Inukjuak Backup Thermal Generating Station

Environmental and social impact assessment statement

Volume 1 – Report

May 2021

Produced by
Hydro-Québec

Inukjuak Backup Thermal Generating Station

Environmental and social impact assessment statement

Volume 1 – Report

Groupe – Distribution, approvisionnement et services partagés
May 2021

This environmental impact statement (EIS) is being filed with the Ministère de l'Environnement et de la Lutte contre les changements climatiques in accordance with section 196 of the Environment Quality Act *with a view to obtaining the necessary authorizations to carry out the project to construct a backup thermal generating station in the northern village of Inukjuak.*

This document is a translation of the environmental and social impact assessment of the Inukjuak backup thermal generating station. Only the French version is official.

This environmental and social impact assessment statement is divided into two volumes :

- Volume 1 – Report
- Volume 2 – Appendices

This assessment was conducted for the Groupe – Distribution, approvisionnement et services partagés by Hydro-Québec's Direction – Environnement. The list of contributors is provided in Appendix A of Volume 2.

Summary

Hydro-Québec plans to build a thermal generating station in the northern village of Inukjuak to provide a backup electricity supply to the community, which will be served by a new generating station (Innavik generating station) starting in 2022. Initially, the backup generating station will be equipped with two generating sets, or gensets, of 2.5 to 3 MW each, to which a third, also with a capacity of 2.5 to 3.0 MW, could be added as needed, for a total capacity of 9 MW. The backup generating station will be built near the new 25-kV substation to which it will be connected. The developed area will be approximately 9,446 m² and will include the generating station, a fuel depot as well as storage spaces for operational needs.

The backup thermal generating station is subject to the environmental and social impact assessment and review procedure under chapter III, title II of the *Environment Quality Act*, since it will have a capacity exceeding 3 MW.

The project has been optimized to avoid negative impacts on wetlands or aquatic environments. Also, the site for the generating station was chosen with the aim of minimizing negative impacts for the community of Inukjuak regarding noise and air quality. Besides helping to secure the electricity supply for the village of Inukjuak, the project will have a positive effect, since we will be increasing the distance between an existing and continuous source of noise pollution and the village by close to 3 km. Furthermore, the project will help reduce GHG emissions compared to the current situation, since the new generating station will only be used as a backup, should the Innavik hydroelectric generating station become unavailable.

The impacts of the project will be felt primarily during construction. The main activities associated with construction of the backup thermal generating station are the preparatory work and site facilities, levelling, backfilling and earthwork, installation of the gensets, buildings and related infrastructure, waste management, transport and traffic, the lodging and presence of workers, as well as jobs and the purchase of goods and services. The work will nonetheless be limited, small in scale and carried out over a period of approximately 18 months.

Components of the surroundings likely to be negatively impacted during the work are soil, the quality and drainage of surface water, birds, air quality, greenhouse gases and climate change, the sound environment, land use, infrastructure and services, the health and safety of residents and sites of cultural, historical and archeological interest.

We will apply Hydro-Québec's Standard Environmental Clauses (SEC) during work to mitigate the primary negative impacts anticipated during this period. We also plan to implement specific mitigation measures for certain environmental components.

During operation, activities likely to result in impacts are the presence of infrastructure, activities, maintenance and servicing of the generating station as well as fuel management, jobs and the purchase of goods and services. Components of the environment likely to be negatively impacted during operation are the sound environment, air quality and, to a lesser extent, soil, water quality and landscape. We propose a sound environment monitoring program during operation to measure actual noise levels from equipment as well as at receivers. The risk of technological accidents are deemed to be low, since this is a known technology, deployed in many generating stations currently in operation and with which operating personnel are proficient; furthermore, we will have accident prevention and facility securement measures.

Lastly, the project will yield positive employment and economic spinoffs during the work and during the generating station's operation phase. Hydro-Québec will maximize the local benefits of this project by implementing a variety of measures.

With the application of the proposed mitigation measures, the environmental and social impact assessment has established the significance of residual impacts on the various components of the biophysical and human environments to be minor.

Content of the environmental and social impact assessment statement

Volume 1 –Report

Volume 2 – Appendices

Table of contents

Tables

Figures

Maps

1 Introduction

1.1 Proponent's presentation

The Groupe – Distribution, approvisionnement et services partagés is responsible, through the Direction – Réseaux autonomes, for ensuring the electricity supply of communities not connected to the transmission system. To do this, the Direction – Réseaux autonomes is responsible for designing, operating and maintaining electricity generation infrastructures in these communities. The Groupe – Distribution, approvisionnement et services partagés is the proponent of the project to develop and operate Inukjuak backup thermal generating station.

1.2 Mission and vision

To meet the needs of off-grid systems, the Groupe – Distribution, approvisionnement et services partagés prioritizes energy efficiency measures and the transition toward renewable energy sources.

Four key principles guide decisions regarding transition projects:

- a positive environmental impact
- reliability of electricity service
- favorable reception from communities
- reduced operating costs

In recent years, the Groupe – Distribution, approvisionnement et services partagés has launched transition initiatives in all off-grid systems.

2 Context and project justification

Several villages in remote areas are not connected to the main grid and are supplied by an independent, stand-alone system, the power for which is generated in whole or in part from fossil fuels. The partial or total conversion of off-grid systems to cleaner energy sources is under way, and the Inukjuak backup thermal generating station project will contribute to this transition. This facility will be a generating station to take over from the Innavik hydroelectric generating station in the event of a breakdown or maintenance. The Innavik hydroelectric generating station project is the result of a partnership between Pituvik Landholding Corporation and the Québec firm Innergex Renewable Energy Inc.

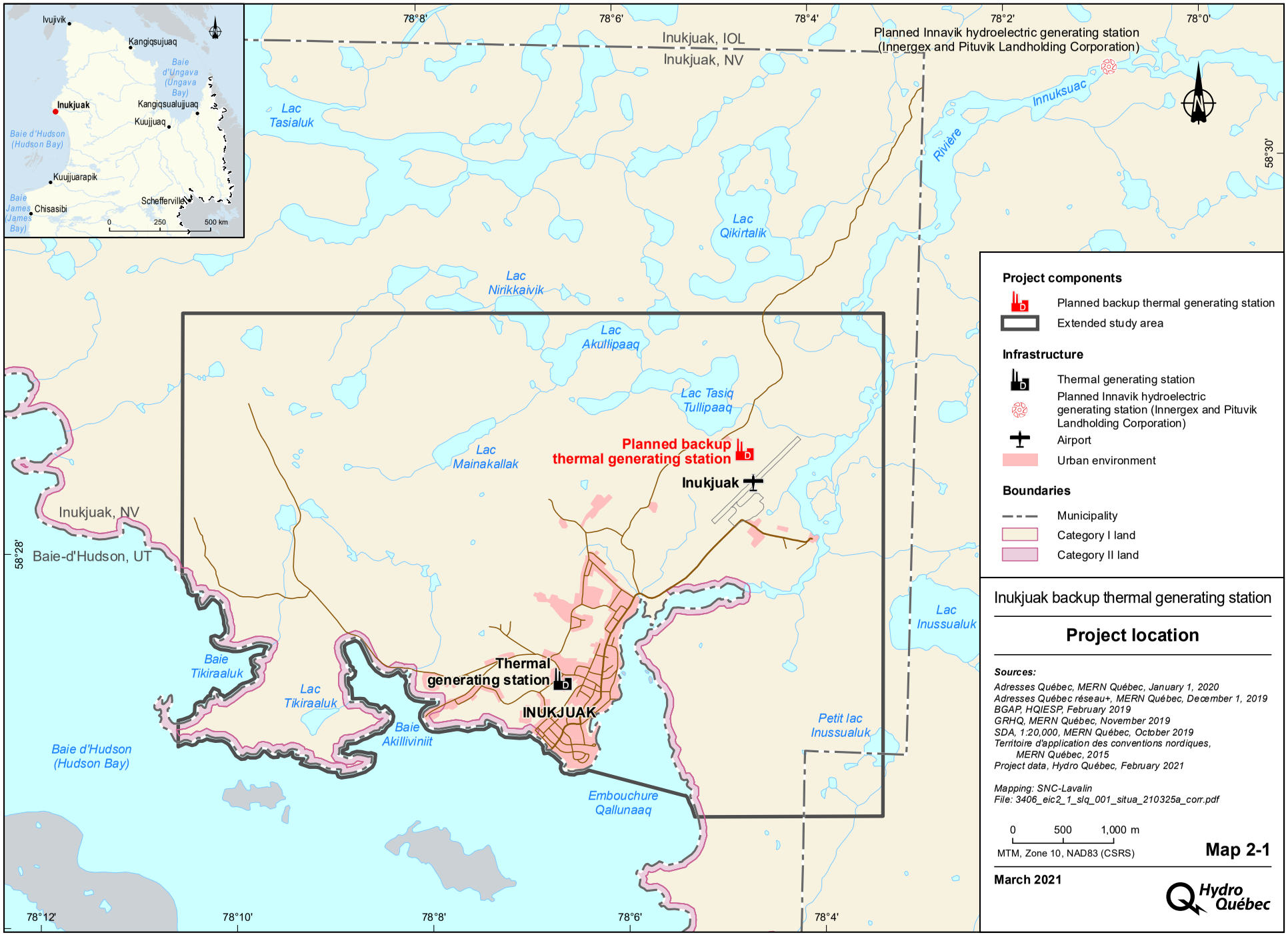
2.1 General project presentation

The project calls for the construction of a backup thermal generating station in the northern village of Inukjuak (see Map 2-1). It will provide a backup electricity supply to the community of Inukjuak, which will be served by a new hydroelectric generating station (Innavik generating station) starting in 2022.

The backup generating station will initially be equipped with two generating sets (gensets) of 2.5 to 3 MW each, for a total installed capacity of approximately 6 MW. A third genset, also with a capacity of 2.5 to 3.0 MW, will be able to be added if needed, which would increase the total capacity of the generating station to 9 MW. The main building will house all power generation, control, automation and protection equipment and systems, and all amenities for maintaining and operating the generating station. It will be built using a “Meccano” type system, meaning a steel structure will be assembled on site on concrete foundations. The site of the generating station will also include a fuel depot and storage spaces for operation and maintenance needs. The developed area will be approximately 9,466 m^2.

2.2 Project justification

Hydro-Québec has signed a 40-year contract with Innavik Hydro Limited Partnership to supply electricity to the community of Inukjuak from the new Innavik generating station. Commissioning is slated for the fall of 2022. Electricity generated by the Innavik plant will be delivered to a new substation near the village by a 25-kV power line owned by Innavik Hydro Ltd. and distributed from a new substation via two new 25-kV lines belonging to Hydro-Québec (to be commissioned in 2022) and connecting to the existing distribution system at the north end of the village.



