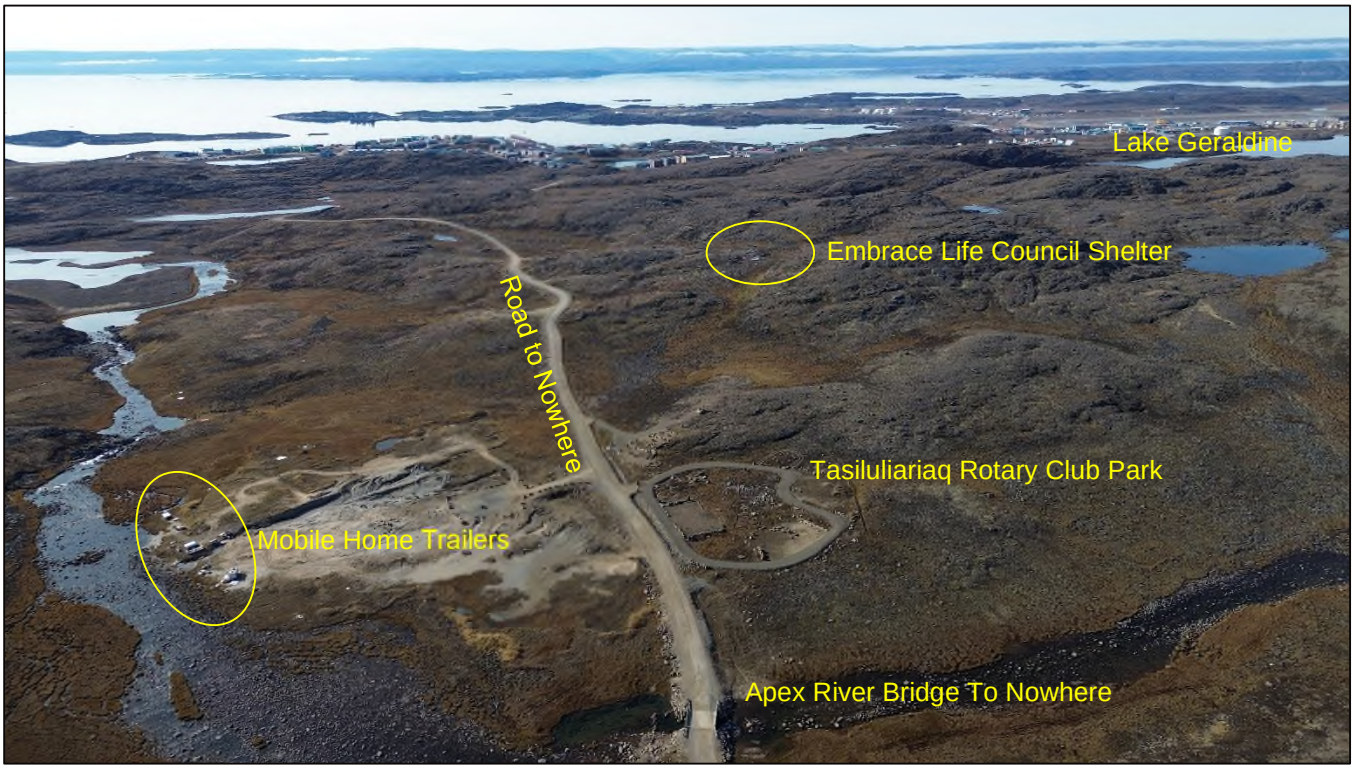
During the September 2023 reconnaissance visit signs of ATV tracks were observed near the Niaqunnguk (Apex) River at the site of the water intake and from the Emergency Road to the Lake Qikiqtalik. Abandoned snowmobiles were also observed from the Road to Nowhere. Small structures and two mobile homes were observed east of the Road to Nowhere downstream of the bridge on the edge of the Niaqunnguk (Apex) River. Two structures owned by the Embrace Life Council were under construction near the Tasiluliariaq Rotary Club Park though not occupied.

See the Figure 2-17 below for the locations of the structures.

The Contract Planner for the City was interviewed as part of the Phase 1 ESA (Arcadis, 2023) and it was indicated that there are no other land uses of the site other than recreational uses such as swimming, temporary camping, picnicking, etc. along the Niaqunnguk River. There have never been any commercial or industrial uses of the site, and she not aware of any above- or underground utilities or above- or underground fuel storage tanks.

No chemical storage areas were observed on the site during the site inspection or were identified in the records review (Arcadis, 2023).

Figure 2-17 Image of Road to Nowhere



2.3.3.2 Subsistence Harvesting

No subsistence harvesting was observed during the reconnaissance visits of September 2023; however, the time of year was not suitable for harvesting of vegetation or for fishing. During the visit, blueberries *Vaccinium uliginosum)*, cranberries (*Vaccinium macrocarpon***)** and crowberries (*Empetrum nigrum*) were observed.

Hunting in the territory of Nunavut is enforced by the Government of Nunavut Department of Environment. Hunters must have a harvesting licence to hunt small game. To hunt big game, hunters need a harvesting licence and species authorization tag(s), hunters require tags to hunt large game, and these are issued by lottery (GN-Env, 2022). The Nunavut Land Claims Agreement (NLCA) states that Hunters and Trappers are to avoid placing traps any place within a radius of one mile, or 1.6 km, of any building or structure (Iqaluit 2022).

Arctic char is an important species for subsistence and commercial fishing in Iqaluit.

The ecological surveys proposed in the Summer of 2024 will identify the species present at the LTWP and will be referred to local elders for their uses.

The main tourist activities in Iqaluit, revolve around experiencing the environment, exploring Inuit culture, and engaging in outdoor adventures (Travel Nunavut, 2023; Iqaluit, 2023) and are:

- Arctic Wildlife Viewing: Boat tours and wildlife excursions to view Arctic wildlife in their natural habitat, including seals, whales, polar bears, and various bird species.
- Cultural Experiences: Visitors can participate in cultural events, visiting art galleries and attending traditional performances.
- Historical and Heritage Sites: Historical and heritage that include museums, archaeological sites, and landmarks like the Nunatta Sunakkutaangit Museum and the Legislative Assembly Building.
- Outdoor Adventures: Hiking, wildlife safaris, dog sledding, snowmobiling, viewing the northern lights and fishing.
- Festivals Toonik Tyme Festival and Alianait Arts Festival take place annually in the spring and summer.

2.3.3.3 Shooting Range

The City of Iqaluit has designated one permitted and regulated area as an official shooting range, located near the end of the Road to Nowhere. In accordance with the City of Iqaluit Firearms Control Bylaw No. 367 Sec 3.1, the discharge of firearms is strictly prohibited within the boundaries of the Town of Iqaluit (Iqaluit, 2025a). The Iqaluit Shooting Association aims to create, support, manage, and oversee outdoor range activities, prioritizing safety and practical use for both its members and the broader Iqaluit community (ISA, 2013). See Figure 1-1 for its location.

2.3.4 Community Infrastructure

The community is divided into approximately 11 neighborhood areas, those being from west to east:

- West 40.
- North 40 / Federal Road.
- Airport.
- Core Area.
- Plateau Subdivision.
- Lower Iqaluit.
- Happy Valley.
- Road to Nowhere.
- Tundra Ridge.
- Tundra Valley.
- Lake Subdivision.

Also included is the community of Apex, which is within the municipal boundary of Iqaluit.

2.3.4.1 The City of Iqaluit's Department of Public Works

According to the City of Iqaluit website, the Public Works and Engineering Department is composed of five divisions and is responsible for the City's water and sewer services, road maintenance, waste collection, and maintenance of municipal buildings.

2.3.4.2 Water and Sewage Services

Both water and sewer operations appear to fall under the umbrella of two divisions within the Public Works and Engineering Department, more specifically, *Trucked Water & Sewer Services* and *Utilidor Operations*. Utilidor operations encompass maintenance of the water treatment plant (potable water supply), sewage treatment facility (sewage and wastewater) and the maintenance of all subsurface infrastructure including access vaults, sewer and water pipes and the operation and maintenance of water booster, reheat, and lift stations.

2.3.4.3 Water Treatment Plant at Lake Geraldine

The treatment for drinking water used for the City of Iqaluit takes place at the Water Treatment Plant (WTP) located near the Lake Geraldine dam. Water use is regulated by the Nunavut Water Borad (NWB). The City of Iqaluit holds a Type "A" Water Licence from the NWB (Licence No. 3AM-IQA1626) dated June 2016. The quantity of water taken from Lake Geraldine is not to exceed 1,100,000 m^3 annually. In an amendment to this license in November 2019, the quantity of water was modified to allow for a limit of 2,000,000 m^3 annually and an additional 500,000 m^3 from Niaqunnguk (Apex) River for transfer to Lake Geraldine (Licence No. 3AM-IQA1626 – Amendment No. 4). Licence No. 3AM-IQA1626 and its amendments expire June 16th, 2026.

Technical issues have cause interruptions of the operations of the WTP starting in the Fall 2021.

To summarize, in October 2021, emergency control and remediation works were launched after a fuel spill from an abandoned Underground Storage Tank (UST) contaminated the WTP and resulted in a "Do Not Consume" Water advisory, which was lifted in December 2022. Additionally, another contamination event was discovered in January 2022, unrelated to the previous event, linked to a bitumen type material being used within the WTP tanks. A multi-tank bypass system was built which maintains safe drinking water production until a more permanent solution could be developed, according to a public service announcement in May 2022 (City of Iqaluit, 2022).

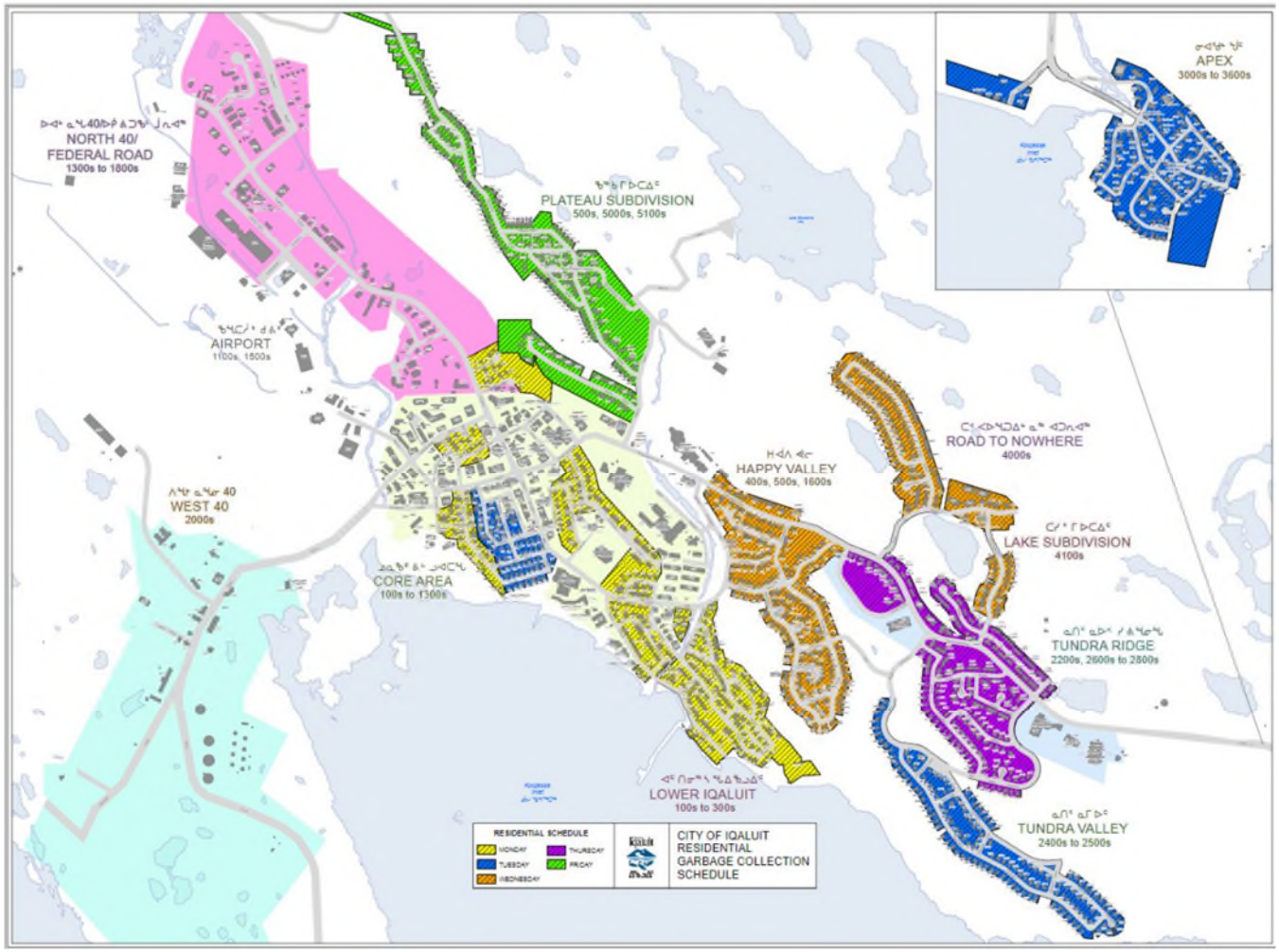
It remained under renovation according to a public announcement by the City in March 2023 (City of Iqaluit, 2023a), however, the WTP appears to have returned to normal services with precautionary boil water advisories as of April 24, 2023 (City of Iqaluit, 2023b). Boil water advisories continue to be issued in the Public Service Announcements webpage of the City.

2.3.4.4 Waste Collection

The City of Iqaluit offers weekly residential waste collection services to its various regions, as shown in Figure 2-18. Only uncoated cardboard is currently recycled, with all other waste being landfilled directly. Other materials such as wood and metal, should be separated from household waste, but is not picked up and must be brought to landfill by citizens (City of Iqaluit, 2018). Additional fees for various types of waste are provided on the City's website, which states that construction debris disposal costs $135.00/$m^3$ (City of Iqaluit, date unknown-b).

Waste is currently managed at the West 40 Landfill located along Akilliq Drive due north of the Iqaluit Port. A new landfill and waste transfer station was announced in 2018 as the current site is almost at capacity, however, multiple issues have pushed the project back from being operational by 2020 to not having even been built yet (CBC, 2022). A Waste Management Plan from January 2014 exists for this potential project and can be found on the City's Public Works and Engineering webpage.

Figure 2-18 Small Area Map of Garbage Collection Schedule in Iqaluit



2.3.4.5 Electricity

Qulliq Energy Corporation (QEC) is the electric utility and distributor of electricity in Nunavut and is owned by the Government of Nunavut (CER, 2023). Almost all of Nunavut's electricity is generated from diesel fuel imported during the summer and then stored for year-round use. Approximately 55 million liters of diesel is consumed annually to generate electricity for the territory, with an installed capacity of approximately 76.9 MW (QEC, 2018). Electricity in Iqaluit is provided by a diesel fired 13.6 MW generator located near the Lake Geraldine Dam (NTI, 2020).

2.3.4.6 Transportation

Access to Iqaluit is facilitated by scheduled commercial flights throughout the year. In winter, snowmobile trails connect the city with other communities on Baffin Island, while in summer, sealift services from the ports of Montreal and Valleyfield in Quebec provide additional transportation options.

Transportation to Baffin Island is via sea or air. Most large shipments are received by barge or sealift at the Port of Iqaluit and trucked into the City. Sealift services are the most economical way to transport bulk materials and typically take place between late June and late October but are largely weather dependent. Management is the responsibility of the Government of Nunavut, specifically the Department of Community and Government Services (CGS) is responsible for annual dry cargo re-supply and Petroleum Products Division is responsible for bulk fuel re-supply (Government of Nunavut, unknown date).

2.3.4.7 Marine Terminals

The Iqaluit Deepsea Port is located south of the City centre across the Koojesse Inlet. The port was reopened on July 25, 2023 after significant infrastructure improvements totalling $85M were made. The port is now able to provide offloading at any tide, streamlining the shipping transportation network significantly (Government of Nunavut, 2023). The official United Nations Code for Trade and Transport Locations (UN/Locode) of this port is CAIQL, and according to a regularly updated website featuring international port statistics called Marine Traffic, the number of vessels arriving and departing from the CAIQL port on any given day for the period of October 16 to November 9, 2023, ranges from 0 to 10 vessels as seen in Figure 2-19 below (Marine Traffic, 2023). In addition, the 2023 seasonal sailing summary report from the Nunavut Eastern Arctic Shipping Inc. (NEAS) shows that eight vessel arrivals occurred this year, each docking for a duration ranging from 1 day to over 10 days (NEAS, 2023).

Figure 2-19 Vessels Arriving and Departing from Iqaluit Deepsea Port (CAIQL port) from October 16, 2023 to November 9, 2023.

The Iqaluit Harbour is another marine terminal located south of the community centre on the north side of the Koojesse Inlet. At this time, it is unclear what type of ships can dock at this location, however, it is assumed that only smaller vessels and local fisherman can moor here.

2.3.4.8 Sealift Operations

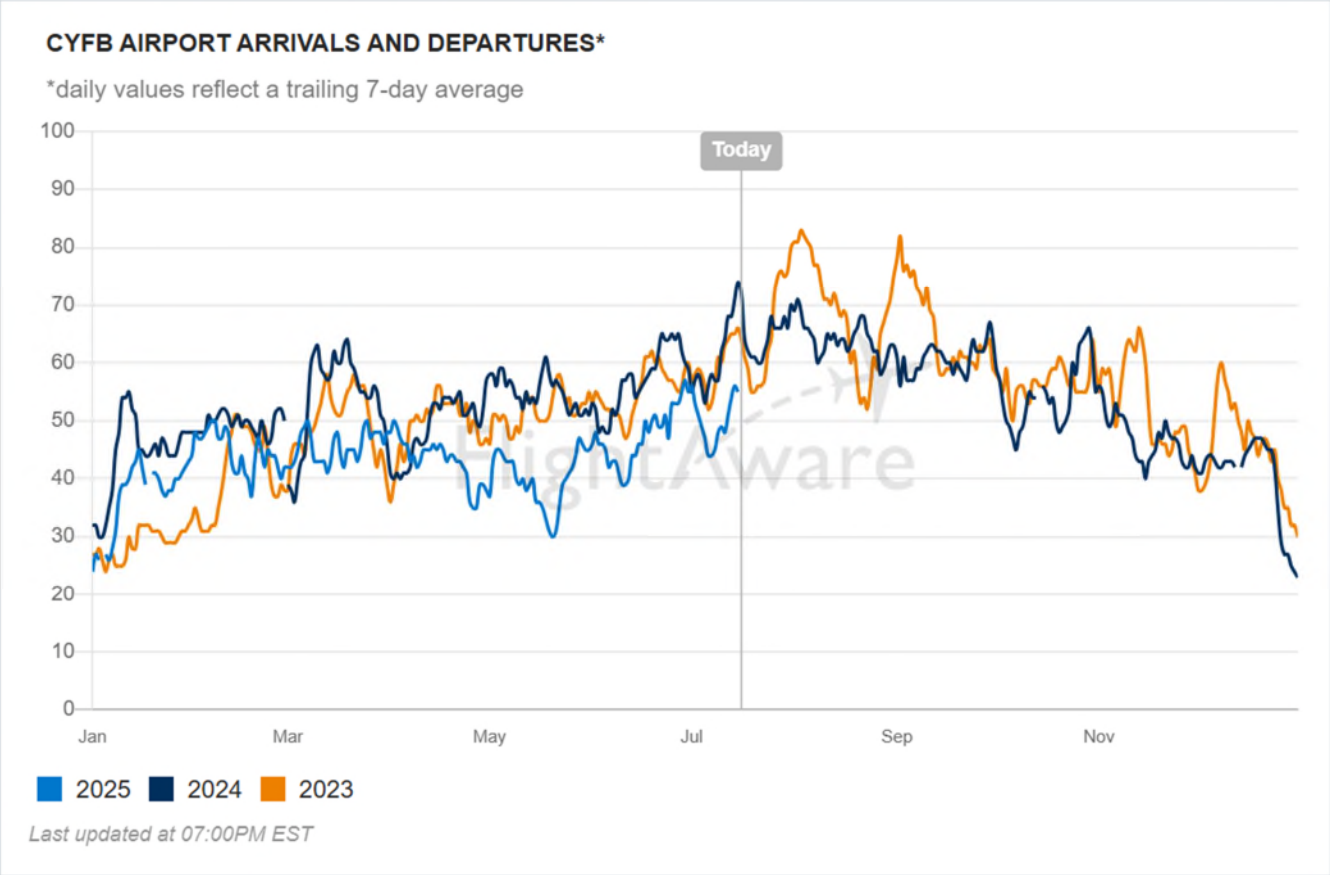
There are two official sealift service providers servicing Iqaluit seasonally. These are Nunavut Eastern Arctic Shipping Inc. (NEAS), and the Arctic Sealift, which itself is composed of three subsidiaries: Desgagnés Transarctik Inc. (DTI), Nunavut Sealink and Supply Inc. (NSSI), and Taqramut Transport Inc. (TTI). A third service provider, the Northern Transportation Company Limited (NTCL) filed for bankruptcy in 2016 and is no longer in operation (Government of Nunavut, unknown date-a).

2.3.4.9 Airport Terminals

The main airport to the community is the Iqaluit International Airport (CYFB), which is operated under a public-private-partnership (P3) agreement. It serves a vital role supporting air transportation in Nunavut, trans-Atlantic air navigation, polar routes and North American Air Defence. The 9300 m^2 runway has one asphalt runway that measures 8605 feet (2.6 km) long by 200 feet (0.61 km) wide. (Government of Nunavut, unknown date -b).

The number of flights has declined in 2025 compared to the two previous years as shown in Figure 2-20 (Flight Aware, 2025).

Figure 2-20 Chart of CYFB Airport Arrivals and Departures in Last Three Years.



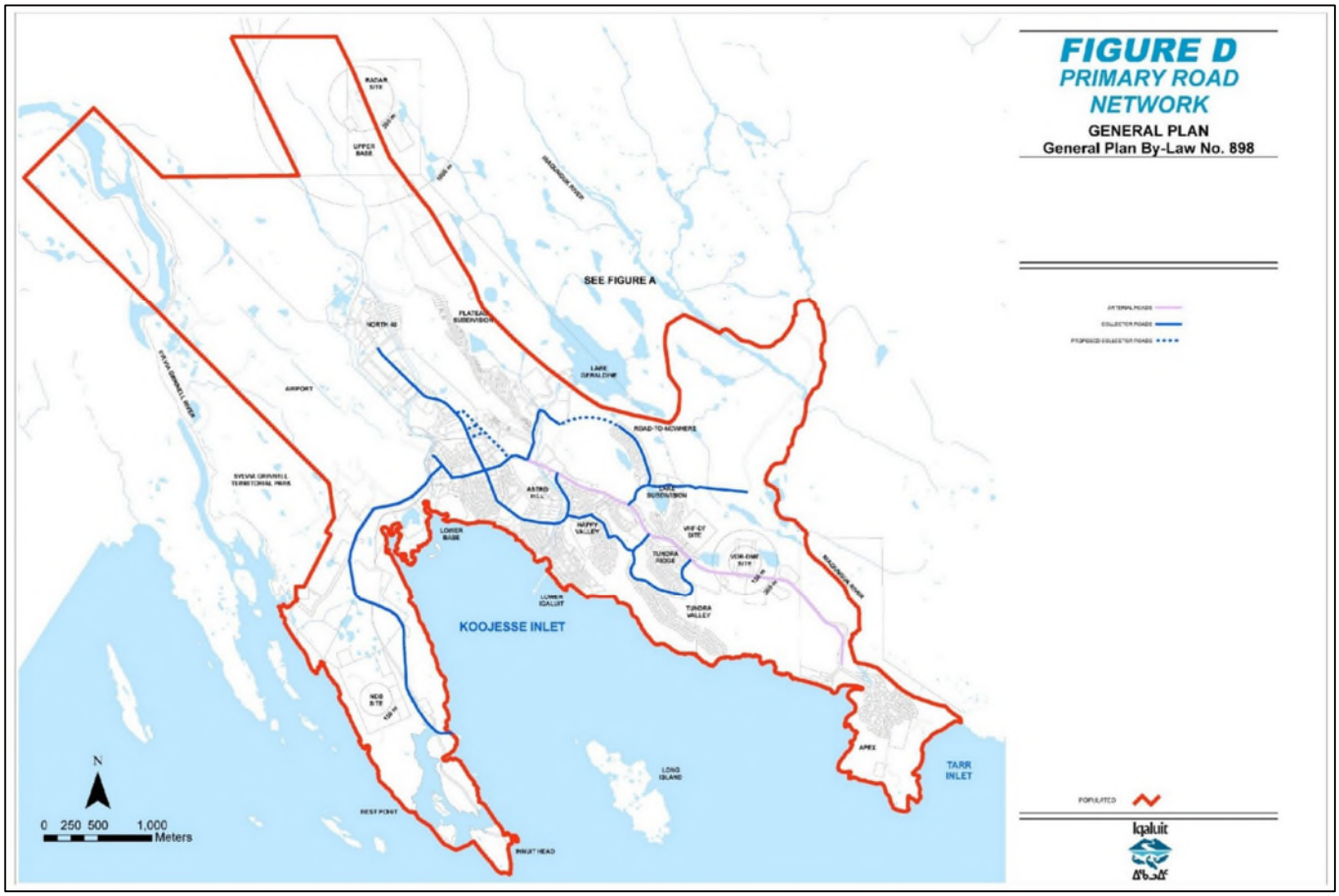
2.3.4.10 Roads

The territory has no road infrastructure between its 26 communities and most inter-community surface travel and transportation is by snowmobile or all-terrain vehicles. Road signals in Nunavut are in English, Inuktitut, and sometimes also in Inuinnaqtun. The City of Iqaluit's primary road network plan shown below in Figure 2-21 indicates there are only a few main arteries connecting the various neighborhoods within the community. Most of these are paved or compacted gravel, though as they reach the outskirts of the community, most are dirt roads. In Figure 2-21, the pink line depicts the main artery used called the Niaqunngusiariaq or Road to Apex. The Queen Elizabeth Highway, more commonly known as the Federal Road is the main highway which passes through Downtown Iqaluit and connects to the Iqaluit Deep Sea Port and the West 40 Landfill through Akilliq Drive and to the Iqaluit International Airport (CYFB) through Ungalliqpaat Cres Road. These will likely be the most suitable roads to transport equipment and materials for construction from the port areas to the Road to Nowhere, which leads to the Project site. The Road to Nowhere is maintained by the City and is composed of compressed gravel, for the most part. It should be noted that the emergency road along the Road to Nowhere is gated and closed to the public.

2.3.4.11 Local and Regional Traffic Patterns

Access to the Project area is via the Road to Nowhere, located northeast of the City of Iqaluit. From the Iqaluit Port to the end of the Road to Nowhere at Lake Qikiqtalik, the trajectory is an approximately 12 km drive when following Akilliq Drive to the Road to Apex and then onto the Road to Nowhere. Considering these are all main roads, there should be little to no restrictions for truck transport throughout the Project. Verification with the City should be made to see if permits are required for trucking within the City according to any municipal traffic bylaws.

Figure 2-21 Iqaluit Primary Road Network



Source: https://www.iqaluit.ca/in/content/figure-d-primary-road-network

2.3.5 Human Health

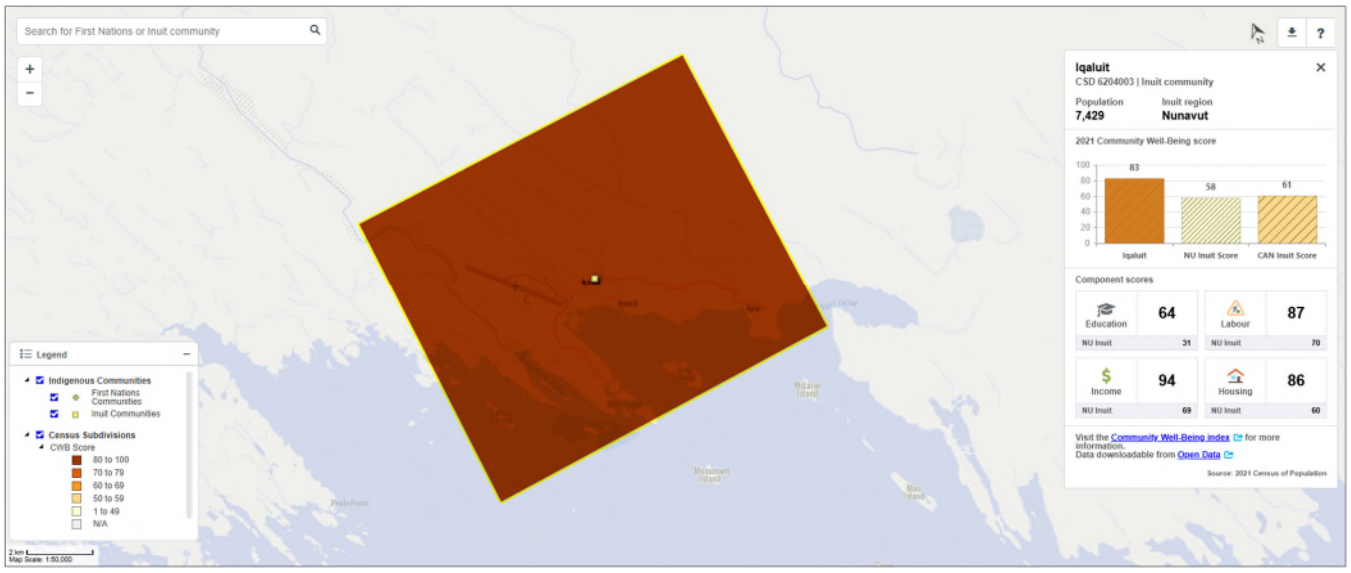
2.3.5.1 Community Well-Being

The Community Well-Being (CWB) index is a measure used to assess socio-economic well-being for Indigenous and non-Indigenous communities over time. The index helps to show where improvements in well-being have been achieved and where significant gaps still exist (ISC, 2021). The index is made up of the following four components:

- Education is based on how many community members have at least a high school education and how many have acquired a university degree.
- Labor force activity measures how many community members participate in the labour force and how many labor force participants have jobs.
- Income is calculated based on a community's total income per capita.
- Housing is based on the number of community members whose homes are in an adequate state of repair and are not overcrowded.

The four CWB components are combined to create a single well-being score for each community. Each CWB score and each component score can range from a low of 0 to a high of 100. (ISC, 2021). The CWB score for Iqaluit is 83 which is higher than the Canada wide Inuit score of 61 and a Nunavut Inuit score of 58 (ISC, 2021). Generally, scores for Inuit in Iqaluit are higher in education, labour, income, and housing than the average Nunavut Inuit scores. See Figure 2-22 below for details.

Figure 2-22 Community Well-Being CWB Index Iqaluit



2.3.5.2 Public Health Services

Iqaluit is served by the Qikiqtani General Hospital (QGH) which treats the approximately 16,000 people living in the twelve communities of the Qikiqtani (Baffin) Region (GN-Health, 2023). The QGH has 35 acute care beds. Also in Iqaluit are public health care services such the Tammattaavik Boarding Home, a Mental Health care centre, the Qikiqtani Rehabilitation centre, and an audiology specialist (GN-Health, 2023).

Emergency services in Iqaluit is provided by Iqaluit Emergency Services (IES) (Iqaluit, 2023). Operated by the City of Iqaluit, it is led by a Fire Chief and Deputy, with assistance from an Assistant Fire Chief. The IES consists of 20 full-time staff members, 5 communications operators, and 15 volunteer firefighters. The operations are closely coordinated with other emergency services in the community, including Municipal Enforcement, the Royal Canadian Mounted Police (RCMP), Airport Fire, Office of the Fire Marshall, and various City Departments. The IES responds to medical calls, medivac services, fires, vehicle incidents, hazardous material spills, and more.

2.3.5.3 Law Enforcement

Law enforcement services is provided by the RCMP which has a detachment in the City of Iqaluit. The City of Iqaluit is responsible for the enforcement of municipal by-laws, as well as selected territorial and federal acts and regulations designated by the territorial government (Iqaluit, 2023).

2.3.5.4 Challenges

Challenges exist to living in Iqaluit. While not an exhaustive listing, some of the major issues are summarized as follows:

- Housing availability: Housing scarcity has resulted in higher house prices in Iqaluit thus adding financial pressures on households. It is also causing overcrowding in households. The City has designed an action plan to address the issue of overcrowding in Iqaluit by increasing infrastructure capacity of at least 50% of the estimated 1400 units of housing required in the City (Iqaluit, 2022b).
- Water availability: This is considered as a factor which limits growth in Iqaluit. There is not enough water available to allow for new housing (CBC, 2022). The aging infrastructure of the City and population growth have put a strain on the water supply system and have led to shortages during peak demand. Climate change impacts, such as shifting precipitation patterns and changes in snowmelt timing, further complicate water availability.
- Cost of Living: There is no road, rail, or year-round ship connection in Iqaluit. Food and materials rely in a higher proportion on air transport to get to Iqaluit. These results in high prices for goods, including food. Iqaluit is a community eligible for Indigenous Services Canada's Nutrition North Canada Retail Subsidy and for the Harvesters Support Grant (ISC, 2023).

2.3.6 Other Socioeconomic Valued Ecosystem Components

No other Valued Socioeconomic Components (VSEC) as determined through community consultation and/or literature review were identified. This section may get updates as further information is collected in the LTWP development.

3 Environmental Impacts

The existing environment serves as the baseline condition against which incremental changes and possible environmental effects associated with the LTWP are evaluated. The existing natural environment is presented in terms of the physical, biological, and socio-economic environments. The environment component headings used to characterize the existing environment follow those required under the NIRB screening process.

The design of the Niaqunnguk (Apex) River intake and RWPS are still currently in development and will be reviewed and updated as details are provided which may change the mitigation requirements below.

At all points during the LTWP construction an environmental monitor will be present onsite to ensure that mitigation is implemented as described below. Following the review of this PBSEIA by the NIRB the mitigation measures recommended made will be added to an Environmental Protection Plan (EPP) which will be used to manage construction and operations activities for the LTWP.

3.1 Impact Classification

The impact classifications for the VECs have been prepared for the LTWP using the criteria outlined by the NIRB. The following classifications are assigned to each VEC, those being:

- Positive: *will the activity positively benefit the affected and surrounding area?*
- Negative and non-mitigable: *will the activity negatively impair the affected and surrounding environment, without the ability to alleviate and reduce adverse effects?*
- Negative and mitigable: *will the activity negatively impair the affected and surrounding environment, with the ability to alleviate and reduce adverse effects?*
- Unknown: *the effects of the proposed activity are not yet known*

The classification of the environmental impacts for the LTWP are labelled as:

- P = Positive
- N = Negative and non-mitigable
- M = Negative and mitigable
- U = Unknown
- "-" = no impacts expected

Table 3-1 below, summarizes the impact classification for the LTWP throughout both construction phase, which includes pre-construction work, and operation phase.

The decommissioning phase of the LTWP has been omitted from the classification of the impacts. The life of the LTWP is expected to be in the range of at least 100 years, if not more, and hypothesizing on the decommissioning strategy for a period that far into the future is not feasible. If and when the LTWP is decommissioned, it will be done in a controlled manner following the appropriate best practices and regulations applicable at that time.

Table 3-1 Identification of Environmental Impacts on Valued Ecosystem Components

Physical Environment												
Designated Environmental Areas	-	-
Ground Stability	M	M
Permafrost	M	M
Hydrology / Limnology	M	M
Water Quality	M	M
Climate Conditions	M	M
Eskers and Other Unique or Fragile Landscapes	M	-
Surface and Bedrock Geology	M	-
Sediment and Soil Quality	M	M
Tidal Process and Bathymetry	-	-
Air Quality	M	M
Noise levels	M	M
Biological Environment		
Terrestrial Vegetation	M	M
Terrestrial Wildlife and Habitat	M	M
Species at Risk and Migratory Birds	M	M
Aquatic Species and Habitat	M	M
Socio Economic Environment		
Archaeological and Cultural Historic Site	M	-
Employment	P	P
Community Wellness	N	P
Community Infrastructure	M	P
Human Health	M	P

3.2 Description of Impacts and Mitigation Measures

The following sections provide justification for the impact classifications shown in Table 3-1 above, as well as applicable mitigation measures for protecting the:

- Physical Environment.
- Biological Environment.
- Socioeconomic Environment.

Mitigation measures provided in the *Recommended Project-Specific Terms and Conditions* in the NIRB Screening Decision Report (File no. 23YN040) response issued to the City on 18 November 2023 have been included where applicable, along with other best practices for reducing or eliminating LTWP impacts on the environment.

3.2.1 Designated Environmental Areas

3.2.1.1 Impacts

No impacts are expected (-) for the construction or operations phases of the LTWP. The LTWP location was identified to be outside of any protected areas. No infrastructure will be built near a designated environmental area.

3.2.1.2 Mitigation

No mitigation measures are being considered at this time.

3.2.2 Ground Stability

3.2.2.1 Impacts

The impacts are potentially *Negative and mitigable (M)* during the construction of the LTWP. It is likely that given the granitic composition of the ground of the LTWP will be stable.

3.2.2.2 Mitigation

The following general mitigation measures will be implemented throughout the Project design and construction to avoid impacts to ground stability:

- Mitigation for ground stability will be addressed primarily in the design phase of the project.
- An Erosion and Sediment Control Plan will be developed and implemented to effectively mitigate the potential environmental impacts of ground stability.
- A Blasting Plan will be developed to address blasting procedures during the construction.

- Regular inspection, maintenance, and repair of erosion and sediment control structures (temporary matting, geotextile silt control filter (curtains) fabric, etc.) will be conducted to detect any damage during construction.

3.2.3 Permafrost

3.2.3.1 Impacts

The impacts are potentially *Negative and mitigable (M)* during the construction phase of the LTWP. At the time of the preparation of this DRAFT report the design of the LTWP is under development and a geotechnical assessment is also being undertaken as previously mentioned. The proposed water supply reservoir and conveyance pipelines are to be situated in areas dominated by shallow bedrock, typically Precambrian granites, or basalts. Where unconsolidated soils overlie the bedrock, it is usually present as a thin veneer or blanket of till or glaciolacustrine deposits, generally being coarse grained in texture. Given the granitic composition of the LTWP site, it is likely that the ground is stable and will not shift with melting of permafrost. A thorough evaluation of the potential impacts on permafrost during project activities will be made once more results are obtained. The following potential impacts are assumed:

- The wet wells of the RWPS will be installed roughly 5 to 9 meters below the existing water line and likely into permafrost which can potentially affect ground temperatures below the reiver bed.
- The displacement of water in the water conveyance pipeline, the flooding of the New Reservoir and establishment of laydown and temporary camp areas will transfer heat into the ground and melt permafrost, however the extent is not known at this point.
- Extraction of material from borrow areas, quarries, and the excavation and extraction of soil from the New Reservoir, RWPS, access road and Niaqunnguk (Apex) River crossing site can expose the underlying permafrost, resulting in melting, ground instability, and soil erosion.