Document for information purposes only. For any other use, please contact Géomatique at Hydro-Québec.

To ensure backup in the event of a breakdown or planned interruption at the Innavik generating station, Hydro-Québec plans to build a backup generating station with an initial capacity of approximately 6 MW, upgradeable to 9 MW if needed. The backup generating station will be connected to the new 25-kV substation.

2.3 Alternative solutions to the project

Since the project concerns a backup generation station to quickly provide electricity to the northern village of Inukjuak in the event the hydropower station goes offline, no alternative solution has been considered. Given that the facility must ensure the village's energy security, the criteria of speed and reliability of the electricity supply mean no other solution would adequately meet the backup needs.

2.4 Legal context

2.4.1 Environmental and social impact assessment and review procedure

Chapter III, title II of the *Environment Quality Act* (EQA) describes the environmental and social impact assessment and review procedure applicable to the territory located north of the 55th parallel, with the exception of category I and II lands for the Crees of Poste-de-la-Baleine (the Cree community in this location is now called Whapmagoostui). Subsequent construction and operation of a fossil-fuel fired thermal generating station, having a heat capacity equal to or exceeding 3,000 kW, are subject to this procedure.

Subject to chapter III of title II of the EQA, the proponent of a project provides preliminary information about the project to the Minister of the Environment and the Fight against Climate Change (MELCC). The Minister indicates the nature, scope and extent of the environmental and social impact statement to be prepared, taking into account the opinion of the Kativik Environmental Quality Commission (KEQC). This directive presents a process aimed at providing the information necessary for the environmental and social assessment of the project proposed.

On March 18, 2020, Hydro-Québec provided the MELCC with preliminary information about its backup generating station project. The guidelines for preparing the environmental impact statement for this project were sent to Hydro-Québec on July 17, 2020.

2.4.2 Government approvals

The project is subject to the prior granting of government approvals, including these key requirements:

- Delivery of a certificate of authorization under section 201 of the EQA following the environmental and social impact assessment and review procedure provided in chapter III of title II of the EQA
- Order in council from the Québec government authorizing the construction of buildings for the production of electricity under section 29 of the *Hydro-Québec Act*
- MELCC authorization for certain elements of the project under section 22 of the EQA

The *Regulation respecting the regulatory scheme applying to activities on the basis of their environmental impact* came into force on December 31, 2020. It indicates that certain activities targeted by section 22 of the EQA can be subject to a statement of compliance or be exempt from an authorization, under certain conditions.

Once the necessary approvals are obtained and depending on the conditions governing such approvals, Hydro-Québec will begin to carry out the project.

Furthermore, as specified in the directive from the Minister, the environmental and social impact statement reports the findings of the proponent's environmental and social impact assessment. It must employ scientific methods and satisfy the requirements of the MELCC and the KEQC regarding analysis of the project and consultation of the public and Indigenous communities concerned. The objective is to enable the competent authorities to decide whether to authorize the project, taking into consideration the potential environmental and social impacts.

Associated developments and projects cited in Section 4.2 of this statement are not subject to the assessment and review of environmental and social impacts. They are, however, mentioned in this impact statement to provide a better overall understanding of the project. As applicable, Hydro-Québec will see to it that all government approvals that may be required are obtained in a timely fashion.

2.5 Hydro-Québec's environmental policy

Hydro-Québec is committed to promoting the responsible use of resources and ensuring sustainable development. Through its Our Environment policy, the company sets out its focus on sustainable development and describes its strategies for improving its environmental performance.

The Our Environment policy sets out Hydro-Québec's commitment regarding its social role. The company defines itself as a responsible corporate citizen committed to making an effective contribution to the economic, social and cultural success of the society in which it carries out its activities.

Hydro-Québec also implements the following directives and procedures:

- Environmental Management Systems (DIR-07). This guidance document sets out the company's requirements regarding the implementation and maintenance of an environmental management system (EMS). It clarifies and completes the requirements of the international standard ISO 14001:1996(F).
- Environmental acceptability and favorable reception of new projects, rehabilitation work and operation and maintenance activities (DIR-21). This guidance stems from the commitments undertaken in the Our Environment and Our Social Role policies. It sets out criteria, elements and company requirements to promote the environmental acceptability of new structures, rehabilitation work, operations and maintenance activities.
- Requirements concerning the prevention and control of pollution and nuisances (DIR-22). This is a tool the company and its officers use to carry out the due diligence and strict environmental management required to prevent pollution and nuisances and minimize their effects.
- Emergency procedure for accidental contaminant spills (PR-DPPSE-447-01). Under existing legislation and the Requirements concerning the prevention and control of pollution and nuisances (DIR-22), this procedure sets out rules and measures for mitigating the environmental impact of an accidental contaminant spill.
- Heritage and multiple uses of land and facilities (DIR-23). This directive contains the rules to be followed and the measures to be taken regarding heritage and multiple uses of land and facilities. Hydro-Québec ensures the protection and enhancement of its equipment, facilities and properties through means that may go beyond environmental impact management. The company incorporates the concept of multiple uses into the design of its new structures and facilities, and strives to ensure versatility in its rehabilitation projects and maintenance activities, while taking the host community's concerns into consideration.

Lastly, Hydro-Québec integrates Standard Environmental Clauses in all of its calls for tenders (Hydro-Québec – Innovation, équipement et services partagés et Société d'énergie de la Baie James, 2018), which establish mitigation measures for at-source reduction of the company's environmental impacts.

3 Public participation

3.1 Information and consultation process

Hydro-Québec implemented a communications program focused on informing and consulting people impacted by the new backup generating station project.

Through this program, Hydro-Québec aims to:

- raise awareness of the project (description, justification, environmental benefits and schedule)
- take stock of the community concerns regarding the project
- respond to and follow up on stakeholders' information needs

To this end, in 2019 and 2020, Hydro-Québec held public assemblies and meetings with the Inukjuak municipal council and the board of directors of Pituvik Landholding Corporation.

However, due to COVID-19 and travel restrictions in the region, Hydro-Québec was obliged to adjust its information and consultation process to enable community members to participate safely.

3.2 Identification of stakeholders

Since the project is taking place on category 1 land, Hydro-Québec must obtain authorization to occupy the land from Pituvik Landholding Corporation.

Furthermore, the northern village of Inukjuak is considered to be an important stakeholder, given that the backup generating station will be built within the boundaries of the village.

Lastly, the Kativik Regional Government is also a stakeholder in the project, since it is offering technical support to the northern village, particularly with regard to land development.

3.3 Information and consultation activities conducted

Hydro-Québec held two meetings with the Inukjuak municipal council and the board of directors of Pituvik Landholding Corporation. The first meeting took place on October 9, 2019, and the second on January 28, 2020.

This project was also presented to community members on January 29, 2020, during a general information week organized for the Innavik hydroelectric generating station.

Lastly, it conducted a consultation via local radio on November 9, 2020. This information session was accompanied by a document explaining the project and a questionnaire.

Information meeting of October 9, 2019

Hydro-Québec held a meeting with representatives of the Inukjuak municipal council and Pituvik Landholding Corporation to present the following points:

- Hydro-Québec presented the new backup thermal generating station as well as the potential sites.
- At the end of the meeting, three potential sites were retained so that Hydro-Québec could proceed with assessments.
- Hydro-Québec explained the field surveys that would be done in the following days and the next steps.

After the meeting, a field visit was made to potential sites with representatives of the northern village and Pituvik Landholding Corporation.

Information meeting of January 28, 2020

After obtaining the results of the site assessment, Hydro-Québec organized a meeting with the Inukjuak municipal council and Pituvik Landholding Corporation.

Key takeaways were as follows:

- Hydro-Québec presented the results of the assessment of the recommended site.
- The Inukjuak municipal council and Pituvik Landholding Corporation accepted the site recommended by Hydro-Québec.
- The Inukjuak municipal council immediately adopted a resolution confirming the site choice.
- Because Pituvik Landholding Corporation did not have a quorum, a resolution was carried by its board of directors at a subsequent meeting.

Public information meeting of January 29, 2020

Key takeaways were as follows:

- During the morning, Hydro-Québec held a public information session via local radio for community members and then, in the afternoon, a session at the Inukjuak community center.
- Hydro-Québec presented the project, a preliminary work schedule and the recommended site as discussed with local authorities.
- No concerns were raised by community members regarding the project or the site chosen.

Public information meeting of November 9, 2020

In light of the COVID-19 pandemic, Hydro-Québec adjusted its community consultation process. It presented the project in greater detail on local radio, and submitted a summary document, accompanied by a brief questionnaire to members of the community.

The company asked community members to speak out on land use in the sector of the new generating station, and to share their concerns regarding the construction and operation phases.

3.4 Hydro-Québec's undertakings

Hydro-Québec committed to keep the community informed regarding progress on the project. To do so, it plans to present annual project updates to community representatives.

Depending on how the health crisis evolves, Hydro-Québec plans to hold in-person meetings or conference calls with community representatives.

4 Project description

4.1 Analysis of options

4.1.1 Site options

Several site options were analyzed based on the following criteria:

- Ideally, seek a rock base.
- Avoid permafrost areas.
- Take into account consultations with the community and any concerns expressed.
- Avoid proximity with the built environment, aiming for a distance of more than 500 m from any homes to avoid any noise nuisance or air pollution for residents.
- Avoid residential and recreational areas.
- Seek sufficient space around the new generating station to have a buffer zone in the event of expansion of the village.
- Avoid areas used for hunting and gathering activities.
- Avoid areas valued by the community for cultural or other reasons.
- Stay at least 100 m away from watercourses.
- Avoid wetlands.
- Avoid habitats of special-status wildlife species.
- Avoid the airport area, to comply with building height limits of less than 71 min the peripheral zone around this infrastructure.
- Seek proximity to a road that is cleared of snow at all times to facilitate access to the generating station.

On the basis of these criteria, we closely analyzed the details of the three potential sites to select the one with the most appropriate characteristics. Poly-Géo is the firm that carried out the detailed analysis, as well as the analysis of a fourth site, the temporary workcamp for workers on the Innavik hydroelectric project (Poly-Géo, 2019).

4.1.1.1 Potential sites

The three sites studied in detail (see Map 4-1, sites 101, 102 and 107) are located within a 2-km radius of Inukjuak and are easily accessible. They are on land where rock is visible or covered by a thin, discontinuous layer of unconsolidated materials. Three other sites had been targeted by photo-interpretation before the site visits, but they were disqualified after a meeting with community representatives and a visit to the locations. The surroundings of the site currently occupied by the temporary workcamp for Innavik hydroelectric project workers were also carefully studied to qualitatively assess the possibility of erecting the new thermal generating station

there. It turned out that the required space is not available and the quality of the land does not ensure the long-term stability of the infrastructure.

Sites 101, 102 and 107 all have the minimum area required (≥ 1 ha) to accommodate the infrastructure associated with the planned generating station, but the potential for expansion or moving the footprint of the planned generating station is very restricted for site 107 due to the topography and the quality of the surrounding land.

The topography of the land studied is generally favorable for the construction of the new thermal generating station. Nevertheless, significant excavation and backfill work would have to be done on sites 101 and 107, where the rock surface is uneven and has height differences in the order of 8 to 10 m in the most extreme cases. At site 101, a slight reorientation of the quadrilateral considered for the construction of the thermal generating station facilities would greatly reduce the backfill needs in the northern area, where there is, furthermore, a rock pan of about 100 m^2. Dynamiting and excavating rock would be hard to avoid at site 107, which backs onto a rocky hill to the north and, to the south, borders wetlands comprised of fine-textured permafrost materials probably containing excess ice. Moreover, the possibilities for optimizing the positioning of the quadrilateral proposed for the construction of the thermal generating station facilities are very limited there.

The quality of the drainage is good at all of the sites and could be improved if necessary. At site 107, inflows of water from the southern slope of the rocky hill could require the implementation of particular drainage measures.

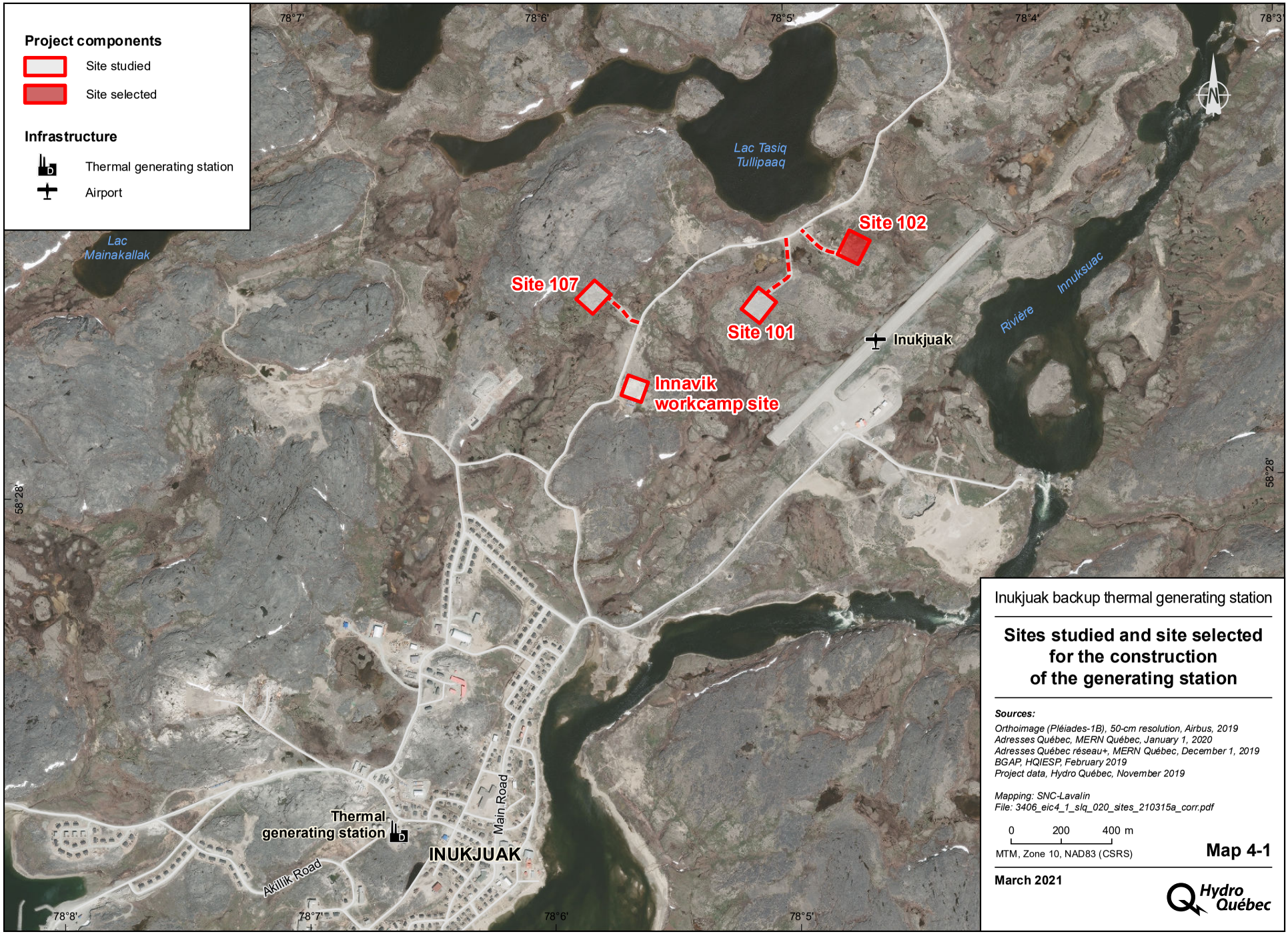
The biological environment does not present any particular constraints for the construction of the generating station at any of the sites studied, and no wildlife or plant species that is endangered, vulnerable or likely to be designated as such has been observed in or near those sites.

4.1.1.2 Site selected

All the sites analyzed appear quite similar and they all have good-quality foundation soil that will not be altered by settlement if the permafrost thaws. Site 102 offers the most advantages, however, primarily because of more favorable topography, the expansion opportunities it offers and the lack of serious environmental constraints. Furthermore, this site is the farthest from current and planned inhabitated areas.

4.1.2 Technological options

As this is a backup generating station, the speed and reliability criteria for the electrical supply and the transportation costs related to the fuel supply mean that only one technological option can be considered, the installation of two diesel-powered generating sets of 3 MW each.



Inukjuak backup thermal generating station

Sites studied and site selected for the construction of the generating station

Sources:

Orthoimage (Pléiades-1B), 50-cm resolution, Airbus, 2019
Adresses Québec, MERN Québec, January 1, 2020
Adresses Québec réseau+, MERN Québec, December 1, 2019
BGAP, HQIESP, February 2019
Project data, Hydro Québec, November 2019

Mapping: SNC-Lavalin
File: 3406_eic4_1_slq_020_sites_210315a_corr.pdf

0 200 400 m

MTM, Zone 10, NAD83 (CSRS)

Map 4-1

March 2021

Hydro Québec

Document for information purposes only. For any other use, please contact Géomatique at Hydro-Québec.

4.1.3 Description of the selected project

The project involves the construction of a backup generating station for the northern village of Inukjuak and its operation for a period of 40 years. The following subsections present the technical characteristics of the generating station, the development of the site, the development of temporary infrastructure for the construction and the recommended work methods.

4.1.4 Technical characteristics of the generating station

4.1.4.1 Powerhouse

The new powerhouse will have a total footprint of about 520 m^2. It will include two generating sets, to which a third could be added, depending on the growth in demand. All the generating sets will be in a single compartment of the powerhouse, which will allow the capacity to be increased without having to expand the building. The powerhouse will be assembled on site, using a "Meccano" type construction system, meaning a steel structure will be erected on concrete foundations with a concrete slab on the ground. The walls will be made of sandwich steel panels inside and outside, and the roof will be made of a two-ply membrane, also called an elastomeric membrane.

In addition to the space to house the generating sets (single compartment able to contain up to three 3-MW sets, with overhead crane), the "generation" section of the powerhouse will include a workshop with a mezzanine and a room for the pumps and fuel.

The workshop will be comprised of a common space on the ground floor, which will house the permanent maintenance and servicing equipment for the generating station and the tool chests for the various trades. It will also include a space for cleaning the engine parts. A service air outlet is also provided for nearby.

The workshop will also include service points for the transfer of production fluids. A mezzanine, located over the pump room and reservoir, will provide storage. This space will be equipped with a 2-tonne overhead crane.

This design concept complies with applicable safety standards. The building has been given a civil protection classification by Hydro-Québec, with a security level of 2.

4.1.4.2 Generating equipment

Hydro-Québec conducted a study to select the type of genset for the new generating station. After considering the cost of acquisition and maintenance, efficiency and consumption, it selected units with a maximum power of 3,000 kW each (voltage of 4.16 kV), with a rating of 1,800 RPM.

During the initial phase, the station will be equipped with two gensets mounted in a single bay, for a total installed capacity of 6,000 kW. In the final phase, it could have three gensets, installed in the single bay, for a total capacity of 9,000 kW.

4.1.4.3 Poured-in-place concrete

For the construction of the foundation walls, bases, floor slabs and pilasters integrated in the foundation walls, and for the pedestals for the supports and tanks, about 150 m^3 of concrete will have to be prepared from aggregates produced nearby.

4.1.4.4 Safety

As one of its safety features, the station's diesel fuel tanks will be double-walled and will meet applicable standards. In compliance with recognized practices, the used oil will be collected inside the main building, where it will be stored. A recovery system has been planned in case of accidental release.

Hydro-Québec has also drawn up safety measures for dealing with accidents, such as fires or fuel leaks. Halutik Enterprises Inc. will be responsible for the transportation and storage of the diesel fuel and will deliver the fuel to the generating station by tank truck.

4.1.4.5 Geotechnical surveys

A geotechnical and environmental soil characterization study was carried out on the study site during summer 2020. An outside business carried out geotechnical surveys in the limited study area to characterize the existing soil and determine the depth and nature of the rock to guide engineering on the positioning of the new generating station and the site preparation activities. The main results of the study are covered in Section 5.4.2.

4.1.5 Site preparation

The Inukjuak municipal council and Pituvik Landholding Corporation have officially accepted the site choice for the construction of the generating station.

The preparation of the site involves expanding the platform that will already have been put in place for the construction of the transformer substation. This preliminary phase, described in Section 4.2, is not subject to the environmental and social impact assessment and review procedure and will be carried out in summer 2021. The site preparation planned for the project that is subject to this impact statement will allow for the construction of the generating station facilities (0.53 ha) (see Map 5-1 in Chapter 5).

The site for the generating station measures 127 by 91 m, at its widest, or 9,446 m^2 (0.9 ha). The entire prepared surface will be enclosed by a chain link fence.

No rock dynamiting or excavation work is expected to be required to make the site surface uniform and create a slight slope toward its edge. The planned average thickness of the granular material that will cover the natural soil to make up the yard in which the thermal generating station will be constructed is 900 mm. The materials used will have to be non-frost susceptible, compactable and free of pebbles larger than 100 mm. The construction of the generating station will require about 1,960 m^3 of excavated materials and about 900 m^3 of MG-112 granular material backfill.