An impact classification of *Negative and mitigable (M)* is given for the operation phase activities that will impact Permafrost at the LTWP. These include, but are not limited to:

- The New Reservoir containment berms and conveyance pipeline will be constructed of unfrozen materials, and it is likely that most of the fill structure will freeze in the years following construction. That is, the permafrost table that was near the original ground surface will aggrade into the constructed dams, dykes, and berms.

3.2.3.2 Mitigation

The following general mitigation measures will be implemented throughout the Project design and construction to avoid impacts to the permafrost layer:

- Surface water will be managed to control soil erosion with silt fences/curtains. (NIRB recommendation 7).
- Vehicle rutting or gouging of ground surface during all construction activities will be avoided by ensuring access roads are built to sustain the weight of all vehicles. Activities will be suspended if rutting occurs. (NIRB recommendation 20).

- A winter route will be selected that that maximizes the use of frozen water bodies (NIRB recommendation 21).
- All drill areas are will be constructed to facilitate minimizing the environmental footprint of the project area (NIRB recommendation 24).
- Workers will be required to travel on pre-established roads and trails where possible, to protect against permafrost damage through heat exchanges (NIRB recommendation 30).
- All disturbed areas will be restored to a stable or pre-disturbed state using Best Available Technology Economically Achievable (BATEA) upon completion of work and/or abandonment (NIRB recommendation 33).
- The required access roads will be constructed following best practices for protection of permafrost, including a raised and compacted roadbed.
- The conveyance pipelines will be constructed using “above-ground burial” where the pipeline is laid on a levelling pad of granular material placed on the ground surface and then covered with a combination of finer granular material.
- The borrow and quarry areas will be evaluated to determine exact mitigation measures to be The borrowed area footprint will be minimized and a setback will be maintained from waterbodies where there may be depressed permafrost zones.
- The temporary trailer camp near the Road to Nowhere will be on cribbing and will be raised. Trailers will be installed at a minimum of 1 m above ground level, which will facilitate heat dissipation in the air space underneath and decrease heat exchange to the ground. These measures will minimize potential negative effects to permafrost in the worker camp area.

The following mitigation measures will be implemented once the LTWP is operational:

- Thermistors will be installed at the LTWP structures to monitor the ground temperatures.

3.2.4 Hydrology / Limnology

3.2.4.1 Impacts

The potential impacts to Hydrology and Limnology are *Negative and mitigable (M)* during the construction phase of the LTWP. The five ponds located in the footprint of the New Reservoir and access road sites will be permanently altered during the construction of the LTWP. The following potential impacts are assumed:

- Dewatering activities and the construction of the New Reservoir could alter natural water flow patterns and levels, potentially impacting aquatic habitats.
- Temporary or permanent changes in drainage patterns due to excavation and infrastructure placement.
- The fill used to construct the earthen dams of the New Reservoir could contain materials which can become suspended in surface water and transferred to Lake Geraldine.

For the operation phase, an impact classification of *Negative and mitigable (M)* is given impact to Hydrology and Limnology at the LTWP. With the construction of the New Reservoir and its dam and dykes, the water levels in the control structure will increase. Natural drainage under the access road will be maintained by using culverts and water flow will be directed to the natural drainage paths towards the Niaqunnguk (Apex) River.

- The presence of piles and intake structures may obstruct or redirect water flow, altering the natural flow regime. This can lead to localized areas of accelerated flow or stagnation.
- Continuous water withdrawal and conveyance could affect the seasonal and long-term water levels in Lake Qikiqtalik and the Niaqunnguk (Apex) River.
- Potential changes in the water balance of Lake Geraldine due to the operation of the New Reservoir.

3.2.4.2 Mitigation

The following mitigation measures will be implemented during the construction phase of the LTWP:

- During the dewater phase of construction, water from the ponds will be pumped into the streams leading to the Niaqunnguk (Apex) River.
- An appropriate depth and flow (i.e., base flow and seasonal flow of water) will be maintained in the Niaqunnguk (Apex) River for the protection of The Niaqunnguk (Apex) River discharge will be monitored using WSC stations 10UH015 and 10UH002 to ensure water is not withdrawn when flow is below 30% of MAD (DFO 2024).
- A Spill Response Plan will be develop and immediately implemented to minimize the risk of deleterious substances entering a watercourse or water body, and to ensure containment kits are available during all phases of the pumping (DFO 2024).
- Sediment control measures such as silt fences, sedimentation ponds, and buffer zones around construction areas will be implemented.
- Activities will be scheduled to minimize exposure of bare soil, particularly during rainy or snowmelt periods.
- Disturbed areas will be promptly stabilized with erosion control materials.
- A Spill Prevention and Response Plans will be developed for construction sites.
- Procedures for proper storage and handling of hazardous materials will be implemented to prevent accidental releases.
- Regular inspection and maintenance of machinery and equipment will be conducted to prevent leaks.

The following mitigation measures will be put in place during operation and maintenance activities at the LTWP:

- Water withdrawal of the Niaqunguk (Apex) River will only occur during the spring freshet.
- Withdrawal from the Niaqunguk (Apex) River will be limited when the natural flow of the Niaqunguk River is above 30% of the mean annual discharge (MAD) and the withdrawals will not exceed 20% of the instantaneous flow of the Niaqunguk River.

- Should the DFO request that withdrawals are to stop due to effects on fish and fish habitat, the activity must cease until DFO indicates withdrawals can resume.
- A Water Management Plan will be designed and implemented that mimics natural flow regimes to maintain ecological balance.
- Regular monitoring of water levels in affected water bodies will be conducted, and operations will be adjusted as necessary to mitigate impacts.

3.2.5 Water Quality

3.2.5.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction and operations activities that will impact the Water Quality VEC due to the following:

- Accidental fuel spills from equipment, machinery and vehicles used during construction, blasting and excavation activities have the potential to impact sediment and water quality. Containing contaminants will be important in maintaining water quality in the New Reservoir.
- The fill used to construct the earthen dams of the New Reservoir could contain materials which can become suspended in surface water and transferred to Lake Geraldine.
- Increased sediment loads from construction activities can degrade water quality and affect aquatic habitats.
- Risk of pollutants entering water bodies from construction sites, including hydrocarbons and heavy metals.

3.2.5.2 Mitigation

The following mitigation measures will be implemented during the construction phase of the LTWP:

- No disturbance of the stream bed, lakebed or the banks of any definable watercourse will be permitted, except where deemed necessary for maintaining project-specific operational commitments or where approved by a responsible authority in cases of spill management (NIRB recommendation 6).
- Erosion and sediment suppression measures will be implanted on all areas during all project activities in order to prevent sediment or fugitive dust from entering any water body or surrounding environment. Erosion prevention measures may include berms or silt fences (NIRB recommendation 7).
- The deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body will be strictly prohibited. An Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies) should be in place (NIRB recommendation 8).
- All fuel and other hazardous materials will be located a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The materials will be stored in such a manner as to prevent their release into the environment (NIRB recommendation 10).

- Secondary containment or surface liners (e.g., self-supporting insta-berms and fold-a-tanks) will be used when storing barreled fuel and chemicals at all locations (NIRB recommendation 11).
- The refueling of all equipment will be done a minimum distance away from the high-water mark of any water body as required by the appropriate authorizing agencies (NIRB recommendation 12).
- The construction contractor will be required to have a Spill Contingency Plan in place at all fuel storage or transfer locations and will be required to ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available (NIRB recommendation 13).
- All spills of fuel or other deleterious materials of 100 litres or more will be reported immediately to the 24-hour Spill Line at (867) 920-8130 (NIRB recommendation 16).
- Steps will be taken to prevent drilling wastes from spreading to the surrounding lands or water bodies (NIRB recommendation 22).
- All land-based drilling or mechanized clearing activities will be undertaken to meet the minimum distance of the normal high-water mark of any water body as required by an authorizing agency (NIRB recommendation 25).
- If an artesian flow is encountered, the City will ensure the drill hole is immediately plugged and permanently sealed (NIRB recommendation 26).
- Sumps will not be located within the minimum distance of the normal high-water mark of any water body as required by an authorizing agency (NIRB recommendation 28).
- All machinery arriving on site will be in a clean condition and meticulously maintained to prevent fluid leaks and invasive species contamination. Environmentally friendly hydraulic fluids, such as biodegradable vegetable oil, will be utilized on equipment whenever possible.
- An Erosion and Sediment Control Plan will be developed and implemented to effectively mitigate the environmental impacts of erosion and sediment runoff.
- Regular inspection, maintenance, and repair of erosion and sediment control structures (temporary matting, geotextile silt control filter (curtains) fabric, etc.) will be conducted for detection of damage during construction.
- Weather conditions will be considered when carrying out the work to ensure that erosion potential associated with wind and rainfall runoff is mitigated. Any work carried out during the freshet would require additional precautions associated with snow melt runoff and flow.

The following mitigation measures will be put in place during operation and maintenance activities at the LTWP:

- Erosion and sediment suppression measures will be implemented in all areas during all project activities in order to prevent sediment or fugitive dust from entering any water body or surrounding environment. Erosion prevention measures may include berms or silt fences (NIRB recommendation 7).
- The deposit of any fuel, chemicals, wastes (including wastewater) or sediment will be prohibited from entry into any water body. An Emergency Spill Response Plan, approved by the appropriate authorizing agency(ies), will be in place (NIRB recommendation 8).

- All fuel and other hazardous materials will be located at a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The materials will be stored in such a manner as to prevent their release into the environment (NIRB recommendation 10).
- Containment or surface liners (e.g., self-supporting insta-berms and fold-a-tanks) will be used when storing barreled fuel and chemicals at all locations (NIRB recommendation 11).

3.2.6 Climate Conditions

3.2.6.1 Impacts

Impacts of Climate Conditions are *Negative and mitigable (M)* for the construction phase of the LTWP. The timescale of the construction period is three years. Climate change impacts for Iqaluit are generally accepted to be a warming of air temperature, potential thawing of permafrost, and increased precipitation. This may impact construction activities during this timeframe manifesting in warmer temperatures and greater potential for extreme weather (high winds, high precipitation and higher temperatures). Climate Condition impacts from climate change during the construction period may include:

- Increased temperature extremes may lead to potential permafrost thaw, leading to ground instability and difficulties in infrastructure placement.
- Periods of increased temperatures may extend the construction season and may also increase heat stress on workers and machinery.
- Higher frequency of storms and extreme weather events may result in construction delays and increased risk of damage to materials, equipment and structures.

An impact classification of *Negative and mitigable (M)* is given for the operation phase activities that will impact Climate Conditions at the LTWP. The LTWP will provide resiliency of the supply of water, which may continue to increase as it is expected that precipitation and temperatures will increase in Iqaluit as an effect of climate change. Climate Condition impacts from climate change during the operations phase may include:

- Changes in precipitation patterns may impact water source reliability.
- Changes in permafrost and it's depth impacting the main components of the LTWP.
- Infrastructure may face increased wear and damage from extreme weather events, leading to higher maintenance requirements.
- Potential for altered ecosystems requiring adjustments in withdrawal and treatment processes.

3.2.6.2 Mitigation

The following mitigation measures will be implemented during the construction phase of the LTWP:

- Ground stability will be monitored in areas where there may be potential for ground movements such as in borrow areas and areas where there is higher potential for permafrost.

- An Erosion and Sediment Control Plan will be created to provide guidance to construction teams during the project construction activities.
- Construction schedules will incorporate flexibility to adjust to unforeseen weather delays.
- Weather conditions will be monitored by construction crews to determine when conditions for extreme weather events may occur and plan their scheduling accordingly.
- Construction equipment and materials, as best as is available, will be weather resistant so as to reduce damage from extreme weather events.

The following mitigation measures will be put in place during operation and maintenance activities at the LTWP:

- The current design of the LTWP incorporates two water supply sources to diversify supply.
- Gauges to monitor real-time water levels in the Lake Geraldine, New Reservoir, Lake Qikiqtalik and the Niaqunnguk (Apex) River are to be installed.
- A LTWP Operations Manual outlining the conditions to manage the LTWP will include details for withdrawal and variability in water supply.
- Regular monitoring and maintenance plans to monitor for and record permafrost changes at key LTWP infrastructure. This will include the installation of thermistors and ground water observation wells.
- Regular maintenance inspections of the LTWP infrastructure are planned and their schedule will be outlined in a LTWP Operations Manual.
- Redundancy planning for critical components will be undertaken (ex. backup generators for pumping stations, inventories of critical spare parts, etc.).
- The City will add the LTWP to it's emergency preparedness planning and will include planning for potential extreme weather events.

The following general mitigation measures will be followed throughout construction to limit climate condition impacts:

- Limit the use of construction equipment and vehicle transport to reduce fuel consumption and emissions.
- Use appropriate exhaust emissions controls such as catalytic converters and diesel particulate filters to mitigate fuel combustion emissions from heavy equipment and vehicles.
- Reduce the use of materials and fossil fuels as much as is possible.
- Phase construction activities to minimize heating requirements.

The following mitigation measures will be followed throughout the operation and maintenance phase to limit climate condition impacts:

- Maintain a low-speed limit on all access roads to limit emissions and dust generation.
- Limit the number of vehicle and equipment movements to reduce fuel consumption.
- Reduce the use of fossil fuels as much as is possible.

- Use and maintain appropriate exhaust emissions controls such as catalytic converters and diesel particulate filters to mitigate fuel combustion emissions from heavy equipment and vehicles.
- Explore the use of renewable energy sources should they be made available in the City.

3.2.7 Eskers and Other Unique or Fragile Landscapes

3.2.7.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction activities that could potentially impact Eskers and Other Unique or Fragile Landscapes VEC. A presumed esker is located near the Lake Qikiqtalik and has been used as source of borrow material for the construction of the Emergency Road. The primary risk is:

- Removing too much borrow material from the area may impact the esker by causing slope instability or erosion.

No impacts are expected (-) for the operations and maintenance phase as no ground clearing or land extraction activities are expected.

3.2.7.2 Mitigation

The following mitigation measures will be followed during construction:

- Erosion and sediment control measures will be implemented in all areas during all project activities to prevent sediment or fugitive dust from entering any waterbody or surrounding environment. Erosion prevention measures may include berms or silt fences (NIRB recommendation 7).
- Locate all fuel and other hazardous materials a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The materials will be stored in such a manner as to prevent their release into the environment (NIRB recommendation 10).
- The construction contractor will have a Spill Contingency Plan in place at all fuel storage or transfer locations and will ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available (NIRB recommendation 13).
- Ensure that all drill areas are constructed to facilitate minimizing the environmental footprint of the project area (NIRB recommendation 24).
- Ensure that all sump/depression capacities are sufficient to accommodate the volume of wastewater and any fines that are produced. The sumps will only be used for inert drilling fluids, and not any other materials or substances (NIRB recommendation 27).
- Ensure all drill holes are backfilled or capped prior to the end of each field season. All sumps must be backfilled and restored to original or stable profile prior to the end of each field season (NIRB recommendation 29).
- Existing trails will be used where possible during project activities on the land (NIRB recommendation 30).

- Land use areas will be kept clean and tidy at all times (NIRB recommendation 31).
- Ensure that all disturbed areas are restored to a stable or pre-disturbed state using Best Available Technology Economically Achievable (BATEA) upon completion of work and/or abandonment (NIRB recommendation 33.

No impacts are expected (-) for the operations and maintenance phase as no ground clearing is expected.

3.2.8 Surface and Bedrock Geology

3.2.8.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction activities that will impact Surface and Bedrock Geology VEC. The LTWP site is mostly composed of bedrock and glacial till cover. There is not a significant amount of soil accumulated on the site. Blasting will be required for the construction of the LTWP to break bedrock into smaller dimensions for transport and use in the construction of roads, dams dykes and berms. This may result in the following impacts:

- Blasting bedrock into smaller dimensions for transport will directly impact the local bedrock surface and cause erosion and sedimentation in water bodies.

No impacts are expected (-) for the operations phase as no ground disturbance activities are expected.

3.2.8.2 Mitigation

The following mitigation measures will be followed for construction activities:

- Erosion and sediment control measures will be implemented in all areas during all project activities to prevent sediment or fugitive dust from entering any waterbody or surrounding environment. Erosion prevention measures may include berms or silt fences (NIRB recommendation 7).
- Avoid vehicle rutting or gouging of ground surface during all construction activities by ensuring access roads are built to sustain the weight of all vehicles. Activities will be suspended if rutting occurs. (NIRB recommendation 20).
- Ensure that all drill areas are constructed to facilitate minimizing the environmental footprint of the project area (NIRB recommendation 24).
- Existing trails will be used where possible during project activities on the land (NIRB recommendation 30).
- Land use areas will be kept clean and tidy at all times (NIRB recommendation 31).
- A blasting plan will be developed and implemented for the use of explosives.

3.2.9 Sediment and Soil Quality

3.2.9.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction activities that will impact the Sediments and Soil Quality VEC due to the following:

- Ground cover disruption from the construction and installation of buildings and infrastructure required for the project will disrupt or eliminate the existing vegetation and soil cover.
- Equipment required for the material handling, loading, and dumping of materials may temporarily disrupt soil cover and sediments.
- Accidental fuel spills from equipment, machinery and vehicles used during construction, blasting and excavation activities have the potential to impact sediment and soil quality. Maintaining this will be important in maintaining soil and water quality in the New Reservoir.

An impact classification of *Negative and mitigable (M)* is given for the operational activities that could impact sediments and soil quality due to the following:

- Accidental fuel or chemical spills from equipment or vehicles used for operations and maintenance activities, have the potential to impact sediment and soil quality.

3.2.9.2 Mitigation

The following mitigation measures will be followed throughout the construction phase, and during operation and maintenance work:

- Ensure that no disturbance of the stream bed, lakebed or the banks of any definable watercourse be permitted, except where deemed necessary for maintaining project-specific operational commitments or where approved by a responsible authority in cases of spill management (NIRB recommendation 6).
- Implement erosion and sediment suppression measures on all areas during all project activities in order to prevent sediment or fugitive dust from entering any water body or surrounding environment. Erosion prevention measures may include berms or silt fences (NIRB recommendation 7).
- Strictly prohibit the deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body. An Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies) should be in place (NIRB recommendation 8).
- Manage all hazardous and non-hazardous waste including food, domestic wastes, debris and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) in such a manner to avoid release into the environment and access to wildlife at all times until disposed of appropriately or at an approved facility (NIRB recommendation 9).
- Locate all fuel and other hazardous materials a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The

materials will be stored in such a manner as to prevent their release into the environment (NIRB recommendation 10).

- Use of adequate secondary containment or surface liners (e.g., self-supporting insta-berms and fold-a-tanks) when storing barreled fuel and chemicals at all locations (NIRB recommendation 11).
- The construction contractor will have a Spill Contingency Plan in place at all fuel storage or transfer locations and will ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available (NIRB recommendation 13).
- Follow the authorizing agencies' direction for management and removal of hazardous materials and wastes (e.g., contaminated soils, sediment and waste oil) (NIRB recommendation 14).
- All spills of fuel or other deleterious materials of 100 litres or more will be reported immediately to the 24-hour Spill Line at (867) 920-8130 (NIRB recommendation 16).
- Avoid any drilling wastes to spread to the surrounding lands or water bodies (NIRB recommendation 22).
- Ensure that all drill areas are constructed to facilitate minimizing the environmental footprint of the project area (NIRB recommendation 24).
- Ensure that all sump/depression capacities are sufficient to accommodate the volume of wastewater and any fines that are produced. The sumps will only be used for inert drilling fluids, and not any other materials or substances (NIRB recommendation 27).
- Ensure all drill holes are backfilled or capped prior to the end of each field season. All sumps must be backfilled and restored to original or stable profile prior to the end of each field season (NIRB recommendation 29).
- All machinery arriving on site will be in a clean condition and meticulously maintained to prevent fluid leaks and invasive species contamination. Environmentally friendly hydraulic fluids, such as biodegradable vegetable oil, will be utilized on equipment whenever possible.
- An Erosion and Sediment Control Plan will be developed and implemented to effectively mitigate the environmental impacts of erosion and sediment runoff.
- Conduct regular inspection, maintenance, and repair of erosion and sediment control structures (temporary matting, geotextile silt control filter (curtains) fabric, etc.) for damage during construction.

3.2.10 Tidal Process and Bathymetry

3.2.10.1 Impacts

No impacts are expected (-). Tidal processes and marine bathymetry are not evaluated for the LTWP since the Project site is considered isolated from the tidal flows from Frobisher Bay.

3.2.10.2 Mitigation

No mitigation measures are being considered.

3.2.11 Air Quality

3.2.11.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction and operations activities that could potentially impact air quality due to the following:

- Particulate matter from construction activities related to the modification of any existing structures and construction of new structures (including but not limited to drilling, cutting, grinding, sanding and demolition activities).
- Dust from any and all earthworks, excavations, and grading activities during the construction phase.
- Dust from soil/aggregate material movement within the LTWP construction area.
- Dust from heavy equipment/vehicle travel on unpaved or heavily soiled areas.
- Fuel combustion gases from heavy equipment and vehicles.
- Air emissions from operating equipment, machinery and vehicles during the post-construction (i.e., the operational phase) will likely have the potential to impact the general air quality from the contributing emissions.

3.2.11.2 Mitigation

The following mitigation measures will be followed:

- A Construction Air Quality Management Plan will be developed and implemented that will take into consideration all potential emission sources from proposed activities and consider management strategies to reduce the generation of emissions and its corresponding impacts to the surrounding environment and communities.
- Implementation of air quality monitoring and dust management measures throughout the construction phase will occur to reduce or eliminate the potential impacts of airborne dust from construction vehicle use along access routes; both private and public.
- A combination of best management practices and proactive mitigation to implement dust control will be used to prevent and/or minimize the uncontrolled generation of dust and to minimize the impacts and disruptions to the surrounding population.
- Routine inspection of construction equipment will be conducted as modern construction equipment and vehicles have been engineered to minimize their emissions and therefore mitigate their potential impact on air quality. Where maintenance is needed to ensure that emission controls are performing effectively, it will be as per manufacturer requirements. The construction contractor will be required to monitor for abnormal emissions and prescribe actions to correct vehicle and equipment maintenance.

The best management principles adopted by the construction industry will be adhered to in order to prevent the emission of dust and other pollutants into the atmosphere, such as:

- Discourage unnecessary on-site vehicle and equipment idling.
- Complete daily inspections of heavy equipment to ensure all construction equipment operated for the Project is in good working order and following the approved maintenance program.
- Monitor visible emissions as well as air quality via handheld and continuous air quality monitoring stations. Where abnormal emissions from equipment such as odours and high opacity is observed and/or measured, the Operators will be actioned to either have under vehicle maintenance or provide records that show it has been tuned and maintained in accordance with preventative maintenance programs following manufacturers requirements in order to minimize harmful emissions from incomplete combustion.
- Use water spray to control dust generation from construction activities.
- Use tarpaulins, soil binders or similar preventative techniques to control dust. However, chemical dust suppressants will not be used in areas where plants, wetlands, or other aquatic organisms could potentially be harmed. When using chemical dust suppressants, a non-chloride dust suppressant that is approved by the Government of Nunavut will be used.
- Tracking of earth or soil from the site by trucks to adjacent roadways will be minimized by using mechanical means such as mud mats (e.g., granular pads located at site entrance), and/or street sweeping and the physical removal of earth from vehicles (e.g., wheel washing), as needed.
- Vehicles hauling soil, aggregates or fine or dusty material will be covered to minimize the generation of dust.
- Schedule and plan construction activities in order to minimize the areas of soil exposed at any given time.
- Construction activities will be scheduled and managed to avoid interfering with peak period traffic and to reduce the obstruction of traffic lanes adjacent to the construction areas in order to minimize idling emissions, without compromising safety of the travelling public and workers.
- Exposed soil areas and adjacent roads will be monitored for dust generation potential, with attention paid to areas used for pedestrian walkways and vehicle traffic.
- On-site sweeping and cleaning will need to be performed as needed to minimize dust generation.
- Restore and stabilize soil surfaces as soon as possible after the cessation of construction works in that area.
- Schedule transportation and delivery of construction materials to minimize the amount of dust-generating construction materials that are stored on-site at a given time.
- Compliance with posted speed limits, and further reducing speed when travelling on unpaved surfaces to reduce the generation of dust. Per Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities, (ECCC, 2005) Section 6.5.1, "Construction sites should limit the speed of vehicles travelling on unpaved access/haul roads within construction sites to a maximum of 16-24 kilometres per hour (10-15 miles per hour) and to 10 kilometres per hour (6 miles per hour) on unmade surfaces".

- Encourage the use of construction equipment that are of low emissions factors and high energy efficiency such as the use of reformulated fuels, emulsified fuels, exhaust catalyst and filtration technologies, cleaner engine repowers, and new alternative-fuelled trucks capable of using ultra-low sulphur diesel fuels and/or equipped with tier 4 (or better) rated diesel engines with diesel particulate matter traps.

3.2.12 Noise Levels

3.2.12.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction and operations activities of the LTWP pertaining to Noise Levels VEC.

It is anticipated that both the construction and the operations would have the potential to impact the acoustic environment at the LTWP site and in the surrounding areas. The construction and the operation of the Project will increase the ambient noise levels in the surroundings, and the increase in noise levels may be disruptive to humans and wildlife located within and adjacent to the LTWP site.

The LTWP site is located more than ~700 m away from the closest residential community in the City of Iqaluit. Due to the large setback distance, it is anticipated that the noise impact from the LTWP on the community would be insignificant, and the existing sources of noise (i.e., transportation and stationary) in the area would dominate the acoustic environment. To confirm this, however, a detailed noise assessment should be conducted at a later stage of the LTWP to evaluate the potential noise impact, once more specific construction and operational details of the LTWP are available. It is expected that any potential noise impacts can be mitigated to minimize the potential for temporary disturbance.

Blasting will be required for the excavation of the New Reservoir and access roads. Some nearby project site receptors were identified in the Blasting Assessment Report (Explotech 2025). Those are summarized in the Table 3-2 below.

Table 3-2 Closest Receptors to the Project Footprint

Receptor	Distance to Receptor (m)	Direction from Blasting Footprint Limits
Residential Structures on Road to Nowhere	~500	South
Residential Structures in Plateau Subdivision	~1050	West
Lake Geraldine Dam	~550	Southwest
Power Plant	~720	Southwest
Water Treatment Plant	~800	Southwest
Hospital	~1120	Southwest

The noise impacts of the construction phase include:

- Temporary increase of the ambient sound levels in the immediate surroundings which can result in a stress response that interferes with routine behaviour, may affect breeding success and may cause wildlife (including terrestrial, aquatic and bird species) to flee from their habitats putting them at risk of predation or human encounters. However, the potential impacts of noise on mammals and birds at the Project location is difficult to evaluate without knowing the current distribution of species present.
- Air overpressure from blasting can cause significant noise, which, while not often damaging, can be a nuisance to humans in surrounding areas. This noise can travel long distances, influenced by environmental factors such as wind and temperature inversions, leading to complaints from residents. Overpressure levels around 141 dB are considered to be the threshold at which damage to structures, like windows in poor condition, could occur, similar to the impact of a strong wind gust.
- Ground vibrations from blasting decrease with distance but can affect human comfort and perceived safety.

As part of the project, the following new sources of sound will be introduced and could potentially cause a *Negative and mitigable (M)* impact to the existing acoustical environment during operation:

- Mechanical equipment int the RWPS at Lake Qikiqtalik.
- Mechanical equipment in the control building for the New Reservoir.
- Vehicular traffic along the new access road from Road to Nowhere to the New Reservoir.

3.2.12.2 Mitigation

The following mitigation measures will be implemented to reduce and/or eliminate noise during construction:

- Adherence to the requirements outlined in the City of Iqaluit's Noise By-law.
- Limit construction activities to only the time period of 07:00 to 22:00, as outlined in the City's Noise By-law.
- If construction needs to occur outside the above-noted hours, an authorization from the City of Iqaluit must be obtained to be exempted from the Noise By-law.
- Schedule major construction activities during daytime hours, where possible, when ambient/existing noise levels are higher, thus avoiding the quieter nighttime period.
- Require the contractor to keep the idling of construction equipment to a minimum as necessary and to maintain equipment in good working condition to reduce noise from construction activities.
- Install and properly maintain noise mitigation equipment (e.g., muffler systems) in accordance with equipment manufacturer requirements.
- Install temporary noise walls to mitigate the noise at the source (i.e. construction equipment).
- Prevent the occurrence of multiple construction activities at the same time (cumulative effects) and for prolonged periods.

- With regards to vibration limits for adjacent residential and commercial industry best practices would employ limits set out by the United States Bureau of Mines USBM Z-Curve (Explotech 2025).
- A vibration limit of 100 mm/s be used near the Lake Geraldine Dam. It should be noted that this recommended limit is extremely conservative, however given the distance between the required blasting and the dam, there is no benefit to applying a higher value (Explotech 2025).
- A monitoring program includes measuring air overpressure and ground vibrations to ascertain the source of complaints and ensure that impacts on infrastructure are minimized.

As part of the project, the following new sources of sound will be introduced and could potentially cause a *Negative and mitigable (M)* impact to the existing acoustical environment during the operations phase:

- Mechanical equipment at the RWPS at Lake Qikiqtalik.
- Mechanical equipment at the control building.
- Vehicular traffic along the new access road from Road to Nowhere to the site.
- Noise generating equipment associated with the RWPS and the control building will be enclosed in buildings.
- Have the proper noise mitigation equipment (e.g., muffler systems) in accordance with equipment manufacturer requirements.
- All vehicles will be maintained and in good working order.
- All workers using the access roads for operation and maintenance activities will follow speed limits.

3.2.13 Terrestrial Vegetation

3.2.13.1 Impacts

The LTWP has the potential to cause *Negative and mitigable (M)* effects to terrestrial vegetation and wetlands during the construction phase. These potential impacts may occur due to:

- Accidental fuel spills from equipment, machinery and vehicles used during construction, blasting and excavation activities that have the potential to impact terrestrial vegetation, wetlands and watercourses. Releases of petroleum-based products can induce toxic effects in terrestrial plants including mortality and sub-lethal effects such as impaired growth or reproductive capacity.
- Land alteration activities such as construction of access roads, grading, blasting, installing of the pipeline and quarrying will destroy vegetation and impact wetlands.
- Removal and disturbance of native plants that may result in a loss of regional biodiversity.
- Disturbance of terrestrial vegetation from vehicular traffic may result in increased erosion and sedimentation.

- Disturbance from construction activities in wetlands that may impact hydrological functions by changing the water regime and the destruction of wetland vegetation by heavy equipment entering wetlands and installing pipelines and covers.
- Heavy machinery and equipment used during project implementation that may increase the risk of transporting noxious weeds and invasive species to and around the site. Noxious weeds and invasive species may negatively impact biodiversity by out-competing and replacing native plants and plant SAR in the area, potentially causing species extirpation and even extinction.

An impact classification of *Negative and mitigable (M)* has been assigned for the operation phase for this VEC due to the following:

- The risk of spills from fuels and chemicals use during routine monitoring and maintenance work.
- Risk of spills from storage of fuels for mechanical equipment (pumps, control station, etc.).
- Potential for erosion of roads, berms and other infrastructure due to frequent usage, for example.

3.2.13.2 Mitigation

The following are mitigation measures that will be implemented to address the potential negative impacts identified above:

- Strictly prohibit the deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body. An Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies) should be in place (NIRB recommendation 8).
- Locate all fuel and other hazardous materials a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The materials will be stored in such a manner as to prevent their release into the environment (NIRB recommendation 10).
- The construction contractor will have a Spill Contingency Plan in place at all fuel storage or transfer locations and will ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available (NIRB recommendation 13).
- Ensure that all drill areas are constructed to facilitate minimizing the environmental footprint of the project area (NIRB recommendation 24).
- Existing trails will be used where possible during project activities on the land (NIRB recommendation 30).
- Land use areas will be kept clean and tidy at all times (NIRB recommendation 31).
- Ensure that all disturbed areas are restored to a stable or pre-disturbed state using Best Available Technology Economically Achievable (BATEA) upon completion of work and/or abandonment (NIRB recommendation 33).
- Development and implementation of a detailed spill prevention and response plan. The plan will include a list of spill response equipment that will be present on-site and will assign implementation and monitoring

roles. Construction personnel will be required to review the plan, understand their roles and responsibilities, and will be properly trained and equipped to conduct spill response activities.

- Implementation of an erosion and sediment control plan that addresses the specific vulnerabilities of terrestrial vegetation (Arcadis, 2024b). This plan states that:
  - Vehicles must remain on access roads and laydown areas. This includes heavy trucks, light-duty trucks, all-terrain vehicles (ATVs), Side-by-sides and cars.
  - Areas where ground disturbance is to occur with be staked in the field before the start of work and the vehicles must remain within the boundaries of this area.
  - Where vehicles must travel across on vegetated ground, they will do so in a single file.
  - Following the completion of the construction activities, the regeneration potential of any damaged areas will be evaluated by a biologist and a regeneration program proposed, and
  - No equipment or vehicles unless the ground surface is in a state capable of fully supporting the equipment or vehicles without rutting or gouging. Overland travel of equipment or vehicles must be suspended if rutting occurs.
- Removal of vegetation will be done using mechanical methods and not biocides.
- Disturbance and impact to wetland vegetation will be kept to a minimum. Movement of equipment will be only permitted in designated areas within wetlands to keep the footprint of disturbance to a minimum.
- Ensure that machinery and materials arrive for use in a clean condition and are maintained free of invasive species and noxious weeds.

3.2.14 Terrestrial Wildlife and Habitat

3.2.14.1 Impacts

The LTWP could potentially have a *Negative and mitigable (M)* impact on wildlife and wildlife habitat during both the construction and operation phases. These potential impacts may occur due to:

- The use of machinery and equipment that could potentially harm terrestrial wildlife, including SAR and migratory birds that enter the Project area and damage previously unknown wildlife habitat features that are encountered during project construction.
- Wildlife becoming trapped in open excavation areas and areas of standing water.
- Releases of petroleum-based products which could induce toxic effects in terrestrial (and aquatic) organisms including mortality and sub-lethal effects such as impaired growth or reproductive capacity.
- Increased levels of noise in the natural environment which could potentially be disruptive to terrestrial and migratory animals in the immediate area, potentially resulting in their relocation from the area.

3.2.14.2 Mitigation

The following are mitigation measures that will be implemented to address the potential negative impacts identified above:

- Strictly prohibit the deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body. An Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies) should be in place (NIRB recommendation 8).
- Manage all hazardous and non-hazardous waste including food, domestic wastes, debris and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) in such a manner to avoid release into the environment and access to wildlife at all times until disposed of appropriately or at an approved facility (NIRB recommendation 9).
- The construction contractor will have a Spill Contingency Plan in place at all fuel storage or transfer locations and will ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available (NIRB recommendation 13).
- Follow the authorizing agencies' direction for management and removal of hazardous materials and wastes (e.g., contaminated soils, sediment and waste oil) (NIRB recommendation 14).
- Ensure that wildlife deterrent systems are utilized at the time of a spill incident in order to avoid wildlife (terrestrial or marine) and migratory birds from being contaminated (NIRB recommendation 15).
- Avoid substantially altering or damaging or destroying any wildlife habitat in conducting the project unless otherwise authorized by the appropriate authorizing agencies (NIRB recommendation 17).
- Existing trails will be used where possible during project activities on the land (NIRB recommendation 30).
- Land use areas will be kept clean and tidy at all times (NIRB recommendation 31).
- Remove all garbage, fuel and equipment at the end of each field season and/or upon completion of work and/or upon abandonment (NIRB recommendation 32).
- Ensure that all disturbed areas are restored to a stable or pre-disturbed state using Best Available Technology Economically Achievable (BATEA) upon completion of work and/or abandonment (NIRB recommendation 33).
- Proper maintenance of equipment and machinery to minimize unnecessary noise pollution. This will include equipping all machinery and equipment with functioning exhaust and muffler systems; ensuring that machinery covers and equipment panels are well fitted and remain in place to muffle noise; and ensuring that bolts and fasteners are tight to avoid rattling.
- Development and implementation of a Wildlife Management Plan within the Environmental Protection Plan which details wildlife protection measures to be employed. The Plan will assign implementation and monitoring roles, require review and understanding by all on-site personnel including their roles and responsibilities, and stipulate training requirements.
- Temporary fencing and barricades will be erected, when possible, to prohibit wildlife from entering the Project site.

- All food wastes will be secured in wildlife-proof containers and will be removed promptly from the site (particularly in warm weather).
- All potential sources of on-site standing water will be minimized.
- Limit potential sources of wildlife shelter by covering or containing piles of soil, rocks and other loose materials, capping ends of pipes and ensuring that trailers, bins, boxes, and vacant buildings are secured at the end of each workday.
- Check work areas for wildlife, prior to beginning work each day.
- Regularly inspect protective fencing, barricades or other installed measures to ensure their integrity and continued function.
- Construction personnel will stop work if wildlife enter work areas. Work will not commence until wildlife have vacated the vicinity of the work area. Wildlife will be allowed to exit the work area on their own, via safe routes.
- Construction personnel will be prohibited from capturing, handling or harassing wildlife. In the event that wildlife on-site appear to be injured, abandoned, or in distress. Construction personnel will immediately notify the Project Manager who will advise on the appropriate management strategy in consultation with a suitable expert.
- Project personnel will stop work if wildlife habitat features (nest, den, borrow, hibernaculum, etc.) are discovered during project implementation, operations and maintenance. On-site personnel will immediately notify the Project Manager and Senior Biologist.
- Wildlife habitat features will not be disturbed within the work area until a Qualified Environmental Professional (QEP) has assessed the situation and developed a management plan that has been approved by the client.

3.2.15 Species At Risk and Migratory Birds

3.2.15.1 Impacts

The LTWP could potentially have *Negative but mitigable (M)* impacts on SAR and migratory birds during both the Construction and Operation Phases. These potential impacts may occur due to:

- Increased levels of noise in the natural environment could potentially be disruptive to terrestrial animals, including migratory/SAR birds, in the immediate area, potentially resulting in their relocation from the area.
- Damage caused by machinery and equipment to SAR and migratory birds that enter the project area and previously unknown SAR habitat features that are encountered during project implementation.
- Construction activities that could potentially result in the loss of nesting habitat, loss of nests (direct mortality) and the disruption to bird breeding and nesting activities. Most native bird species in Canada are protected under the *Migratory Birds Convention Act*, 1994 (*MBCA*), and are collectively referred to as “migratory birds”. General prohibitions under the *Act* and its regulations protect migratory birds, their nests and eggs anywhere they are found in Canada.