These earthworks are required for the installation of the generating station equipment and the construction of troughs to drain the surface water from around the equipment and buildings. An embankment will encourage water to run to the northern and eastern sides and toward part of the south side of the site. All the drainage water from the slopes of the platform will then be directed to the southeast. The 300-mm top coat will be made of 20-0 mm aggregate, compacted and placed on a non-frost-susceptible fill compacted to 95%. The slope of the prepared surface will be ± 1% toward the outside, with embankments that have a slope of 2H:1V, and will be protected by a layer of 50-150 mm riprap about 300 mm thick. Geotextile will be placed between the riprap and the backfill. The granular materials will come primarily from borrow pits near the northern village of Inukjuak.

In addition to the powerhouse, various outbuildings and structures will be installed or constructed on the prepared surface, including:

- one 20-ft by 40-ft utility pole rack
- two 50,000-l fuel tanks
- four 40-ft shipping containers, heated, with garage door
- one 20-ft shipping container, heated, with garage door
- one hazardous material recovery center (HMRC) container
- one garage for lineworker equipment
- twelve 6-ft by 10-ft tables for transformers
- one 30-ft by 60-ft shelter for SkyTrak lift truck

The perimeter of the prepared surface and the access will be closed with a galvanized steel chain link fence 2.1 m high, with an access barrier.

The granular materials and crushed rock required to prepare the surface will come from sites near the northern village of Inukjuak. It should be noted that the used oil will be stored inside the powerhouse, in a room constructed for this purpose, and in an HMRC shelter (specially designed container to store residual hazardous materials that will be near the generating station).

4.1.6 Temporary facilities and infrastructure

Because of the work method chosen, explained in the next section, the temporary facilities and infrastructure required for the construction of the thermal generating station will be reduced to the minimum. All receiving, handling and storage areas for the materials as well as the machinery and fuel tank yards will be on the platform that will be built in summer 2021 during the construction of the transformer substation.

The site for the waste materials depot will also be on this platform.

Lastly, the construction of a temporary camp to house the workers assigned to the construction of the thermal generating station and the wastewater treatment facilities will be the responsibility of the general contractor responsible for the work. Consequently, we cannot provide more specifications about these facilities at this stage of project development.

4.1.7 Labor

It is estimated that for the first construction season, in 2023, up to 25 workers will be active on the worksite, while in the second construction season, in 2024, this number will be reduced to 20. The project will also require local workers to be hired, particularly for the preparation of the generating station site and the construction of the access road, as well as the transportation of the granular materials. The purchase of goods and services in the northern village of Inukjuak by workers from outside will add to the economic spinoffs associated with hiring local resources.

4.1.8 Operation phase

The energy from the backup generating station will be required for the equivalent of one month per year until 2063, to compensate for a loss of power or energy or during planned maintenance on the Innavik hydroelectric generating station.

Even if it is not required to provide energy, the backup generating station must operate periodically for short periods. Its gensets will have to be synchronized to the system at 70% of their nominal capacity for one hour a month to comply with Operating Procedure GEN-D-211-AUT for off-grid gensets.

Of course, if the Innavik hydroelectric generating station became unavailable, the backup generating station would be used until it is again available, partly or in full.

The fuel will be supplied by the Fédération des Coopératives du Nouveau-Québec (FCNQ). Halutik Enterprises Inc. will be responsible for the transportation and storage of the fuel. Up to 35 fuel deliveries per year are expected, for a total volume of 350,000 l. The fuel will be sent by FCNQ to the Inukjuak dock and then by truck from Halutik Enterprises Inc. to the site of the thermal generating station. At the site, the fuel will be stored in two tanks with a capacity of up to 50,000 l each.

The equipment maintenance plan will take into account the manufacturers' recommendations and Hydro-Québec's expertise for these types of equipment. No service interruption is anticipated during the work.

Hydro-Québec agrees to provide decommissioning plans for the works and facilities five years before the cessation of operations.

4.1.9 Hazardous and residual waste management

It is estimated that the construction of the backup thermal generating station will generate about 300 m^3 of waste materials and residual hazardous materials. These will be collected and stored in hermetic containers and then sent to southern Québec to treatment locations authorized by the MELCC.

4.2 Developments and related projects

The construction of the transformer substation and the preparations it requires—that is, the construction of the platform where the substation will be located and the access road leading to it, the installation of electrical distributions lines and the dismantling of the current thermal generating station—are projects that are related to the construction of the Inukjuak backup thermal generating station. They are not subject to the environmental impact assessment and review procedure for the biophysical and social environments. They are, however, mentioned in this impact statement to provide a better overall understanding of the project. As applicable, Hydro-Québec will see to it that all government approvals that may be required are obtained in a timely fashion.

4.2.1 Access infrastructure

An access road will be built between the site of the new 25-kV substation, which will be commissioned in 2022 to serve the new Innavik generating station, and the access road to that generating station. The construction was the subject of an attestation of exemption from the environmental and social impact assessment and review procedure, which was issued on September 30, 2020 (3215-05-007).

4.2.2 Borrow pits

No new borrow pits are expected to be opened for this project. Instead, Hydro-Québec intends to draw supplies from borrow pits already in operation but not yet identified. The supply of granular materials will be the subject of a call for tenders after which one or more suppliers will be selected. The location of the selected borrow pits and the volumes withdrawn from each will depend on the supply strategy retained later. The authorizations related to these borrow pits will be the responsibility of the selected suppliers.

4.2.3 25-kV transformer substation and distribution lines

Electricity generated by the Innavik plant will be distributed from a new 4.16/25-kV transformer substation and two new distribution lines of the same voltage that will connect to the existing distribution system in the village of Inukjuak. These infrastructures will be commissioned in 2022. The construction work will begin in summer 2021.

Distributions lines will be installed on wooden poles to form a loop with the generating station along the access road shown in Section 4.2.1. The substation will be constructed near the planned backup generating station. Its dimensions will be about 44 by 33 m (1,452 m^2). It will feature two transformers and switchgear mounted on metal frameworks.

As the backup generating station will be constructed a few metres from the new substation, the project does not entail any works related to energy distribution other than the installation of two transmission cables (about 30 m long each) between the generating station and the substation.

4.2.4 Dismantling of the existing generating station

The existing thermal generating station will be dismantled and the site will be rehabilitated after the new generating station is commissioned, in 2025-2026. A summary of the measures to be taken during the dismantling of the current generating station and the environmental rehabilitation of site is presented in Table 4-1.

The sequence of activities and relevance of their execution will depend on the direction taken by the Groupe – Distribution, approvisionnement et services partagés for the future of the land where the existing generating station and powerhouse stand. Although the cessation of oil or diesel electricity-generating activities requires the environmental rehabilitation of the site (*Land Protection and Rehabilitation Regulation*), Hydro-Québec is unaware, at the time of publication, what will become of the site after the powerhouse is dismantled.

Table 4-1: Preliminary Timeline and Sequence of Activities for the Dismantling of the Existing Generating Station and the Environmental Rehabilitation of the Site

Stage	Activity	Expected duration
1	**Dismantle the existing generating station**	**2025**
1.1	Set up temporary hazardous waste storage areas and temporary residual hazardous materials recovery areas at the jobsite and supply response equipment in case of an accidental release.	Spring 2025
1.2	Start dismantling the facilities.	Spring–summer 2025
1.3	Install containers to receive waste materials; sort waste materials and send them to authorized facilities.	Spring–summer 2025
2	**Conduct the environmental characterization of the site**	**2026**
2.1	Conduct environmental characterization.	Spring–summer 2026
2.2	If the characterization study reveals the presence of contaminants in concentrations exceeding the regulatory limits, hire a company to carry out the environmental rehabilitation plan for the site, which must be sent to the department for approval, in accordance with the *Environment Quality Act*.	Fall–winter 2026
3	**Carry out the environmental rehabilitation of the site**	**2027**
3.1	Undertake the environmental rehabilitation project of the site.	Spring–summer 2027
3.2	Receive certification from an expert confirming that the rehabilitation work has been completed in accordance with the plan requirements.	TBD

4.3 Project timeline and cost

Schedule

Hydro-Québec conducted studies to collect the data needed to make decisions concerning the project. These studies made it possible to define the technical characteristics of the project, choose the site for the generating station, determine positive and negative impacts on the environment, establish a schedule and determine the construction costs. The draft design phase included information and consultation activities with the local community. Government approvals will be sought in spring 2022. The planned generating station will be commissioned in December 2024. Table 4-2 presents the summary project schedule.

Table 4-2: Project Schedule

Activity	Period
Detailed engineering: plans and specifications, specification documents for major materials supply, etc.	February 2021 to November 2022
Issuance of government approvals	May 2021 to October 2022
Major materials supply: call for tenders, manufacture and delivery to warehouse for marine transportation	March 2021 to May 2022
Operation of borrow pits and transport of materials	April 2023 to August 2023
Levelling, backfilling and earthwork	July 2023 to August 2023
Construction of the generating station and substation, installation of equipment, final developments, etc.	August 2023 to August 2024
Startup period	July 2024 to December 2024
Commissioning of the generating station	December 2024

Project costs

The cost of the project has been roughly estimated at $44 million.

5 Description of the environment

5.1 Extended study area

The extended study area makes it possible to place the various components of the environment potentially affected by a project in a regional context. It is used for the general description of the components of the human and natural environments.

The extended study area targeted for the backup generating station project covers an area of 3,032 ha (see Map 5-1). It is located in the Nord-du-Québec administrative region, more specifically in the territory of Nunavik (north of the 55th parallel). It includes the northern village of Inukjuak (NV) and a small section of Inuit Owned Lands (IOL). The extended study area was delineated to exclude the marine area since there are no anticipated impacts there.

5.2 Limited study area

The limited study area corresponds to the immediate vicinity of the substation and describes the components of the physical and biological environment that are more directly affected by the project.

With a surface area of 13.8 ha, the limited study area is bounded by the access road to the future Innavik generating station on the northwest side and the Inukjuak airport landing strip on the southeast side (see Map 5-1). The existing conditions of the components affected by the project are described in Chapter 6.

5.3 Methodology

The description of the environment is based on various sources of information from different agencies and departments including:

- Base de données topographiques et administratives (BDTA)
- Centre de données sur le patrimoine naturel du Québec (CDPNQ)
- Hydro-Québec
- Québec, Ministère de la Culture et des Communications (MCC)
- Québec, Ministère de l'Énergie et des Ressources naturelles (MERN)
- Québec, Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC)
- Environment and Climate Change Canada (ECCC)
- Kativik Regional Government (KRG)

The first step was to analyze the information to determine the presence of sensitive features that could be affected by the project activities. Field surveys were also conducted to identify these sensitive features and to analyze the impacts. Plant and wildlife surveys were conducted within the limited study area, and the analysis of the human environment and landscape components focused on the extended study area. The specific methods and protocols used for the plant and wildlife surveys, as well as the methodological approaches for collecting data from the Inuit community, are discussed in the sections pertaining to these topics.