- Construction activities that could potentially result in the loss of SAR and SAR habitat. Section 33 of the *Species at Risk Act* (*SARA*) prohibits damaging or destroying the residence of a listed threatened, endangered, or extirpated species. SARA defines residence as: “a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating”.

3.2.15.2 Mitigation

The following are mitigation measures that will be implemented to address the potential negative impacts identified above:

- Manage all hazardous and non-hazardous waste including food, domestic waste, debris and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) in such a manner to avoid release into the environment and access to wildlife at all times until disposed of appropriately or at an approved facility (NIRB recommendation 9).
- Ensure that wildlife deterrent systems are utilized at the time of a spill incident in order to prevent wildlife (terrestrial or marine) and migratory birds from being contaminated (NIRB recommendation 15).
- Avoid substantially altering or damaging or destroying any wildlife habitat in conducting the project unless otherwise authorized by the appropriate authorizing agencies (NIRB recommendation 17).
- Carry out all phases of the Project in a manner that protects migratory birds and avoids harming, killing or disturbing migratory birds or destroying, disturbing or taking their nests or eggs. In this regard, the City will take into account Environment and Climate Change Canada’s *Avoidance Guidelines*. The City’s actions in applying the *Avoidance Guidelines* will be in compliance with the *Migratory Birds Convention Act, 1994* and with the *Species at Risk Act* (NIRB recommendation 18).
- Avoid disturbing or destroying the nests or eggs of any birds. If active nests of any birds are discovered or located (i.e., with eggs or young), the construction contractor will avoid these areas until nesting is complete and the young have naturally left the vicinity of the nest by establishing a protection buffer zone (according to recommended setback distances established by ECCC for different bird groups nesting in tundra habitat) appropriate for the species and the surrounding habitat (NIRB recommendation 19).
- Existing trails will be used where possible during project activities on the land (NIRB recommendation 30).
- Ensure that all disturbed areas are restored to a stable or pre-disturbed state using Best Available Technology Economically Achievable (BATEA) upon completion of work and/or abandonment (NIRB recommendation 33).
- Wildlife Management considerations will be included in the Environmental Protection Plan for the Protection of SAR and migratory birds during construction.
- A qualified biologist will conduct a bird nest survey within two days prior to commencement of vegetation removal activities if activities are to be conducted during the nesting period and/or if there is the potential that nests of SAR, migratory birds, eagles, peregrine falcons, gyrfalcons may be present in the work area. If nests are present, a qualified biologist will develop a management plan identifying protective measures specific to the species present. Species specific management plans should be developed as needed. The

qualified biologist is provided with authority to modify or halt project activities if it is deemed necessary to do so for the protection of bird species or habitat and will monitor the plan throughout construction.

- Require a Stop work Order if nests are encountered at any time during project implementation and inform the Project Manager. Work in the vicinity of the nest will not commence until a qualified biologist has been to the site, assessed the feature and developed a management plan.
- Avoid damages or destruction to any nests from mid-May or the date when adults are first seen building or occupying the nest (whichever is earlier) to August 19 or when the bird is last seen at the nest (whichever is later).
- Create a buffer of 30 m should a nest be observed in order to not disturb the birds during breeding bird season.

3.2.16 Aquatic Species and Habitat

3.2.16.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction and operations activities of the LTWP pertaining to the Aquatic Species and Habitat VEC.

The Project has the potential to affect aquatic species and habitat during both its construction and operation phases. The potential negative effects are anticipated on the habitats, populations and migrations/spawning of the fish and other aquatic species in Lake Qikiqtalik, Niaqunnguk (Apex) River, the two lakes forming the New Reservoir, Lake Geraldine and other minor waterbodies in the LTWP.

Construction of the intake/discharge pipes at the terminus of the pipelines/canals, construction of the New Reservoir (in particular, construction of the berms/dykes and blasting and removal of waste rock), dewatering activities necessary to prepare areas of construction (for example intake and outfall structures) and construction of the pipeline and ancillary features including roads, utilities and other supporting structures necessary to construct, operate and maintain the water supply system may result in the following effects:

- Lethal effects to fish from blasting, in-water material placement and dewatering; Currently, there is no evidence of fish inhabiting the two lakes that will form the New Reservoir. Nevertheless, if any fish are found in these lakes, the construction activities planned for the New Reservoir will likely result in direct lethal effects to the fish. These effects may include stranding on land due to dewatering and physical damage, such as ruptures, caused by blasting.
- Changes in water quality include an increase in turbidity and sediment load due to erosion and dewatering, increase in nitrogen compounds from explosives residue, introduction of hydrocarbons and other deleterious substances from machinery operation in and around the water. An increase in turbidity and sediment load in aquatic environments can have adverse effects on fish and their habitats by reducing water clarity, limiting light penetration, and disrupting feeding and reproductive behaviors. Elevated nitrogen compounds as well as the introduction of hydrocarbons and other deleterious substances can be toxic to fish, affecting their health and potentially leading to mortality. These combined effects can disturb the

balance of aquatic ecosystems, impacting the survival, reproduction, and overall well-being of fish populations and the habitats they rely on.

- Physical disturbance and stream alterations during spawning/migrations. These disruptions can lead to the displacement of spawning grounds, damage to critical habitat, and interference with the natural behaviors of fish during their crucial reproductive and migratory phases. These disturbances can result in reduced recruitment and long-term impacts on fish populations, potentially leading to declines in their numbers and overall health.
- Removal of benthic habitat and changes to benthic invertebrate communities. Benthic habitats serve as essential foraging areas and refuge for fish, providing access to prey, shelter, and suitable conditions for growth and reproduction. Disruption of these habitats can lead to reduced food availability and affect overall health and survival of fish.
- Introduction of invasive species. The introduction of invasive species to aquatic ecosystems can have devastating effects on native aquatic species and habitats. Invasive species often outcompete native species for resources, disrupt food chains, and alter the physical and chemical characteristics of aquatic habitats. These impacts can lead to declines in native species, changes in ecosystem structure, and pose a significant threat to the health and sustainability of aquatic ecosystems.

Potential effects on aquatic species and habitats during the operation phase of the Project may include the following:

- Mortality of fish and other aquatic organisms due to entrainment and impingement in the pumping equipment.
- Loss of fish habitat and stranding of fish and other organisms in Lake Qikiqtalik as a result of the drawdown.
- Loss of fish habitat and stranding of fish and other organisms in the New Reservoir and Lake Geraldine if changes are made to the drawdown regime.
- Possible impacts on fish from alterations in water temperature due to the discharge of water into Lake Geraldine from the New Reservoir. Temperature alterations can impact the metabolic rates, growth, and reproduction of aquatic organisms, potentially leading to changes in species distribution and abundance. Water temperature changes can affect the timing of critical life cycle events like spawning and can potentially trigger harmful algal blooms and other ecological disturbances.
- The flow into Lake Geraldine has the potential to result in bed erosion within the channel and an associated increase in the sediment load.

It is worth noting that potential effects on water quality in Geraldine Lake, aside from changes in temperature resulting from the discharge from the New Reservoir, are not addressed here. This is because the water in Lake Qikiqtalik, which will be pumped into the New Reservoir, complies with the CCME Guidelines for the Protection of Aquatic Life.

3.2.16.2 Mitigation

The potential effects on the Aquatic Species and Habitat during the construction phase of the Project will be avoided or minimized by adhering to industry best practices, guidelines, and recommendations (e.g., DFO and CIRNAC). The mitigation measures will include the following:

- Ensure that no disturbance of the stream bed, lakebed or the banks of any definable watercourse be permitted, except where necessary for maintaining project-specific operational commitments or approved by a responsible authority in cases of spill management (NIRB recommendation 6).
- Implement erosion and sediment suppression measures on all areas during all project activities in order to prevent sediment or fugitive dust from entering any water body or surrounding environment. Erosion prevention measures may include berms or silt fences (NIRB recommendation 7).
- Do not deposit, nor permit the deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body. The City should have in place an Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies) (NIRB recommendation 8).
- Manage all hazardous and non-hazardous waste including food, domestic wastes, debris and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) in such a manner to avoid release into the environment and access to wildlife at all times until disposed of appropriately or at an approved facility (NIRB recommendation 9).
- Locate all fuel and other hazardous materials a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The materials will be stored in such a manner as to prevent their release into the environment (NIRB recommendation 10).
- Use of adequate secondary containment or surface liners (e.g., self-supporting insta-berms and fold-a-tanks) when storing barreled fuel and chemicals at all locations (NIRB recommendation 11).
- Ensure that refueling of all equipment occurs a minimum distance away from the high-water mark of any water body as required by the appropriate authorizing agencies (NIRB recommendation 12).
- The construction contractor will be required to have a Spill Contingency Plan in place at all fuel storage or transfer locations and will be required to ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available (NIRB recommendation 13).
- Ensure that wildlife deterrent systems are utilized at the time of a spill incident in order to avoid wildlife (terrestrial or marine) and migratory birds from being contaminated (NIRB recommendation 15).
- All spills of fuel or other deleterious materials of 100 litres or more will be reported immediately to the 24-hour Spill Line at (867) 920-8130 (NIRB recommendation 16).
- Avoid substantially altering or damaging or destroying any wildlife habitat in conducting the project unless otherwise authorized by the appropriate authorizing agencies (NIRB recommendation 17).
- Ensure that any deleterious substances (as defined in the *Fisheries Act*) resulting from their activities do not enter into any water bodies frequented by fish (NIRB recommendation 23).
- Avoid killing fish by means other than fishing (DFO 2024).
- Monitor for fish stranding caused by reduced water level and conduct fish rescues as needed (DFO 2024).
- Limit the duration of in-water works, undertakings, and activities so as to not diminish the ability of fish to carry out one or more of their life processes (e.g., spawning, rearing, feeding, migrating) (DFO 2024). Avoid

in-water construction work during the period from September 1 to June 30, in waters supporting arctic char and any forage fish.

- Ensure intake pipes are screened and sized appropriately to prevent entrainment or impingement of fish. Adhere to the Interim code of practice: *End-of-pipe fish protection screens for small water intakes in freshwater* (DFO 2025).
- Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish and fish habitat (DFO 2024).
- While there is currently no evidence of fish inhabiting the two lakes that will eventually become part of the New Reservoir, any fish present in the lakes will be carefully captured and relocated to a similar natural habitat as a precautionary measure before dewatering activities.
- Should blasting in a fish bearing water body be required, the DFO's *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (1998)* will be consulted and a procedure prepared.
- In-water works will be minimized to the greatest extent possible. Where pipelines and ancillary structures must cross waterbodies, the crossing area will be appropriately isolated with accommodation to allow fish movement around the construction area if necessary, and pumping facilities will be in place to ensure that instream flows are maintained and the construction area is not at risk of flooding.
- A setback distance of 30 meters will be enforced, prohibiting any non-essential construction activities within 30 meters of Lake Qikiqtalik, Niaqunnguk (Apex) River, the two lakes that constitute the New Reservoir, and Geraldine Lake.
- A water treatment reservoir will be constructed to collect water from dewatering and construction areas, ensuring the removal of harmful substances, such as nitrogen compounds and sediment, before releasing the treated water into the natural environment.
- All machinery arriving on site will be in a clean condition and meticulously maintained to prevent fluid leaks and invasive species contamination. Environmentally friendly hydraulic fluids, such as biodegradable vegetable oil, will be utilized on equipment whenever possible.
- To minimize disruption to the banks and bed of the waterbody, machinery operations will, whenever feasible, take place above the high-water mark. Steep-banked or sloped areas will be conscientiously avoided when entering or exiting a waterbody.
- Conduct regular inspection, maintenance, and repair of erosion and sediment control structures (temporary matting, geotextile silt control filter (curtains) fabric, etc.) for damage during construction.
- The clearing of riparian vegetation will be minimized, and existing trails, roads, or cut lines will be utilized whenever possible to avoid disturbing riparian vegetation and prevent soil compaction.
- Activities that could alter flow, water levels, or obstruct fish movement or migration will be strictly avoided.
- Construction activities in fish-bearing waterbodies will adhere to Nunavut Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat. These timing windows are designed to safeguard fish during critical spawning and incubation periods when spawning fish, eggs, and fry are particularly vulnerable to disturbance or sediment. For fall-spawning Arctic char, the timing window spans from August 15 to June 30.

The following mitigation measures will be implemented during the operations phase of the Project:

- Ensure that no disturbance of the stream bed, lakebed or the banks of any definable watercourse be permitted, except where deemed necessary for maintaining project-specific operational commitments or approved by a responsible authority in cases of spill management (NIRB recommendation 6).
- Do not deposit, nor permit the deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body. The Proponent should have in place an Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies) (NIRB recommendation 8).
- Manage all hazardous and non-hazardous waste including food, domestic wastes, debris and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) in such a manner to avoid release into the environment and access to wildlife at all times until disposed of appropriately or at an approved facility (NIRB recommendation 9).
- Water intakes will be equipped with screens in accordance with DFO's Freshwater Intake End-of-Pipe Fish Screen Guideline (1995) to prevent fish entrainment and impingement.
- The screens will be designed and installed to prevent the uptake and entrainment of sediment and benthic organisms.
- Regular maintenance and cleaning of the intake and screens will be conducted to prevent fouling with debris and fish impingement. Provisions will be made for screen removal, inspection, and cleaning, with pumps being shut down during this process.
- Withdrawal from Lake Qikiqtalik will be limited to less than 10% of the lake's volume. Withdrawal will cease once Lake Geraldine reaches its capacity.
- If any modifications to the drawdown regime in Lake Geraldine or the New Reservoir become necessary, a separate permit request will be submitted, and an additional effects assessment will be conducted.
- Should studies confirm that Lake Geraldine and the New Reservoir are fishless, an application should be made to DFO to request that these waterbodies be classified as artificial, part of the City’s water supply system and therefore they would not be considered as fish habitat.
- Water temperature in the New Reservoir and Lake Geraldine will be monitored before discharge to ensure compliance with guidelines for aquatic life protection (e.g., alteration of existing thermal stratification and subsequent turnover dates or exceeding the maximum weekly average temperature [CCME 1987]) in Lake Geraldine.
- An Erosion and Sediment Control Plan will be developed and implemented to effectively mitigate the environmental impacts of erosion and sediment runoff.
- Prior to commencing any work, robust erosion and sediment control measures will be established to prevent sediment entry into the waterbody. These measures will be subject to regular inspection, maintenance, and repair if damaged during operations.

3.2.17 Archaeological and Cultural Historic Site

3.2.17.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction activities of the LTWP that will impact the Archaeological and Cultural historic SVEC due to the following:

- Archaeological sites KkDn-54, KkDn-55, and KkDn-58 were determined to be historically significant sites with interpretive value. The AECOM reports recommended as part of the AIA that KkDn-54, KkDn-55, and KkDn-58 be avoided if possible. However, if it is not possible to avoid disturbing the features as part of the project construction then mitigation measures such as detailed mapping, dismantling of the feature, and mitigative excavations will be undertaken.

An impact classification of *No impacts are expected (-)* is given during the operations and maintenance phase as any known archaeological sites would have been encountered during the construction phase and mitigation measures would have already been implemented.

3.2.17.2 Mitigation

The following mitigation measures will be followed during construction should a culturally protected site be encountered:

- Ensure that archaeological and paleontological sites are not purposely or inadvertently disturbed by clients or staff as a result of project activities (NIRB recommendation 34).
- Ensure that all clients and staff are aware of the Proponent's responsibilities and requirements regarding archaeological or paleontological sites that are encountered during land-based activities. This should include briefings explaining the prohibitions regarding removal of artifacts and defacing or writing on rocks and infrastructure (NIRB recommendation 35).
- No activities will be conducted in the vicinity (50 metres buffer zone) of any archaeological/historical sites. If archaeological sites or features are encountered, activities will immediately be interrupted and moved away from this location. Each site encountered needs to be recorded and reported to the Government of Nunavut-Department of Culture and Heritage (NIRB recommendation 36).

3.2.18 Employment

3.2.18.1 Impacts

An impact classification of *Positive (P)* is given for the construction and operations and maintenance activities of the LTWP for the Employment SVEC. The construction of the LTWP is expected to create employment opportunities for the three years of planned construction. The LTWP will also create economic opportunities for the community of Iqaluit through indirect employment through materials supply, services, and housing requirements. It is likely that the Iqaluit based workers will be used during this period, however some temporary workers may need to be flown into Iqaluit and lodged in hotels or established work camps. Construction of the LTWP will be through a turnkey

contractor with connections to the industry in Iqaluit. Likely the operations of the LTWP will require the hiring of new personnel to oversee the additional LTWP infrastructure and maintenance and service providers will be required to support the maintenance of the LTWP over its lifetime.

Impacts during the construction phase are as follows:

- Positive impacts from employment opportunities for the community of Iqaluit.
- Positive impacts from the need for supporting services and business in the City of Iqaluit.

3.2.18.2 Mitigation

Notwithstanding the Positive Impact, the following mitigation measures will be implemented:

- To the extent possible, hire local people and access local services where possible (NIRB recommendation 39).
- Opportunities to employ Inuit will be included.
- Temporary workers will be housed in existing locations in the City of Iqaluit. No new residential areas or work camps are required for the construction of the LTWP.

3.2.19 Community Wellness

3.2.19.1 Impacts

An impact classification of *Negative and non-mitigable (N)* is given for the construction activities of the LTWP as they pertain to the Community Wellness SVEC. This classification acknowledges the potential likelihood that the construction of the LTWP will limit access to the east of Iqaluit on the Road to Nowhere due to construction equipment operating during the construction period. This would include the use of the shooting range, the swimming areas area south of the bridge on the Road to Nowhere and potentially limiting the use of the rotary park. The Niaqunnguk (Apex) River valley is used for snowmobiling leading north to Lake Qikiqtalik north out of the municipal boundaries. A *Negative and non-mitigable (N)* classification is assigned as the Embrace Life shelter and shooting range will be permanently moved to a new location. Impacts include;

- The temporary disruption of existing recreational and traditional land uses during the construction phase of the LTWP.
- The temporary and permanent relocation of the existing structures caused by the contraction of the LTWP.
- Potential risks for collisions of snowmobiles with newly constructed LTWP infrastructure.

An impact classification of *Positive (P)* is given for the operation and maintenance activities of the LTWP as they pertain to the Community Wellness SVEC. This classification reflects the fact that the operation of the LTWP will provide a reliable supply of drinking water to supplement Lake Geraldine source. The operations will create employment opportunities for the routine operations of the LTWP as well as for the planned maintenance activities.

3.2.19.2 Mitigation

The following mitigation measures are proposed to address the potential negative impacts during construction:

- Local residents will be engaged regarding planned activities in the Project area and information will be solicited from Inuit Qaujimaningit regarding current recreational and traditional usage of the LTWP which may inform project activities. Posted public notices will be translated and direct engagement will be had with potentially interested groups and individuals prior to undertaking project activities is strongly encouraged (NIRB recommendation 37).
- Steps will be taken to ensure that project activities do not interfere with Inuit wildlife harvesting or traditional land use activities where it is safe for the public to do so.
- Signage at appropriate areas across the LTWP pipeline pathways indicating the presence of recent construction and new infrastructure will be posted during the winter periods between construction years.
- Public notices will be made to inform snowmobile users to remain cautious when operating their snowmobiles near the LTWP site.
- A section of the water pipeline crossing the eastern tributary of the Niaqunnguk (Apex) River leading to Lake Qikiqtalik near the existing access road will be more gradually sloped to ensure that snow mobiles can pass over the pipeline without potential for collision.

Notwithstanding the Positive impacts, the following mitigation measures are proposed during the operations and maintenance phase.

- Signage at appropriate areas across the LTWP pipeline pathways indicating the presence of infrastructure will be posted during the winter periods between construction years.
- Access roads leading to the New Reservoir and Lake Qikiqtalik RWPS will the gated to limit vehicle access close to the planned infrastructure.

3.2.20 Community Infrastructure

3.2.20.1 Impacts

An impact classification of *Negative and mitigable (M)* is given for the construction activities of the LTWP for the Community Infrastructure SVEC, though details are unclear as the construction plans and schedule for the LTWP are not yet available. It is likely that the construction activities will require the temporary use of existing municipal roads and bridges to move construction materials and vehicles. In addition, the Project would likely involve the use of the ports for the delivery of materials and may require shipping special types of construction vehicles. Water may be required for concrete mix. Waste materials generated will require disposal in the landfill. Electricity will be needed to power the construction and operations phases. Sources being evaluated are either to use mobile fossil fuel powered generators or to construct a utility connection. During construction, the laydown area mobile offices, rock crushers and concrete plants will need electricity to operate. Once the LTWP is in operation, the RWPS and the New Reservoir will need electricity to operate their pump and control equipment.

An impact classification of *Positive (P)* is given for the operations and maintenance activities of the LTWP for the Community Infrastructure SVEC due to the following:

- The operation of the LTWP will provide a reliable and safe supply of drinking water to supplement Lake Geraldine.

3.2.20.2 Mitigation

While the use of community infrastructure is unavoidable during construction, measures can be taken to reduce unnecessary pressures, including:

- Limiting truck usage in Iqaluit by avoiding the use of quarry and borrow material sources located in the west end of the City of Iqaluit.
- Avoiding the use of drinking water for construction activities.

No mitigation measures are proposed during the operations and maintenance phase.

3.2.21 Human Health

3.2.21.1 Impacts

An impact classification of *Negative but mitigable (M)* is given for the construction activities of the LTWP as they pertain to the Human Health SVEC for the following reasons:

- Approximately 30 to 120 temporary workers in Iqaluit are estimated for the construction period and may place an undue strain on the emergency services of Iqaluit should there be a large-scale medical urgency on the LTWP. The construction plans and schedule have not been prepared but will be later in the planning of the LTWP.
- See Section 3.2.12 Noise for noise impacts specifically.

An impact classification of *Positive (P)* is given for the operations and maintenance activities of the LTWP for the Human Health SVEC due to the following:

- The operation of the LTWP will provide a supply of drinking water to supplement Lake Geraldine to the City of Iqaluit.

3.2.21.2 Mitigation

The following mitigation measures will be followed during construction:

- All workers on the LTWP construction site will be subject to respect the applicable laws and regulations applied to Health and Safety.
- Appropriate Personal Protective Equipment (PPE) will be worn as required. This includes steel-toed boots protecting the ankle, high visibility vests, safety helmets and safety glasses.

- Should the number of workers expect for the construction phase of the LTWP exceed the capacity of the available emergency services of the Iqaluit, it is proposed that a third-party service that can support first aid and emergency services be available during the construction activities.
- Should any contaminated soils need to be handled, appropriate measures to protect the health and safety of the workers including appropriate PPE will be taken.

No mitigation measures are proposed during the operations and maintenance phase.

4 Cumulative Effects

A cumulative impact (or effect) can be defined as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period.

This report will discuss how the effects of this project interact with the effects of relevant past, present and reasonably foreseeable projects in a regional context as per the requirements outlined in the *Proponent's Guide - NIRB Technical Guide Series*.

There are four basic steps in a cumulative effects assessment:

1. Identifying any adverse residual environmental effects of the proposed project (as presented in Section 3).
2. Identifying other projects or activities that could potentially interact with the residual effects of the proposed project.
3. Considering the likelihood for an interaction in terms of:
    a. Similar effects from other projects and activities that might contribute to those caused by the proposed project.
    b. The time over which these potential interactions coincide.
    c. The geographic area in which the effects occur, and
4. For the effects indicated, determining whether there is overlap in time and space, and where that occurs, the resultant overall cumulative effect and its significance.

4.1 Identify Adverse Residual Environmental Effects

Based on the assessment of effects in Section 3 of this PBSEIA, and as summarized in Table 4-1, there is one (1) Negative and non-mitigable (N) project effects to be considered in a cumulative effects assessment and the only impacts are the permanent relocation of the Embrace Life structure. The residual impact is that this building will need to be demolished and relocated. These cumulative effect is summarized below.

Table 4-1 Project Effects on VECs

Relevant VECs	Direct Effect on VEC	Residual Impacts Expected (Y/*N)
Community Wellness	• Embrace Life structure (former Iqaluit Ski Club) to be permanently removed and relocated.	Yes

4.2 Identifying Other Projects or Activities

Other projects identified that could potentially interact cumulatively with the LTWP as proposed which are in the project area are identified in the Table 4-2 below.

Table 4-2 Other Projects or Activities

Category	Projects or Activities	Description	Cumulative Impacts Likely
Past or Existing Projects or Activities	Water Treatment Plant	Water pumped from the Lake Geraldine reservoir is treated prior to distribution to the City.	No
	Lake Geraldine Reservoir	The Lake Geraldine dam maintains the water supply of the City of Iqaluit by creating the New Reservoir.	Potential
	Shooting Association Range	The City of Iqaluit's designated area for the use of firearms.	No
	Borrowing at Road to Nowhere	Borrowing fine materials for construction from the end of the Road to Nowhere.	Potential
	Berry Picking	Berry picking near the Niaqunnguk (Apex) River.	No
Certain/Planned Projects or Activities	Iqaluit Ski Club (Embrace Life) cabin	Formerly belonging to the Iqaluit Ski Club and will be a retreat and storage location for the Embrace Life Council.	No
	Future Community-Use Development – City of Iqaluit	Unknown, estimated development in 2025.	No
	Future Park development – City of Iqaluit	Near Niaqunnguk (Apex) river. No municipal servicing, plans include parking lots and picnic facilities. Estimated development in 2024-25.	No
Reasonably Foreseeable Projects or Activities	TBD	TBD	

A review of the NPC and NIRB websites did not identify any other planned projects within the LTWP project area that require significant infrastructure, industrial or commercial developments.

4.3 Likelihood for an Interaction

The likelihood of interactions on two existing activities were evaluated in this section, those being:

- Lake Geraldine Reservoir, and
- Borrowing at Road to Nowhere

There is the potential that the Lake Geraldine Dam and its reservoir may be impacted as more water will be available for use in the Lake Geraldine reservoir, this extra volume may raise the water levels of the reservoir. It is important to note that there is a spillway integrated into the Lake Geraldine Dam which keeps the reservoir elevation at maximum of 111.33 m. Above this elevation, water spills over the Lake Geraldine Dam and into the river channel, through the City of Iqaluit into Frobisher Bay. Despite the increase in water volumes available, Lake Geraldine's surface area will likely not increase past its existing maximum level, however depending on the operation regime of the LTWP, there may be less variation in elevation. Also, to consider if the likelihood that the Lake Geraldine is a limited fish bearing potential, it is not some likely that Aquatic Species and Habitat will be impacted. This potential impact will only cover the current maximum area of Lake Geraldine and will be occur in the operations of the LTWP.

Borrowing at the Road to Nowhere may be potentially impacted. The area is used by the City of Iqaluit as a source of sands and fines for construction material. The construction of the LTWP may impact the borrowing activities at the Road to Nowhere by limiting access to the area during the construction activities of LTWP. This will likely only occur during the periods where the Road to Nowhere is inaccessible when the LTWP conveyance pipeline is buried under the road. It is likely that during these limited periods of time burrow material can be sources form other locations should they be required.

4.4 Overall Cumulative Effects

For the effects indicated, it is determined that there will be no resultant overall cumulative effects from the LTWP.

5 Conclusions

The LTWP is expected to have an overall Positive environmental impact by ensuring a safe and reliable long-term drinking water supply for the City of Iqaluit. One Negative non-mitigable (N) impact was identified whereby the Embrace Life shelter will be permanently relocated as part of the LTWP construction. While there is potential for some Negative impacts associated with both the construction and operational and maintenance phases of the LTWP, all potential Negative impacts can be reduced or eliminated except for one with the implementation of well-known and understood mitigation measures.

It is determined that there will be no resultant overall cumulative effects from the LTWP.

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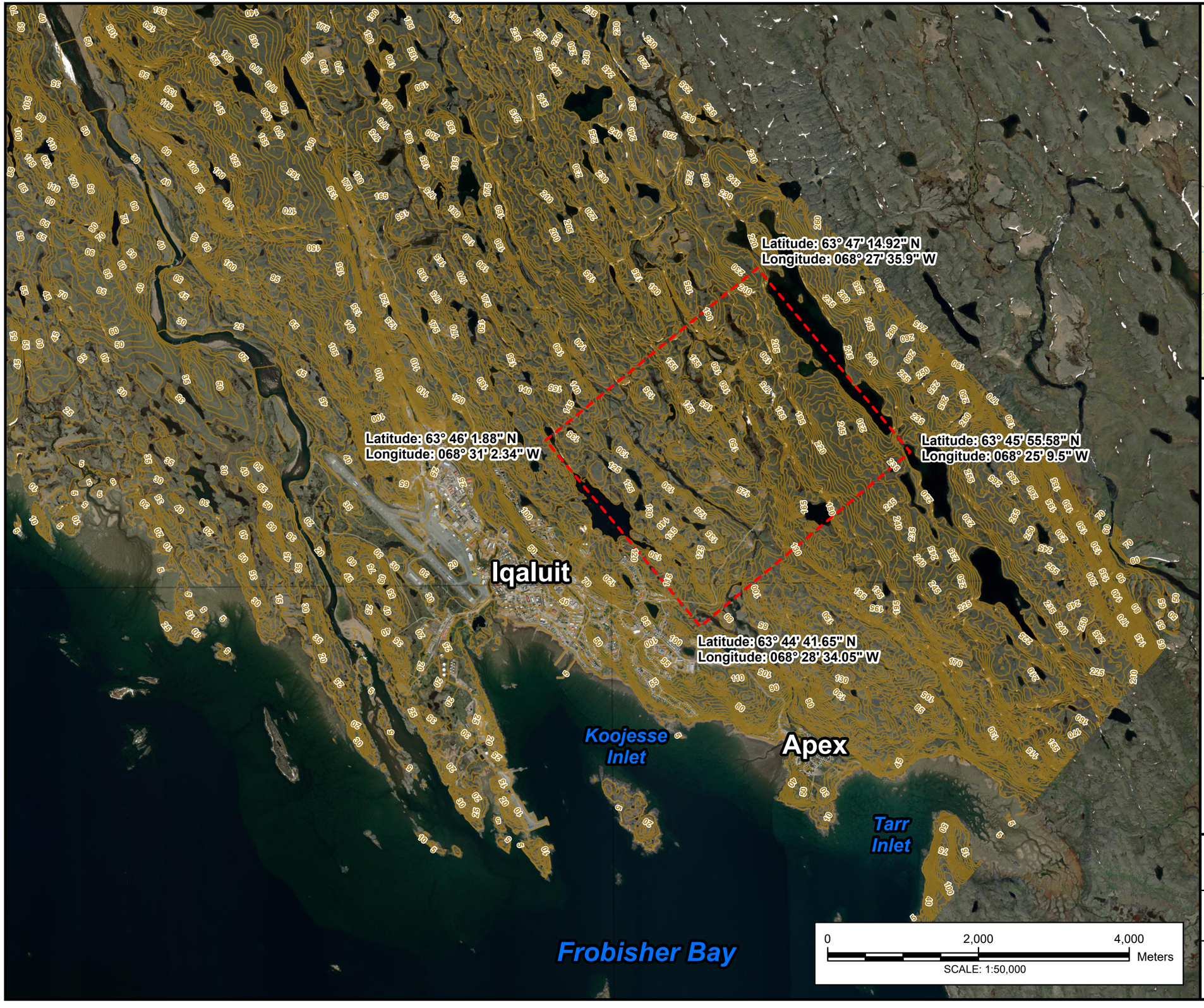
7 Appendices

Appendix A

Site Plans

Site Location - Regional View



LEGEND

- INDEX CONTOURS (5 M INTERVALS)
- SITE BOUNDARY

NOTES:

1. HORIZONTAL DATUM: NAD 1983 CSRS UTM ZONE 19N METER.
2. BASEMAP SOURCE: ESRI NAIP IMAGERY WEB SERVICE.

PRELIMINARY GEOCHEMICAL REPORT
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT
CITY OF IQALUIT

SITE LOCATION PLAN

ARCADIS

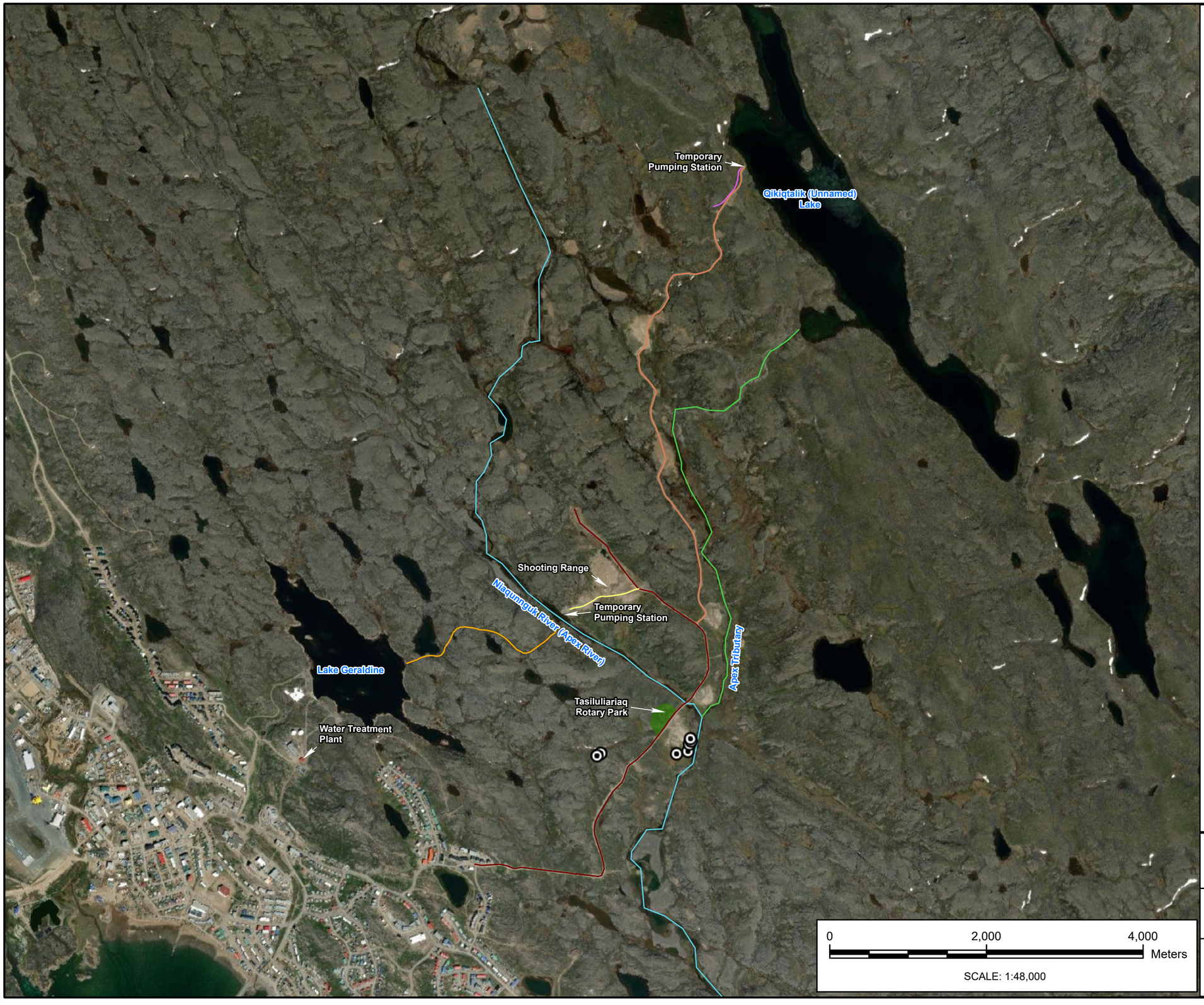
FIGURE
1

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: mayyar7350 T:_ENV\City of Iqaluit\Pro\Proposed Explosives Storage Facility.aprx\Figure1_Site_Location_Plan 11-06-2025 09:29

Appendix B

Site Plans

Long Term Water Project Components



LEGEND

- STRUCTURES
- ROAD TO NOWHERE
- ROTARY PARK

EXISTING_ENVIRONMENT

- APEX RIVER
- APEX TRIBUTARY
- ACCES ROAD TO APEX RIVER

EMERGENCY PIPELINES

- IQALUIT 2019 EMERGENCY WATER SUPPLY PROJECT
- IQALUIT 2019 EMERGENCY WATER SUPPLY PROJECT - NEW ROAD
- RIVER (EMERGENCY WATER SUPPLY)

Image source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.
Date: 2022/07/08