5.4 Physical environment

5.4.1 Climate and climate change

5.4.1.1 Current weather data

A weather station is located at the Inukjuak airport (see Map A, pocket insert). However, according to ECCC (Government of Canada, 2019), only historical weather data is available for this area. The comprehensive weather data available closest to Inukjuak is from the Kuujjuaq station. Although some 600 km away from Inukjuak, this station is located at approximately the same latitude. The Inukjuak and Kuujjuaq regions are characterized by a polar climate with moderate precipitation and a very short growing season (Gerardin and McKenny, 2001):

- Mean annual temperature varying from −9.4°C to −6.0°C
- Annual precipitation ranges from 470 to 799 mm
- Growing season of 90 to 199 days per year

According to weather data recorded in Kuujjuaq, the average daily temperature ranges from −24.7°C in January to 11.8°C in July. Average monthly precipitation ranges from 27.3 mm in April to 73.8 mm in September. The average annual total is 541.6 mm.

For wind conditions, it is best to analyze hourly records from the Inukjuak airport station. Over the past few decades, ECCC and NAV CANADA have set up several stations and observation programs at the airport. The hourly wind records from station 7103280, operated at the airport by NAVCAN since January 2011, are the most comprehensive. The annual and seasonal wind roses are shown in Figures 5-1 and 5-2. On an annual basis, winds are slightly more likely to come from the southwest, but no one direction is really dominant. Southeast winds are the least frequent. Calm winds are infrequent (less than 2%). Due to the low surface roughness at this latitude, the average wind speed at 10 m above ground (22.9 km/h) is much higher than in southern Québec. The wind roses do not show pronounced differences between seasons.

Inukjuak backup thermal generating station

Study area

Sources:

Orthoimage (Pléiades-1B), resolution 50-cm, Airbus, 2019
Adresses Québec, MERN Québec, January 1, 2020
Adresses Québec réseau+, MERN Québec, December 1, 2019
BGAP, HQIESP, February 2019
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, November 2019
SDA, 1:20,000, MERN Québec, October 2019
Territoire d'application des conventions nordiques, MERN Québec, 2015
Project data, Hydro-Québec, February 2021

Mapping: SNC-Lavalin
File: 3406_eic5_1_slq_002_zetude_210315a.mxd

0 250 500 m
MTM, Zone 10, NAD83 (SCRS)

Map 5-1

March 2021

Hydro Québec

Document for information purposes only. For any other use, please contact Géomatique at Hydro-Québec.

Figure 5-1: Annual wind rose at the Inukjuak Airport

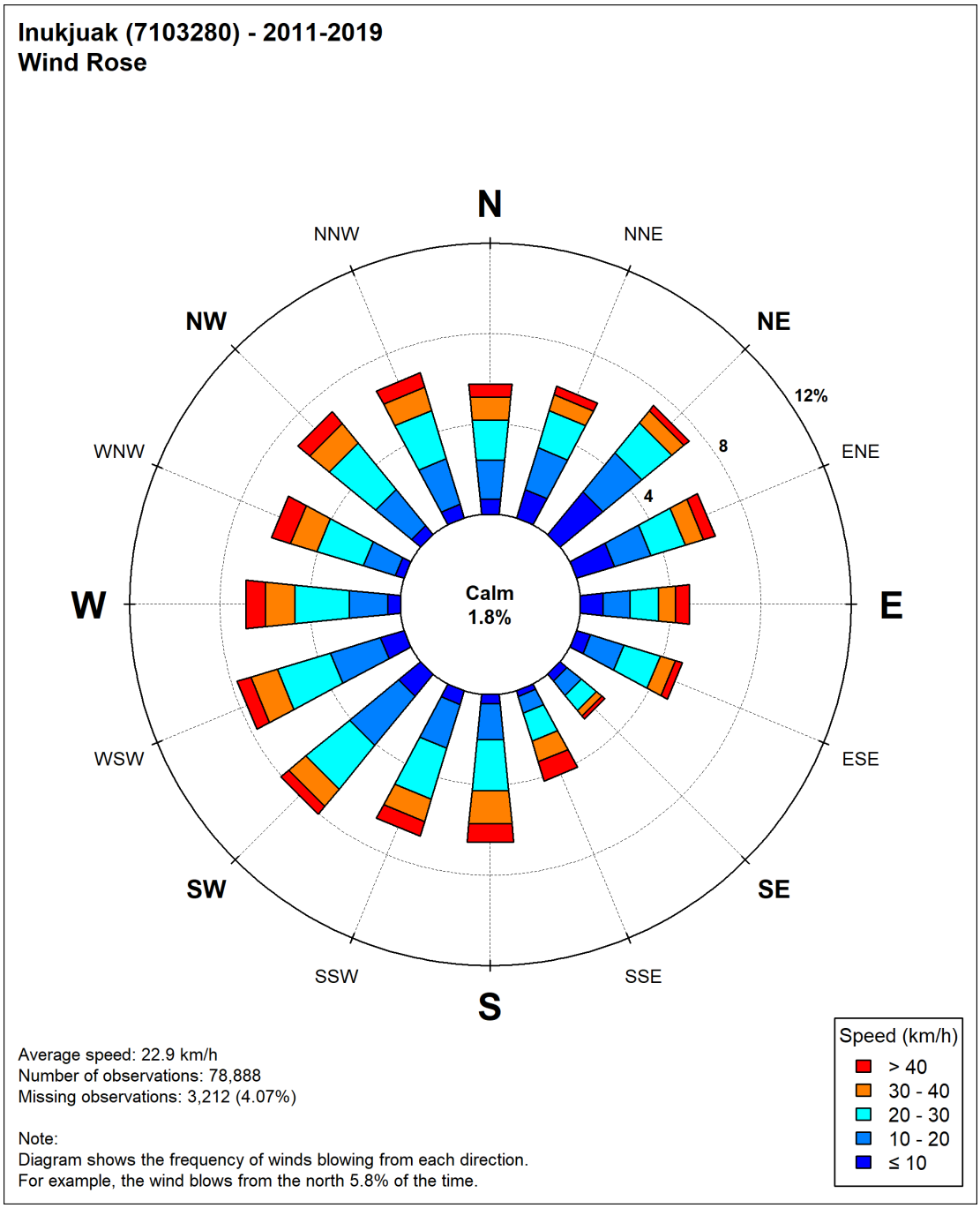
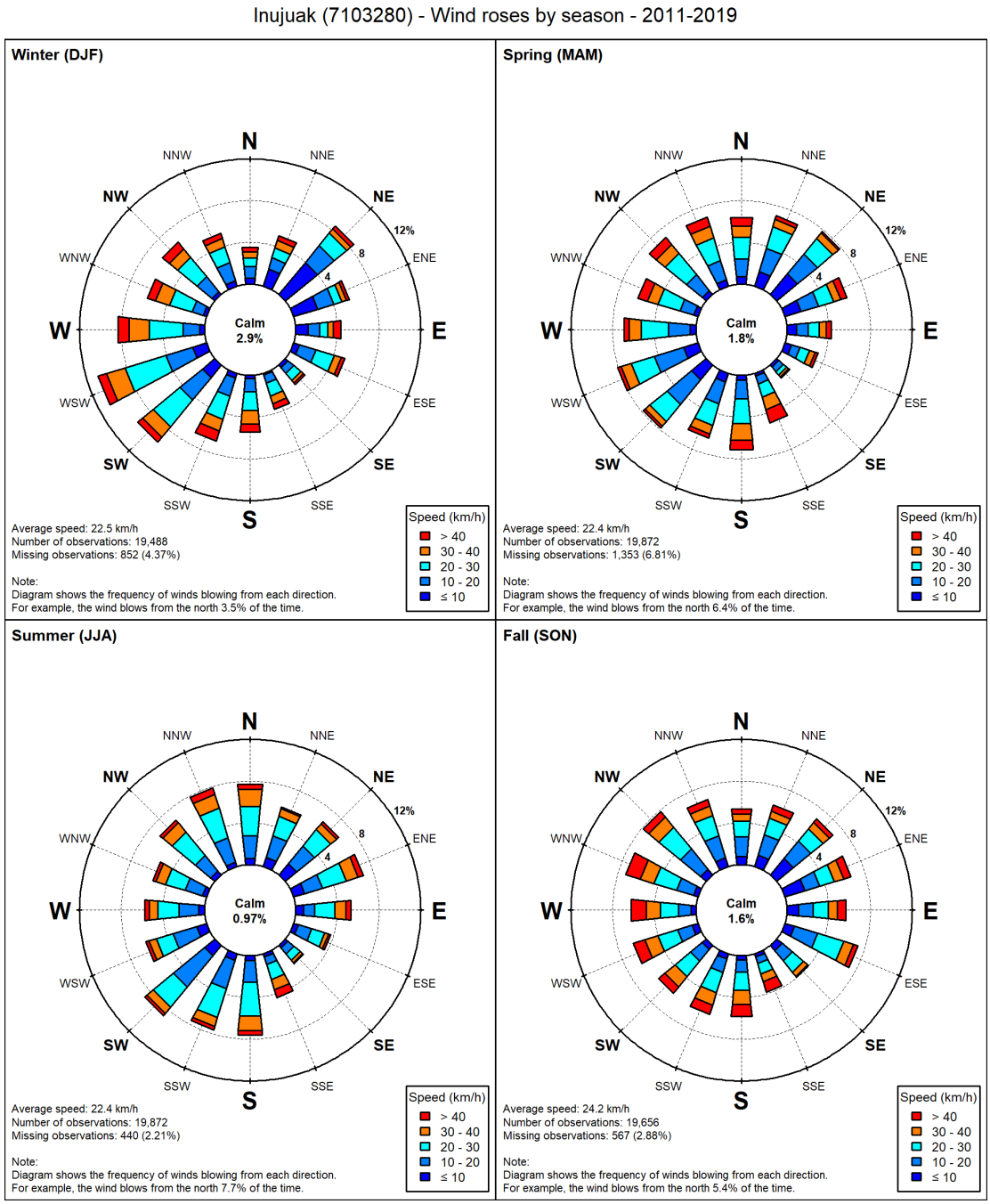


Figure 5-2: Seasonal wind roses at the Inukjuak Airport



5.4.1.2 Adapting the project to climate change

The climate projections for the project area were obtained via the Ouranos Climate Portraits platform. Since a thermal generating station has a service life of approximately 30 to 50 years, the future time horizon of 2041 to 2070 was chosen. Table 5-1 describes the changes in climate variables between the 1981–2010 period and 2041–2070 horizon.