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SCALE: 1:48,000

LONG TERM WATER PROJECT IN IQALUIT, NUNAVUT
CITY OF IQALUIT

EXISTING ENVIRONMENT

ARCADIS

FIGURE 1-1

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: mayyar7350
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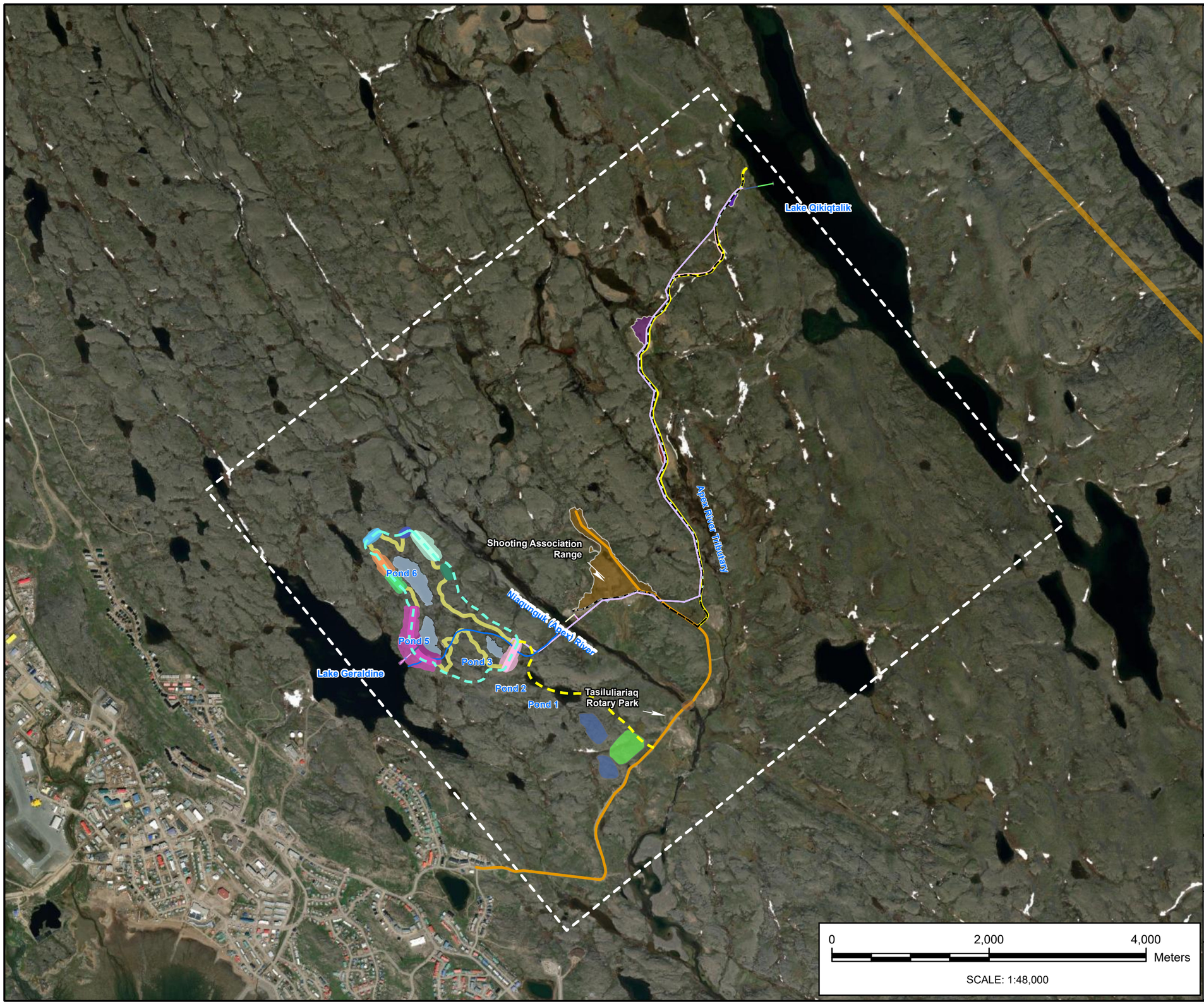


LEGEND

- SITE AREA
- ROAD TO UNNAMED LAKE
- ROAD TO NOWHERE
- PROPOSED ACCESS ROAD
- ALIGNMENTS AND SURFACE BORDER
- PROPOSED 150MMØ AIRBURST LINE
- PROPOSED 2X750Ø HDPE PIPES
- PROPOSED CONNECTION SYSTEM
- PROPOSED INTAKE STATION
- INTAKE (APPROX. 55M)
- PUMPHOUSE/PIPELINE CONDUIT
- PROPOSED BORROW 1: SHOOTING RANGE
- PROPOSED BORROW 2: LOWER SAND DEPOSIT
- PROPOSED BORROW 3: UPPER SAND DEPOSIT
- PROPOSED BORROW 4: QIKIQTALIK ESKER
- PROPOSED PUMPING STATION
- PROPOSED SCREENING
- 50M BUFFER BRIDGE ROAD TO NO WHERE
- RESERVOIR FOOTPRINT
- DAM1
- DYKE2
- DYKE3
- DYKE4
- DYKE5
- DYKE6
- DYKE7 (SPILLWAY)
- DYKE8
- WATER
- BUILDINGS
- PROPOSED LAYDOWN AREA
- PROPOSED QUARRY AREAS
- PUMP STATION
- MUNICIPAL BOUNDARY OF THE CITY OF IQLAUIT

Image source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.
Date: 2022/07/08

0 2,000 4,000 Meters

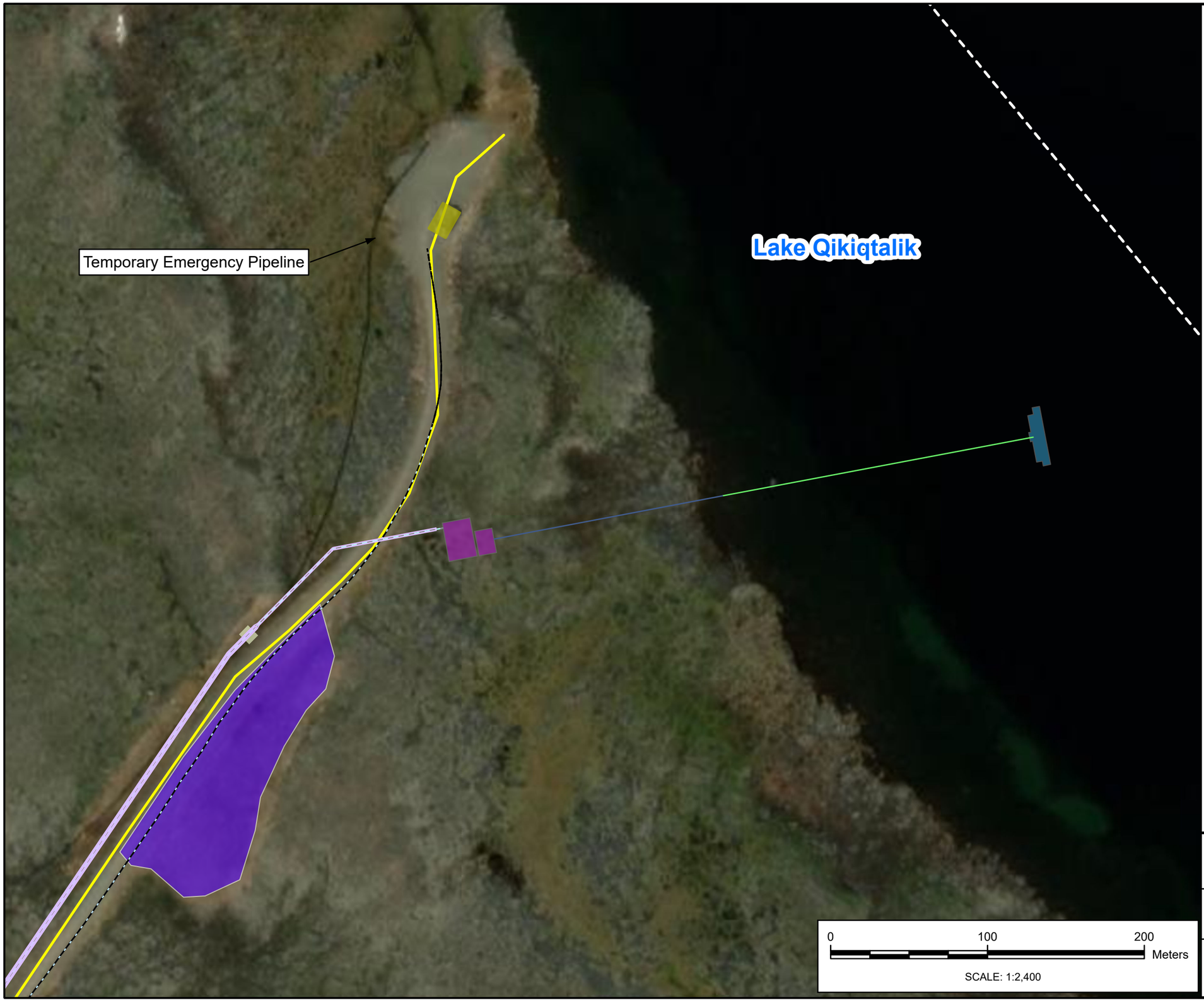
SCALE: 1:48,000

NUNAVUT PLANNING COMMISSION APPLICATION
CITY OF IQALUIT

LONG TERM WATER PROJECT COMPONENTS

ARCADIS | FIGURE 1

City: SYR Div/Group: IMDV Created By: J.RAPP Last Saved By: mayyar7350
T:_ENV\City of Iqaluit\Pro\Terrestrial Wildlife and Habitat.aprx Fig 1 : Long Term Water Project Components 12/16/2024 9:59 PM



LEGEND

- SITE AREA
- ROAD TO UNNAMED LAKE
- PROPOSED 150MMØ AIRBURST LINE
- PROP. 750MMØ INTAKE
- ROAD
- WATER CONVEYANCE PIPELINE
- PROPOSED BORROW 4: QIKIQTALIK ESKER
- LAKE QIKIQTALIK PUMP STATION
- PROPOSED SCREENING
- BUILDINGS
- DECOMMISSIONED EMERGENCY PUMP STATION

Image source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.
Date: 2022/07/08

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NUNAVUT PLANNING COMMISSION APPLICATION
CITY OF IQALUIT

LAKE QIKIQTALIK INTAKE AND RAW WATER PUMP STATION

ARCADIS

FIGURE 2

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: maryar7350
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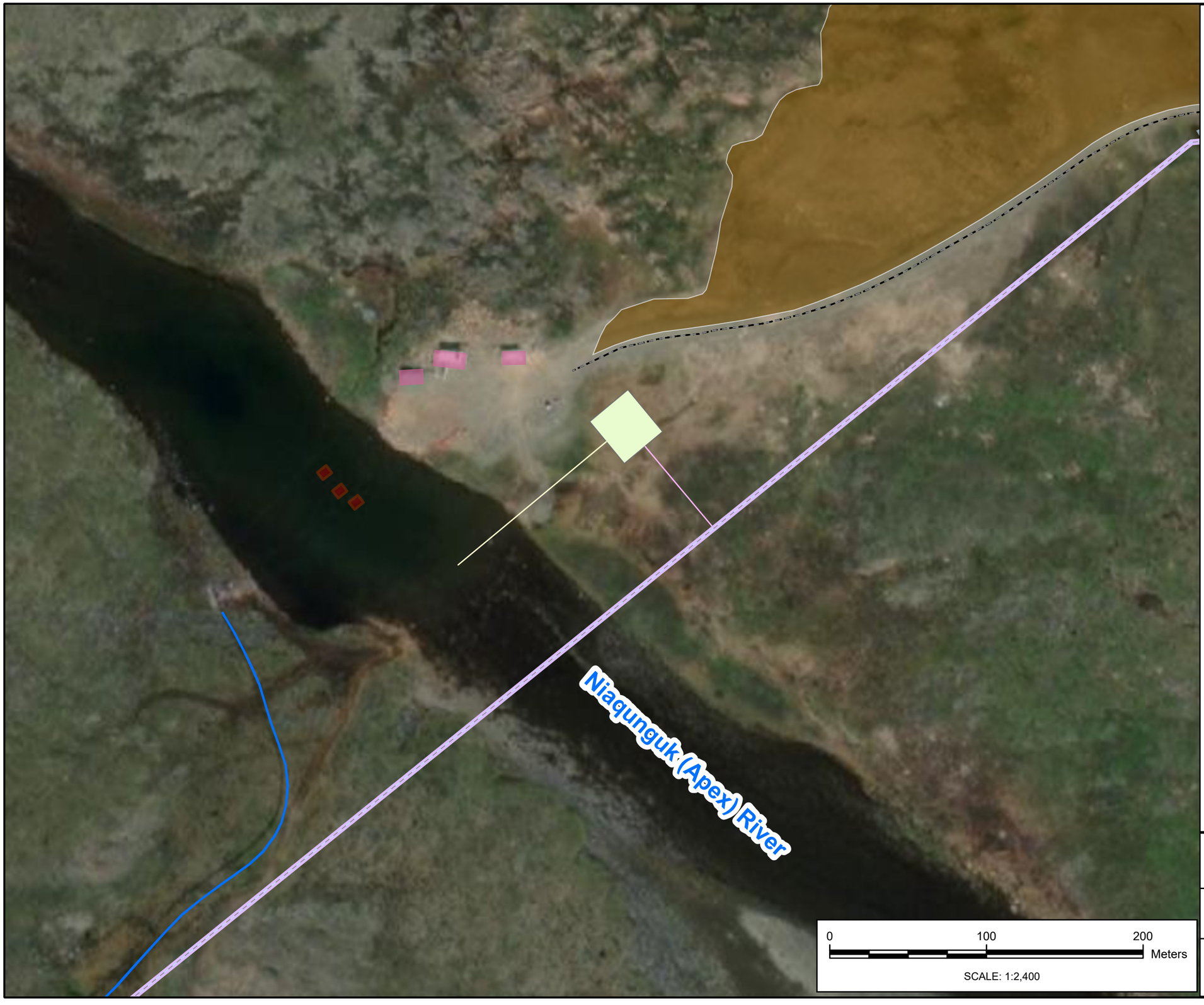

LEGEND

- SITE AREA
- INTAKE (APPROX. 55M)
- PUMPHOUSE/PIPELINE CONDUIT
- ROAD
- WATER CONVEYANCE PIPELINE
- TEMPORARY EMERGENCY PIPELINE
- PROPOSED BORROW 1: SHOOTING RANGE
- APEX RIVER PUMP STATION
- THREE SUBMERSIBLE PUMPS
- APEX RIVER EMERGENCY PUMP STATION

0 100 200 Meters

SCALE: 1:2,400

Image source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.
Date: 2022/07/08

NUNAVUT PLANNING COMMISSION APPLICATION
CITY OF IQALUIT

APEX RIVER INTAKE AND RAW WATER PUMP STATION

ARCADIS

FIGURE 3

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: mayyar7350
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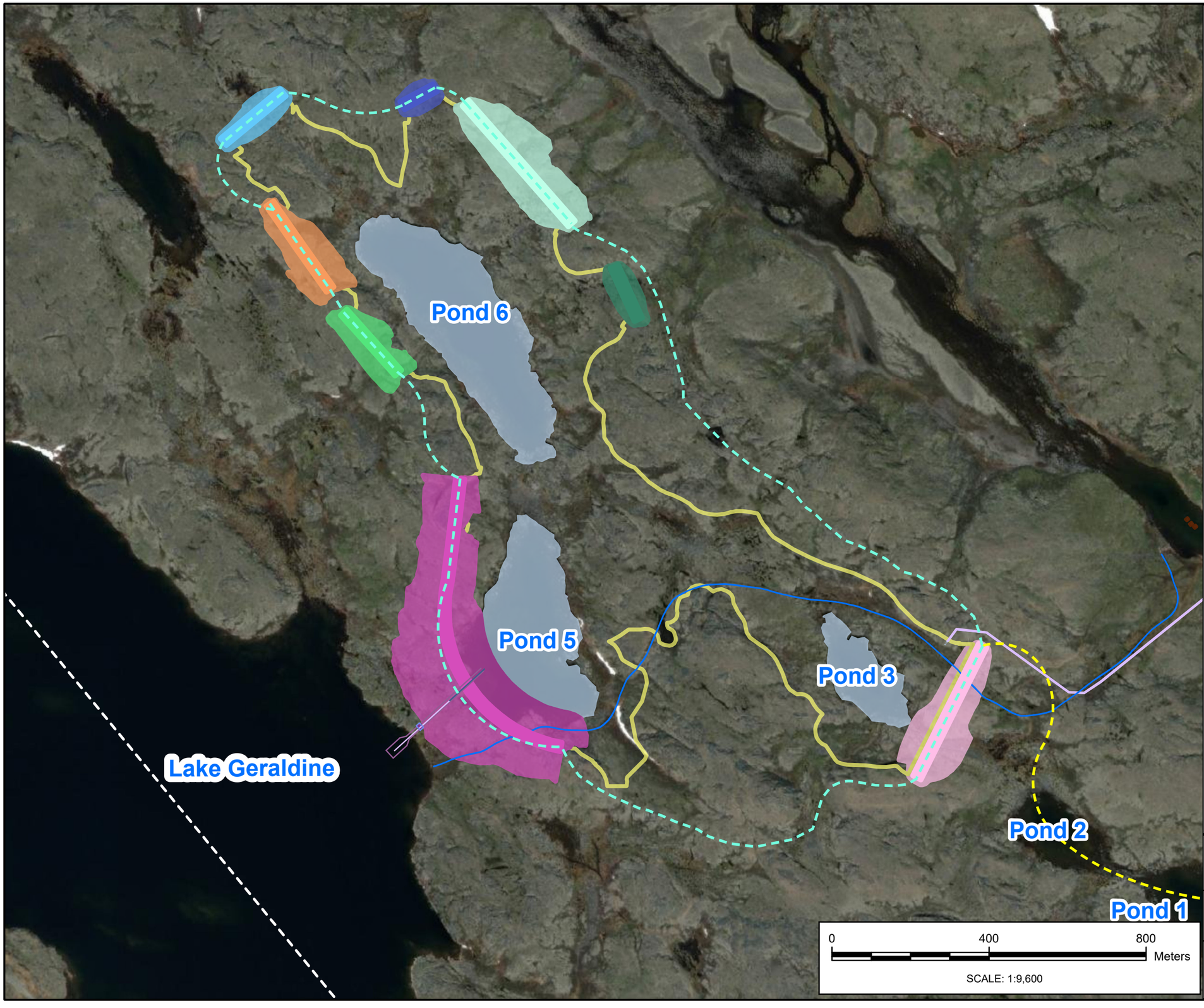


LEGEND

- SITE AREA
- PROPOSED ACCESS ROAD
- RING ROAD
- APEX RIVER TO LAKE GERALDINE PIPELINE
- PROPOSED CONNECTION SYSTEM
- PROPOSED INTAKE
- WATER CONVEYANCE PIPELINE
- LAKE QIKIQTALIK PUMP STATION
- RESERVOIR FOOTPRINT
- DAM1
- DYKE2
- DYKE3
- DYKE4
- DYKE5
- DYKE6
- DYKE7 (SPILLWAY)
- DYKE8
- WATER

0 400 800 Meters

SCALE: 1:9,600

Image source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.
Date: 2022/07/08