Table 5-1: Current and Future Climate Data for the Project Area

Climate variables	1981–2010 period	2041–2070 horizon	Variance
Temperatures (average annual)	-5.3°C	-1.6°C	+ 3.7°C
Average daily maximum temperatures	-1.8°C	1.5°C	+3.3°C
Total precipitation (annual average)	494 mm	577 mm	+83 mm
Maximum 5-day precipitation	41.8 mm	49.4 mm	+-7.6 mm
Number of freeze/thaw cycles	61	49.8	-11.2

Source: All data in the table originates from the Ouranos Climate Portraits platform.

The results for the reference period and future horizons are calculated from the time series of 11 climate simulations. The results for the 1981–2010 reference period are compared with those for the 2041–2070 horizon under the high scenario (RCP 8.5), which considers an increase in emissions until the end of the century with the choice of the 50 percentiles of the set of simulations.

Analysis of future climate projections for the area of the backup generating station shows a marked increase in mean and maximum temperatures and total annual precipitation. The annual and five-day precipitation projections are not problematic for the design of the generating station built on bedrock. The number of freeze/thaw cycles will decrease, which should also limit the impacts on the facility.

Based on the interpretation of these results, key climate changes may impact the operation of the backup generating station:

- Increased average temperatures leading to permafrost melting and a loss of its load-bearing capacity may create stability issues for the proposed infrastructure.
- The likely increase in the frequency and magnitude of extreme weather events, such as thunderstorms, high winds and heavy precipitation in liquid or solid form, may lead to failures of the backup facility.
- Changes to the ice cover may impact the supply of fuel by ship.

The impacts of climate change on the following were assessed:

1) Electricity supply for Inukjuak residents:

   The actual construction of the backup facility will increase the reliability of the electricity supply for Inukjuak residents. The backup generating station will have enough power to supply the entire village should the hydroelectric generating station be forced to shut down due to an extreme weather event.

2) Choice of construction site:

   The increase in average annual temperatures is the climate variable that can put the backup generating station at the greatest risk, as it leads to accelerated melting of the permafrost.

   To mitigate this risk, a rocky site was chosen for the construction of the plant.

3) Fuel supply and autonomy:

   No negative impact from climate change on supply by ship is anticipated. On the contrary, ice melting could facilitate access to the territory.

   The quantities of fuel stored on site would allow the village of Inukjuak to be supplied for four to five days in the event of a failure of the Innavik hydroelectric generating station or of the power lines connecting it to the switching substation.

5.4.2 Geology, geomorphology and surface deposits

The extended study area is part of the Péninsule d'Ungava (Ungava Peninsula) natural province. The Péninsule d'Ungava is a large, gently undulating plateau sloping to the west. The altitude increases slightly from Baie d'Hudson (Hudson Bay) and rarely exceeds 400 m (Li et al., 2019). Elevations there range from 0 to 140 m. As for the site selected for the construction of the generating station, it is slightly hilly, with an elevation of about 35 m.

The extended study area is located in the Superior Province, which occupies the central part of the Canadian Shield. The Superior Province is largely composed of Neoarchean rocks, some of which are the oldest on Earth. The northern sector belongs to the Minto Subprovince, which has significant units of charnockitic rocks (MERN, 2020). Surface deposits are predominantly rock outcrops and shallow-water facies deposits. Built on marine sands and gravels, the low-lying terrain in the Inukjuak region is generally poorly drained, and some of these areas contain small, low mounds of permafrost (Allard et al., 2007). Permafrost in this region is continuous and variable in thickness, exceeding 150 m in places (Allard and Seguin, 1987). The active layer can range in thickness from 0.8 to over 2.0 m. Due to climate change, it may have degraded in recent years.

As part of the geotechnical and environmental soil characterization study (Englobe, 2021), 35 borings were completed in the location of the backup thermal generating station, or the limited study area. All boreholes were made in a till deposit consisting of predominantly silty, trace silty, gravelly or trace gravelly sand, and occasionally with the presence of finer soil ranging from sandy silt to sand and silt. The thickness of the deposits ranged from 0.35 to 2.43 m under a thin layer of organic soil. The rock was intercepted at all boreholes (except one due to potential inability to drive the excavator over the permafrost), and was sound in appearance with no major alteration.

Borings drilled more specifically at the generating station site had soils composed mainly of medium sand and gravel. Rock was intercepted at all boreholes at depths ranging from 0.51 to 1.34 m (Englobe, 2021).

5.4.3 Hydrography, hydrology and drainage

The village of Inukjuak is located at the mouth of the Rivière Innuksuac, which flows into the Baie d'Hudson. The Rivière Innuksuac is part of the Baie d'Hudson watershed and flows out of Lac Chavigny, located more than 260 km from Inukjuak. The Baie d'Hudson is located approximately 3 km from the proposed thermal generating station, while the Rivière Innuksuac is over 500 m away. Although the bay and river are within the extended study area, they will not be affected by the project. In addition to these two features, numerous perennial and indeterminate watercourses and small water bodies are found throughout the extended study area. The airport area is drained by a network of indeterminate watercourses, likely drainage ditches. A few significant lakes occupy the northern portion of the study area: Nirikkaivik, Akullipaaq and Tasiq Tullipaaq (see Map A, pocket insert).

The generating station site is located at the interface of two sub-watersheds one draining to Lac Tasiq Tullipaaq to the northwest and the other to Rivière Innuksuac to the southeast. Most of the site drains to the landing strip ditch and then to the Rivière Innuksuac.

5.4.4 Soils

Contaminated sites are identified in the extended study area. The Treasury Board of Canada Secretariat reports the presence of two contaminated sites (TBS, 2019), while five sites with contaminated soil or groundwater are recorded in the MELCC Répertoire des terrains contaminés [inventory of contaminated lands] (2019*a*). Table 5-2 provides a brief description of these contaminated sites, and Map A (pocket insert) shows their locations.

Table 5-2: Contaminated Sites in the Extended Project Area

Site	Location	Contamination type	Contaminant	Site rehabilitation	Source	Distance from the proposed facility (km)
Inukjuak upper air station	Near the intake of the Inukjuak drinking water plant	Suspected	Not available	Not available	Federal contaminated sites	1.1
Inukjuak air station	Along the road to the airport	Suspected	Not available	Not available	Federal contaminated sites	0.9
Inukjuak northern airport	Inukjuak airport	Soil	Polycyclic aromatic hydrocarbons, light hydrocarbons, C10 to C50 petroleum hydrocarbons	Completed in 2016	Inventory of contaminated lands	0.7
Site 2 former air station	Municipal garage	Soil	Monochlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, C10 to C50 petroleum hydrocarbons, molybdenum (Mo), lead (Pb)	Completed in 2000	Inventory of contaminated lands	2.8
Former FCNQ fuel depot	Inukjuak service station	Soil and groundwater	Benzene, ethylbenzene, polycyclic aromatic hydrocarbons, C10 to C50 petroleum hydrocarbons, methyl naphthalenes, toluene, xylenes (o,m,p)	Not completed	Inventory of contaminated lands	2.8
Existing Inukjuak thermal generating station	Existing Inukjuak thermal generating station	Soil	Polycyclic aromatic hydrocarbons, C10 to C50 petroleum hydrocarbons	Not completed	Inventory of contaminated lands	3.0
NAV CANADA	Near the existing Inukjuak thermal generating station	Soil	Benzene, ethylbenzene, C10 to C50 petroleum hydrocarbons, toluene, xylenes (o,m,p)	Completed in 2004	Inventory of contaminated lands	2.9

Sources: TBS, 2019 and MELCC, 2019*a*.

A Phase I characterization study was conducted on and around the site (Englobe, 2020*a*). Phase I allows us to establish the history of activities at a site and determine if activities liable to contaminate the site were carried out on or near it. This study was carried out in accordance with the principles of the CSA Z768-01 standard and the MELCC *Guide de caractérisation des terrains*. This study did not reveal the presence of a significant environmental risk liable to affect the site. However, an environmental soil characterization (Englobe, 2021) was conducted as part of the geotechnical study of the site (Englobe, 2020*b*). This soil characterization determined that there were no contaminated soils at the locations surveyed. Consequently, no additional environmental characterization is required.

5.5 Biological environment

5.5.1 Vegetation

5.5.1.1 Biophysical environment

The extended study area covers a total area of 3,032 ha and is located in the shrub Arctic tundra bioclimatic domain (MFFP, 2019). The dominant vegetation consists of shrub species such as willow, dwarf birch, as well as herbaceous species, mosses and lichens. No tree-like species are present, and shrubs do not exceed two metres in height. The permafrost is continuous and the landform is the result of periglacial activity.

The biophysical environment accounts for over 90% of the area here, or 2,815.6 ha (see Table 5-3 and Map A, pocket insert). It consists primarily of shrub tundra at 1,325.8 ha (44% of the area) and wetlands at 488.7 ha (16%). The water system is also significant, covering 305.1 ha or 10% of the area. It consists of rivers, lakes and ponds. The barren surfaces cover an area of 696.1 ha (23%) and are represented mainly by rocky outcrops. The remainder of the area is an anthropogenic environment of varied use that represents 216.4 ha, or 7% of the area.

Table 5-3: Distribution of Biophysical Environment Types in the Extended Study Area

Environment type	Surface area (ha)	Proportion (%)
Terrestrial	***2,021.8***	***66.7***
• Shrub tundra	1,325.8	43.7
• Dry barrens	696.1	23.0
Wetlands and aquatic	***793.8***	***26.2***
• Shrub swamp	>0.01	>0.01
• Marsh	>0.01	>0.01
• Water body	305.1	10.1
• Open fen	2.2	0.1
• Undefined fen	486.5	16.0
Anthropogenic	***216.4***	***7.1***
• Varied anthropogenic	216.4	7.1
Total	**3,032.0**	**100.0**

In July 2020, a site visit was conducted to characterize the 13.8-ha limited study area. Table 5-4 presents the primary plant species observed in the terrestrial environment. The most common species include bog birch, black crowberry, bearberry willow and bog bilberry.