NUNAVUT PLANNING COMMISSION APPLICATION
CITY OF IQALUIT

NEW RESERVOIR DAMS AND DIKE LOCATIONS

ARCADIS

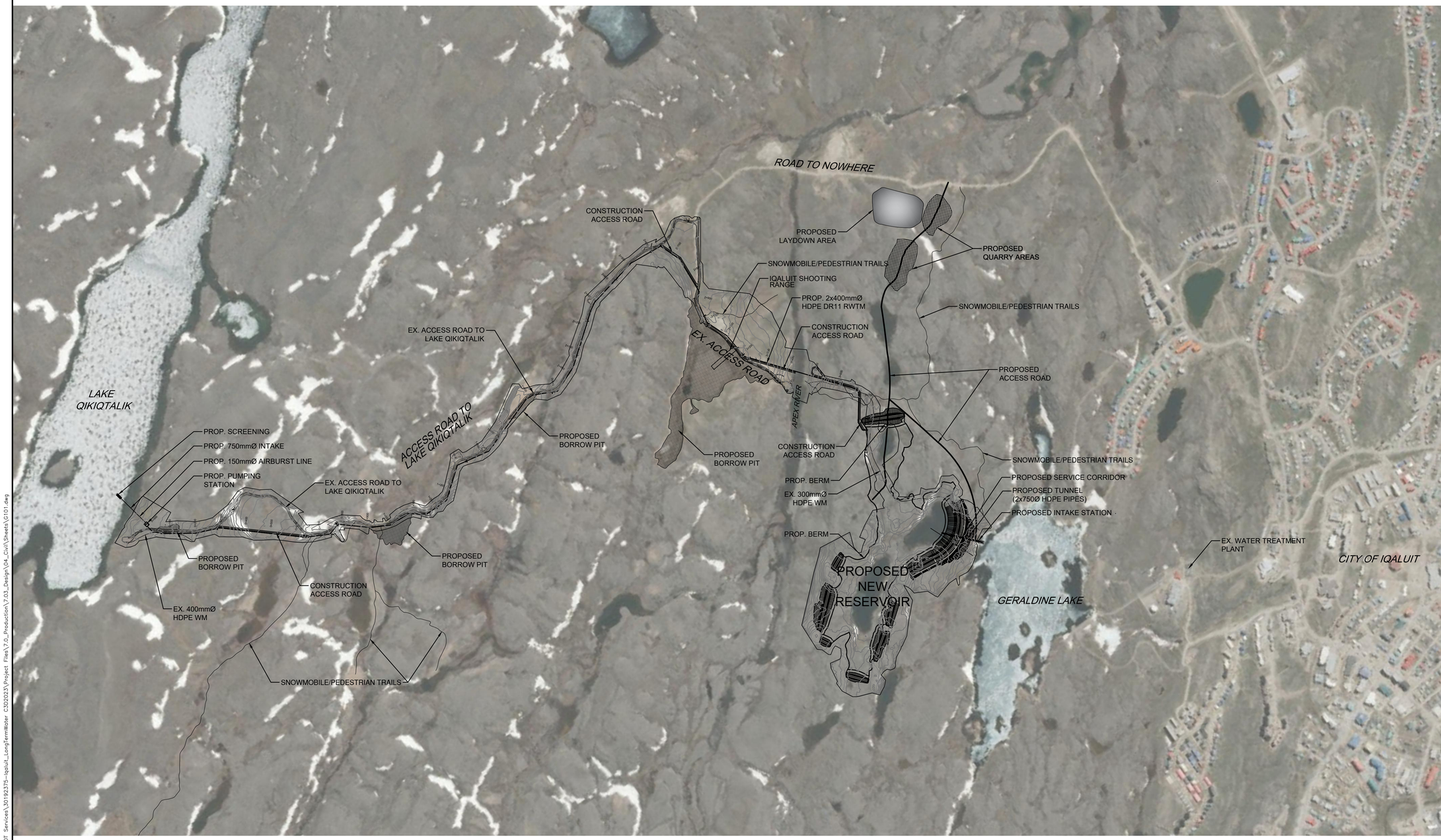
FIGURE 4

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: maryar7350
T:_ENV\City of Iqaluit\Pro\Terrestrial Wildlife and Habitat.aprx Fig 4 New Reservoir Dams and Dike Locations 12/18/2024 9:26 AM

Appendix C

Site Plans

Preliminary Design Report Drawings



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PRELIMINARY
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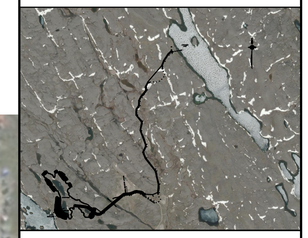

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Revision	Description	Date
B	ISSUED FOR PRELIMINARY DESIGN	2024-03-08
A	ISSUED FOR CONCEPT DESIGN	2023-11-27

Consultant

ARCADIS
121 Granton Drive, Suite 12
Richmond Hill ON L4B 3N4 Canada
tel 905 764 9380
www.arcadis.com

Project title

LONG TERM WATER PROGRAM RAW WATER SUPPLY AND STORAGE

Designed by
O.N.

Drawn by
N.V.

Approved by
G.G.

Project Manager
C.G.

Drawing title

GENERAL OVERALL SITE PLAN

Project no.	Drawing no.	Revision no.
30192375	**G101**	**B**

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LEGENDS :

- CUTTING
- FILLING

Revision	Description	Date
A	ISSUED FOR PRELIMINARY DESIGN	2024-03-22

Consultant
ARCADIS
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Project title

CITY OF IQALUIT

LONG TERM WATER PROGRAM RAW WATER SUPPLY AND STORAGE

Designed by: R.J.
Drawn by: A.A.
Approved by: E.L.
Project Manager: C.G.

Drawing title

CIVIL

RING ROAD PLAN

Project no.	Drawing no.	Revision no.
30192375	C319	A

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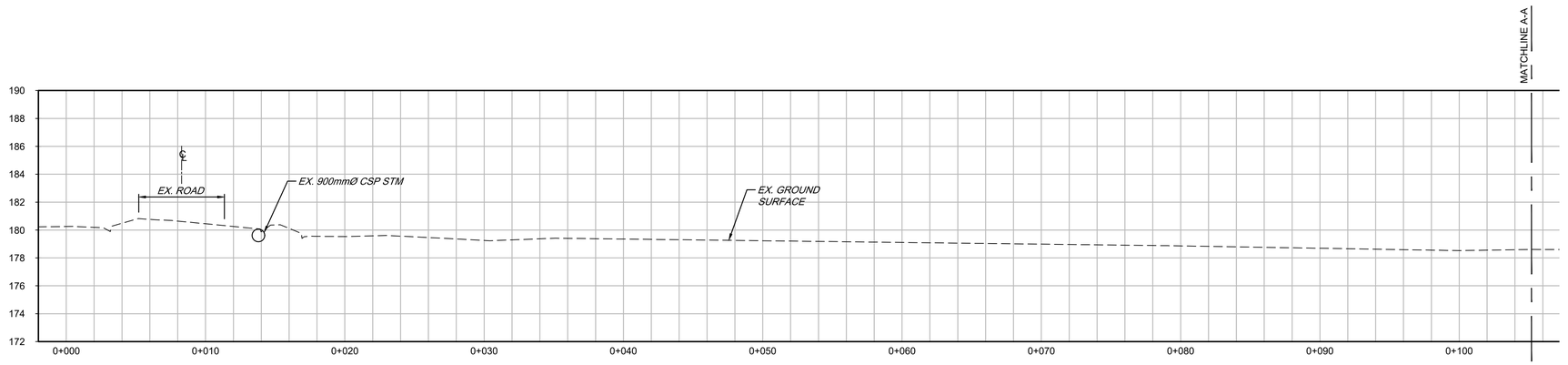

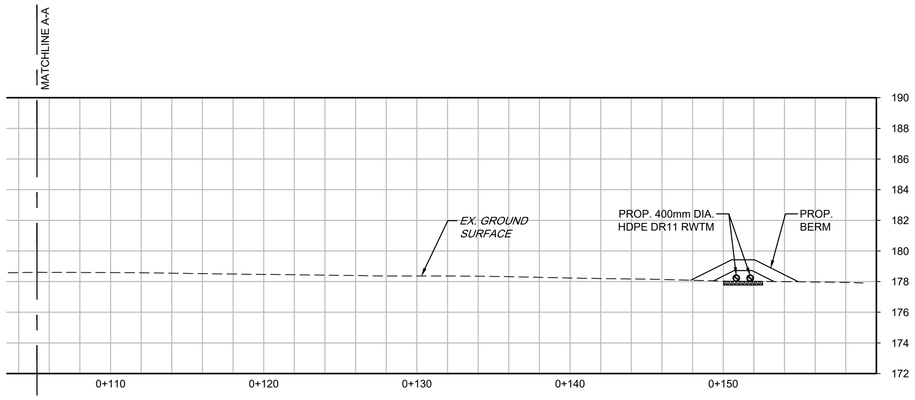

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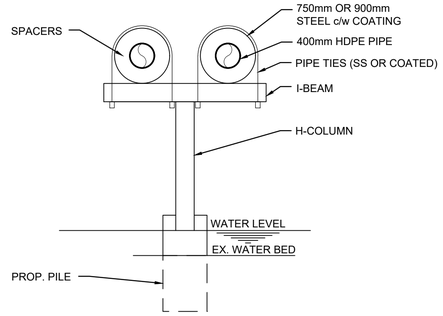

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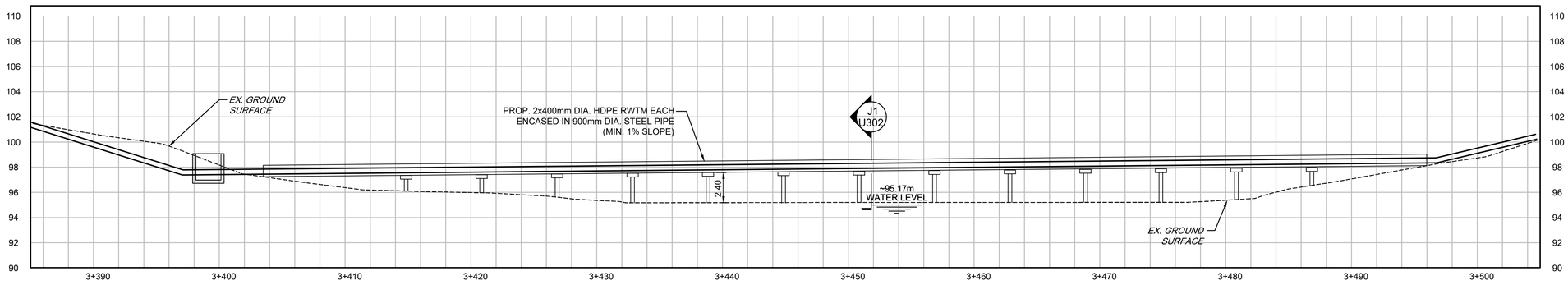

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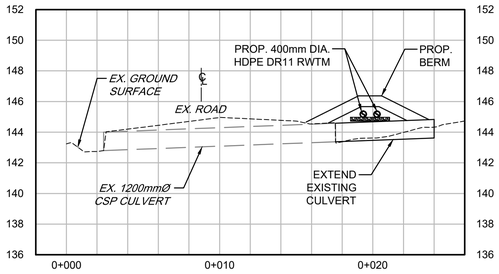

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PRELIMINARY
NOT FOR CONSTRUCTION

Revision	Description	Date
B	ISSUED FOR PRELIMINARY DESIGN	2024-03-22
A	ISSUED FOR CONCEPT DESIGN	2023-11-27

Consultant

ARCADIS
121 Granton Drive, Suite 12
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www.arcadis.com

Project title

LONG TERM WATER PROGRAM
RAW WATER SUPPLY
AND STORAGE

Designed by **O.N.**
Drawn by **L.E.**
Approved by **G.G.**
Project Manager **C.G.**

Drawing title

CIVIL

WATERMAIN CROSS SECTIONS
2 OF 2

Project no.	Drawing no.	Revision no.
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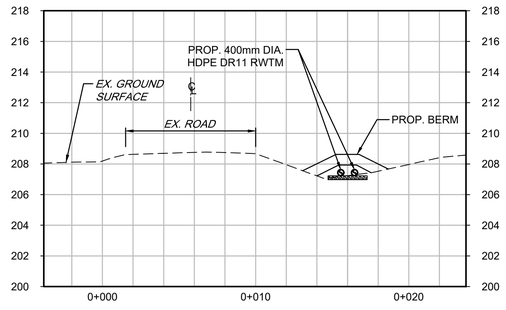

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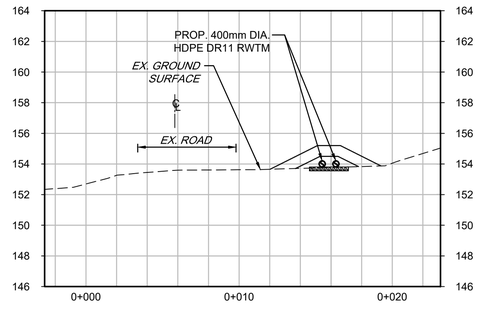

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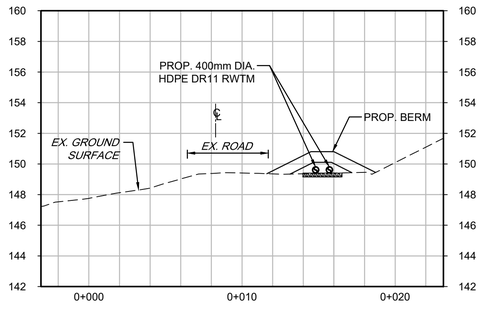

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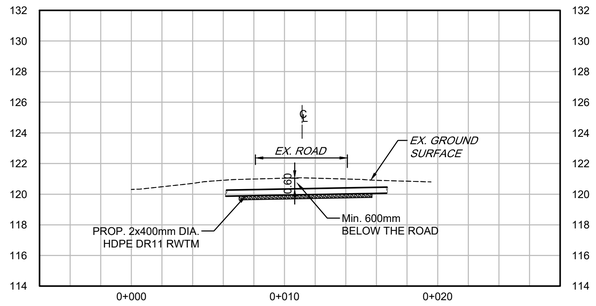

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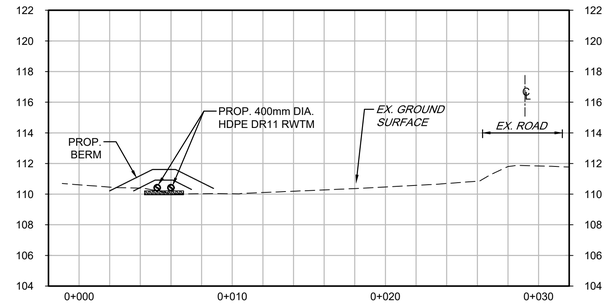

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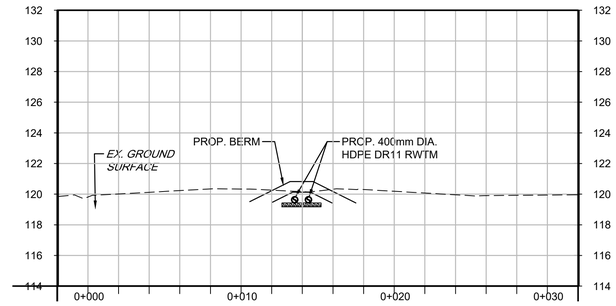

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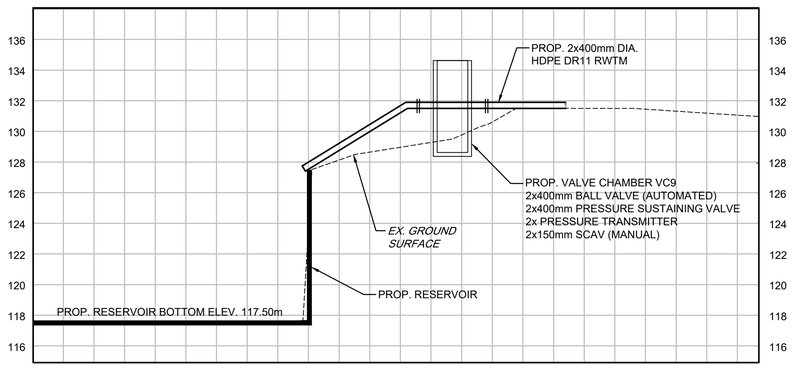

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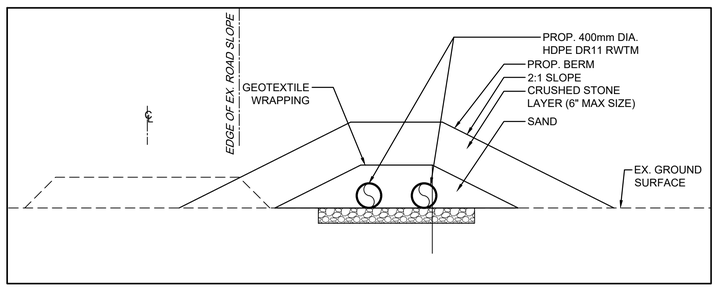

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PRELIMINARY
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Revision	Description	Date
B	ISSUED FOR PRELIMINARY DESIGN	2024-03-22
A	ISSUED FOR CONCEPT DESIGN	2023-11-27

Consultant

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Project title

LONG TERM WATER PROGRAM
RAW WATER SUPPLY
AND STORAGE

Designed by **O.N.**
Drawn by **L.E.**
Approved by **G.G.**
Project Manager **C.G.**

Drawing title

CIVIL

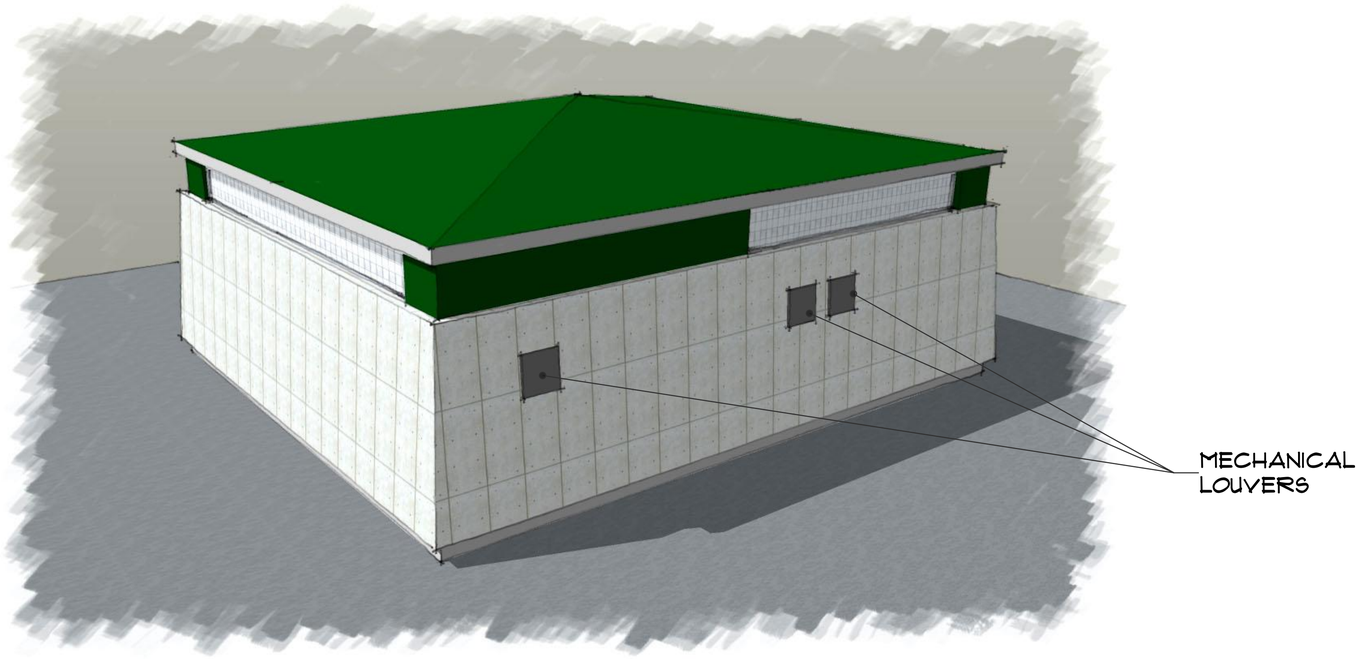
WATERMAIN CROSS SECTIONS
1 OF 2

Project no.	Drawing no.	Revision no.
30192375	**U301**	**B**

C:\Users\cosmo.nezzi\DC\ACCDocs\IBI - DT Services\30192375-Iqaluit_LongTermWater C3D2023\Project Files\7.0_Production\7.03_Design\04_Civil\Sheets\U301-U302.dwg

A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm



NORHT EAST VIEW -
CONCEPTUAL

SOUTH EAST VIEW -
CONCEPTUAL

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PRELIMINARY
NOT FOR CONSTRUCTION

Revision	Description	Date
A	ISSUED FOR CONCEPT DESIGN	2023-03-22

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Project title

IQALUIT
LONG TERM WATER PROGRAM
RAW WATER SUPPLY
AND STORAGE

Designed by
P.D.

Drawn by
A.V.

Approved by
M.J.

Project Manager
C.G.

Drawing title

ARCHITECTURAL

PUMP STATION
EXTERIOR VIEWS

Project no.	Drawing no.	Revision no.
30192375	A002	A

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