Table 5-4: Primary Terrestrial Vascular Plant Species Observed in the Limited Study Area

English name	Latin name
Bog bilberry	*Vaccinium uliginosum*
Lingonberry	*Vaccinium vitis-idaea*
Siberian sea thrift	*Armeria maritima ssp. sibirica*
Alpine azalea	*Kalmia procumbens*
Bog birch	*Betula glandulosa*
Alpine bearberry	*Arctous alpina*
Lapland reedgrass	*Calamagrostis laponica*
Black crowberry	*Empetrum nigrum ssp. hermaphroditum*
Bluebell	*Campanula rotundifolia*
Norway sedge	*Carex norvegica*
Northern painted-cup	*Castilleja septentrionalis*
Arctic daisy	*Arctanthemum arcticum ssp. arcticum*
Dwarf hairgrass	*Deschampsia sukatschewii*

Table 5-4: Primary Terrestrial Vascular Plant Species Observed in the Limited Study Area *(continued)*

English name	Latin name
Fireweed	*Chamaenerion angustifolium ssp. angustifolium*
Dwarf fireweed	*Chamaenerion latifolium*
Stiff clubmoss	*Spinulum annotinum ssp. annotinum*
Alpine bluegrass	*Poa alpina ssp. alpina*
Lapland lousewort	*Pedicularis lapponica*
Elephant's head	*Pedicularis groenlandica*
Purple mountain heather	*Phyllodoce caerulea*
Arctic bluegrass	*Poa arctica*
Field horsetail	*Equisetum arvense*
Common bearberry	*Arctostaphylos uva-ursi*
Beautiful willow	*Salix glauca var. cordifolia*
Bearberry willow	*Salix uva-ursi*
Tufted saxifrage	*Saxifraga cespitosa*
Moss campion	*Silene acaulis*

5.5.1.2 Wetlands and aquatic environments

Wetlands

Wetlands in the extended study area were identified using the MELCC's mapping of potential wetlands in Québec (2019*b*), the MFFP's northern Québec vegetation mapping (2020) and the MERN's database of northern indigenous villages (2013). The results of aerial photo interpretation of the limited study area using 7 cm resolution orthophotographs and wetland data characterized during field inventories conducted in July 2020 were also included.

The wetlands present in the extended study area cover 488.7 ha or 16.1% (see Table 5-5), of which 486.5 ha are undefined bog type wetlands, from databases (see Map A, pocket insert). Few marshes or shrub swamps are present (< 0.1%).

Table 5-5: Distribution of Wetland Types in the Extended Study Area

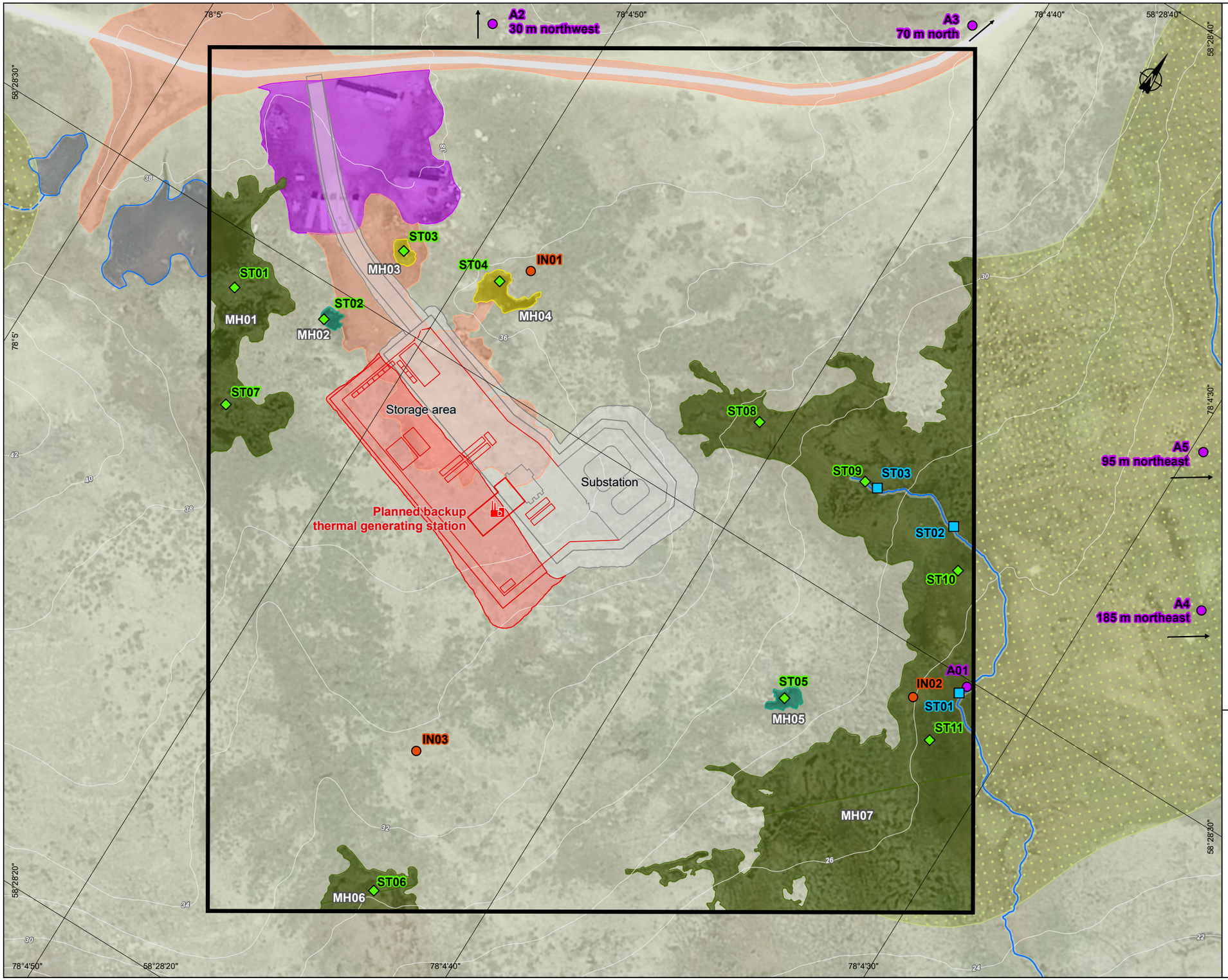
Type of wetland	Surface area (ha)	Proportion (%)
Marsh	< 0.1	< 0.1
Shrub swamp	< 0.1	< 0.1
Undefined fen	486.5	16.0
Open fen	2.2	0.1
Total	**488.7**	**16.1**

A visit to the limited study area was conducted in July 2020. This visit validated and characterized the wetlands captured by aerial photo interpretation. Nearly 2.3 ha of wetlands were mapped and characterized (see Map 5-2). The remainder is covered by shrub tundra and anthropogenic features. Table 5-6 presents the surface area of each type of environment and their proportion in relation to the limited study area.

Table 5-6: Distribution of Environment Types in the Limited Study Area

Environment type	Surface area (ha)	Proportion (%)
Wetland	***2.3***	***16.4***
• Marsh	< 0.1	0.3
• Shrub swamp	< 0.1	0.1
• Open fen	2.2	16.0
Other	***11.5***	***83.6***
• Anthropogenic	1.5	10.7
• Shrub tundra	10.0	72.9
Total	**13.8**	**100.0**

The seven wetlands present in the limited study area were characterized using 11 stations (see Map 5-2). As mentioned, open fens occupy the largest area of wetland in the limited study area (fen; 2.2 ha). The observed marshes and shrub swamps are located in small depressions and represent less than 0.1 ha (0.4%) of the total area.



Hydrography

- Perennial watercourse
- Indeterminate watercourse
- Water body

Terrestrial environment

- Shrub tundra

Wetlands

Potential wetlands

- Cartographie des milieux humides potentiels du Québec, MELCC Québec, December 2019

Characterized wetlands (2020)

- Open fen
- Shrub swamp
- Marsh

Biological surveys (2020)

- ST01 Watercourse characterization station
- ST01 Wetland characterization station
- IN01 Avian wildlife point count
- A01 Amphibian survey station

Human environment

- Industrial sector
- Disturbed environment

Project components

- Planned backup thermal generating station
- Planned platform and infrastructure (generating station)
- Planned platform and infrastructure not in scope (substation and access road)
- Limited study area

Inukjuak backup thermal generating station

Biophysical and human environment
Limited study area

Sources:

Orthoimage (Pléiades-1B), 50-cm resolution, Airbus, 2019
Adresses Québec, MERN Québec, January 1, 2020
BDVA, 1:2,000, MRN Québec, November 2013
Cartographie des milieux humides potentiels du Québec, MELCC, December 2019
Végétation du Nord québécois, MFFP Québec, May 2020
Project data, Hydro Québec, February 2021

Mapping and inventory: SNC-Lavalin
File: 3406_eic5_2_slq_018_mnh_zrestreinte_210315a_corr.pdf

0 17.5 35 m
MTM, Zone 10, NAD83 (CSRS)
Contour interval: 2 m

Map 5-2

March 2021

Hydro Québec

Three fens, two shrub swamps and two marshes were characterized in the limited study area (see Table 5-7).

Table 5-7: Area by Wetland Type Characterized in the Limited Study Area

Wetland No.	Type	Surface area (ha)	Characterization station No.
WL01	Open fen	0.30	ST01, ST07
WL02	Shrub swamp	0.01	ST02
WL03	Marsh	0.01	ST03
WL04	Marsh	0.03	ST04
WL05	Shrub swamp	0.01	ST05
WL06	Open fen	0.08	ST06
WL07	Open fen	1.82	ST08, ST09, ST10, ST11
Total	**–**	**2.26**	**–**

Characterized fens are dominated by bog birch (*Betula glandulosa*), black crowberry (*Empetrum nigrum ssp. hermaphroditum*), northern willow (Salix arctophila) and blueberry (*Vaccinium uliginosum; V. vitis-idaea*) on raised plateaus, while portions of the flats are dominated by either water sedge (*Carex aquatilis var. aquatilis*) or common cottongrass (*Eriophorum angustifolium ssp. angustifolium*), accompanied by needle spikerush (*Eleocharis acicularis*) and tufted bulrush (*Trichophorum cespitosum*). The soil is saturated with water, the water table being located near the surface, at a depth of about 15 cm. The thickness of organic matter varies from 10 to 25 cm and is usually underlain by fine sand. The fens also have shallow pools of water that are more or less dry.

Both marshes are located in small depressions. They consist primarily of water sedge, fragile sedge (*Carex membranacea*) or mountain rush (*Juncu arcticus ssp. arcticus*). Northern bur-reed (*Sparganium hyperboreum*) and mare's tail (*Hippuris vulgaris*) were also observed in the nearly dry pond at WL04. Beautiful willow (*Salix glauca var. cordifolia*) and bog birch are among the few prostrate shrubs observed at the edge. The soil consists of fine sand that is more or less saturated with water. The water table was reached at a depth of 40 cm in WL04, but was not reached in WL03.

Both shrub swamps have similarities to small marshes and are located in small, enclosed depressions. The dominant shrub species are bog birch and willows (*Salix planifolia; S. glauca var. cordifolia*). Herbaceous species are mainly needle spikerush and lapland reedgrass (*Calamagrostis lapponica*), accompanied by sedges (*Carex membranacea; C. norvegica; C. aquatilis var. aquatilis*), mountain rush and tufted bulrush. The soil consists of fine sand, and rock was reached at a depth of 15 cm (WL02) and 25 cm (WL05). The water table was not reached.

Detailed characterization sheets are presented in Appendix B. Note that the majority of species encountered in the tundra domain do not have a wetland status (obligatory, facultative or non-indicative) as defined in the guide by Bazoge et al. (2015). For this reason, the species status ratings for the state of Alaska presented by Lichvar et al. (2016, updated in 2018) were used.

Aquatic environments

The aquatic environment of the extended study area was determined using data from the MERN topographic maps of northern indigenous villages (2013) and an analysis of LIDAR topographic data. A total area of 305.1 ha is made up of water features, i.e., watercourses, lakes and ponds. The numerous small ponds are typical of the northern landscape and are mainly the result of thawing at the surface of permafrost (thermokarst ponds).

Within the limited study area, only one watercourse (WC01) was observed at the eastern edge (see Map 5-2). It flows towards the Inukjuak airport to the southeast and discharges into the landing strip ditch. This watercourse, which was characterized in July 2020, originates in the WL07 fen and flows permanently. Parts of its channel are well defined while other areas are rather diffuse in the fen. The riparian strip on either side is natural, consisting of herbaceous plants and some shrubs. Table 5-8 presents the data from the watercourse characterization, which was conducted in three different segments. Photographs of each of the three characterized segments are shown in Appendix C.

Table 5-8: Watercourse WC01 Characterization Data

Parameters		Segment 1 (downstream)	Segment 2 (central portion)	Segment 3 (upstream, mouth of stream)
Flow		Perennial	Perennial	Perennial
Flow facies		Glide (100%)	Glide (100%)	Glide (100%)
Mean depth (m)		0.05	0.05	0.05
NHWL width (shore) (m)		1.42	0.83	0.71
Wet stream width (m)[a]		0.58	0.47	0.42
Bankfull discharge width (m)		1.20	0.60	0.50
Estimated slope right bank (%)		<30%	<30%	<30%
Estimated slope left bank (%)		<30%	<30%	<30%
Bank height (m)		<5	<5	<5
Width of right riparian strip (m)		10	10	10
Width of left riparian strip (m)		10	10	10
Substrate (%)		Organic matter (80%), cobble (10%), pebble (5%), block (5%)	Organic matter (75%), cobble (15%), pebble (10%)	Organic matter (93%), gravel (5%), cobble (2%)
Terrestrial vegetation (right bank)	Dominant bank Sub-dominant bank	Herbaceous None	Herbaceous Herbaceous	Herbaceous Shrubs
	Dominant shore Sub-dominant shore	Herbaceous Shrubs	Herbaceous Herbaceous	Herbaceous Shrubs
Terrestrial vegetation (left bank)	Dominant bank Sub-dominant bank	Herbaceous None	Herbaceous Herbaceous	Herbaceous Shrubs
	Dominant shore Sub-dominant shore	Herbaceous Shrubs	Herbaceous Herbaceous	Herbaceous Shrubs
Aquatic vegetation	% of complete submergence	0	0	0
	Dominant and sub-dominant	N/A	N/A	N/A
	Aquatic vegetation comment	None	None	None

a. At the time the characterization was completed (July 2020).

Ecological functions of wetlands and aquatic environments

Wetlands and aquatic environments provide many ecological services due to their different functions throughout the ecosystem. According to the *Act to affirm the collective nature of water resources*, they have the following functions:

> "(1) acting as a pollution filter, controlling erosion and retaining sediments by, among other things, preventing and reducing surface water and groundwater pollution and sediment input;
>
> (2) acting as a regulator of water levels by retaining meteoric water and meltwater and allowing part of it to evaporate, thereby reducing the risk of flooding and erosion and promoting groundwater recharge;
>
> (3) conserving the biological diversity that enables the environments and ecosystems to provide living species with habitat in which to feed, find cover and reproduce;
>
> (4) acting as a sun screen and natural wind-shield by maintaining vegetation, which prevents excessive warming of water and protects soils and crops from wind damage;
>
> (5) sequestering carbon and mitigating the impacts of climate change; and
>
> (6) protecting the quality of the landscape by preserving the natural character of a site and the attributes of the countryside associated with it, thus enhancing the value of adjacent land."

The primary function of the wetlands identified in the extended study area is biodiversity conservation. The northern tundra is not very productive in terms of vegetation. Therefore, open fens and undefined fens, prostrate shrub swamps and marshes provide important feeding and shelter areas for northern wildlife. Although the process of organic matter decomposition is reduced at these latitudes (climate, reduced growing season, etc.), arctic fens also play a role in carbon sequestration and climate regulation. Lastly, in a sparsely vegetated landscape, the wetlands, although mainly composed of herbaceous species and prostrate shrubs, contribute to the preservation of the natural character of this particular environment.

5.5.1.3 Special-status plant species

A request was made to the Centre de données sur le patrimoine naturel du Québec (CDPNQ) [Québec natural heritage data center] to verify the presence of any plant species that are threatened, vulnerable or likely to be so designated (PSTVL) in the study area (CDPNQ, 2017). An analysis of the habitat potential for PSTVL was also conducted using the *Les plantes vasculaires en situation précaire au Québec* guide (Tardif et al., 2016), volumes 1, 2 and 3 of *La Flore nordique du Québec et du Labrador* (Payette et al., 2013, 2015 and 2018) and the *Atlas des plantes des villages du Nunavik* (Blondeau, 2004).

According to data from the CDPNQ, there are no known occurrences of PSTVL in the limited study area. However, two historical occurrences of species likely to be designated as threatened or vulnerable are recorded in the vicinity of the village of Inukjuak, namely alpine hairgrass and short-leaved spear moss. The analysis of the habitat potential of vascular species also shows that the area may have habitat potential for 13 special status plant species. Table 5-9 lists these species along with a description of their preferred habitats.

Surveys were conducted in July 2020 to verify the presence of special-status plant species in the limited study area. No special-status species were observed.

Table 5-9: Special-Status Plant Species Potentially Present in the Extended Study Area

Common name	Latin name	Provincial status	Habitat [a]	Best observation period	Presence in limited study area	CDPNQ
Vascular plants						
Arctic mouse-ear chickweed	*Cerastium arcticum*	SLDTV [b]	Terrestrial environments (rocky outcrops/scarp, scree slopes/exposed boulder/gravel fields, arctic tundra), found in sunny locations only, on dry substrate, no pH affinity.	Summer	No	–
Regel's mouse-ear chickweed	*Cerastium regelii*	SLDTV	Palustrine (rocky/gravelly shores) and terrestrial (arctic tundra) environments, occurring in sunny locations only, on mesic substrate. On river alluvium, solifluous soils and moss carpets.	Summer	No	–
Alpine hairgrass	*Deschampsia alpina*	SLDTV	Palustrine (rocky/gravelly shores) and terrestrial (exposed scree slopes/boulder fields/gravels) environments, occurring in sunny places only, on mesic and basic substrate.	Summer	No	1 historic occurrence near the village
Cayouette's draba	*Draba cayouettei*	SLDTV	Palustrine (rocky/gravelly shores) and terrestrial (arctic tundra) environments, occurring in sunny locations only, on mesic substrate. This xerophilous and basiphilous woodland inhabits periglacial and exposed environments with little snow cover, hilltops dotted with tundra ostioles and polygons.	Summer	No	–

Table 5-9: Special-Status Plant Species Potentially Present in the Extended Study Area *(continued)*

Common name	Latin name	Provincial status	Habitat [a]	Best observation period	Presence in limited study area	CDPNQ
Vascular plants (continued)						
Flattop whitlowgrass	*Draba corymbosa*	SLDTV	Saltwater estuarine (rocky/gravelly shores) and terrestrial (exposed rocky outcrops/scarp, scree slopes/boulder/gravel fields, fine bare deposits (clay, silt)) environments, occurring in sunny locations only, on dry, basic substrate. The xerophilous, calcicole species is well adapted to rocky and stony, exposed summits with little snow cover.	Summer	No	–
Bluff cinquefoil	*Potentilla arenosa ssp. chamissonis*	SLDTV	Palustrine (rocky/gravelly shores) and terrestrial (exposed scree slopes/boulder fields/gravels) environments, occurring in sunny places only, on mesic and basic substrate. It is found in rock crevices and flats, rocky escarpments, slopes and ridges, and in open dry tundra covered with lichens and dwarf shrubs. It is occasionally observed in snow patches.	Summer	No	–
Tall alkali grass	*Puccinellia angustata*	SLDTV	Palustrine (bare muddy shores) and terrestrial (exposed scree slopes/boulder fields/gravels) environments, occurring in sunny places only, on mesic, basic or ultrabasic substrate.	Late summer	No	–
Sulphur yellow buttercup	*Ranunculus sulphureus*	SLDTV	Palustrine (rocky/gravelly shores, wet prairies) and terrestrial (arctic tundra) environments, occurring in sunny locations only, on mesic substrate. A calciphile species that generally colonizes moist soils in snow patches, stream banks and banks flooded by spring freshets.	Summer	No	–
Ross' stitchwort	*Sabulina rossii*	SLDTV	Terrestrial (arctic tundra, exposed scree slopes/boulder fields/gravels) environments, occurring in sunny places only, on mesic and basic substrate. Both known occurrences were in fens, snow patches and/or riverbanks.	Summer	No	–

Table 5-9: Special-Status Plant Species Potentially Present in the Extended Study Area *(continued)*

Common name	Latin name	Provincial status	Habitat [a]	Best observation period	Presence in limited study area	CDPNQ
Vascular plants (continued)						
Starry saxifrage	*Micranthes stellaris*	SLDTV	Terrestrial environments (rock outcrops/scarp, exposed scree slopes / boulder/gravel fields), occurring in sunny locations only, on dry, basic substrate. The starry saxifrage grows in scree slopes and rocky escarpments well supplied with water.	Summer	No	–
Pink-flowered asphodel	*Tofieldia coccinea*	SLDTV	Terrestrial (rocky outcrops / escarpments) environments, occurring in sunny places only, on mesic and basic substrate. The plant is generally found on dry and mesic grounds, of stony nature, and on rocky outcrops. Calcicole species.	Summer	No	–
Cutleaf daisy	*Erigeron compositus*	Vulnerable	Terrestrial (rocky outcrops/escarpments, exposed scree slopes/boulder fields/gravels) environments, occurring in sunny places only, on dry and basic substrate. Bank of sand, gravel, pebbles and boulders.	Summer	No	–
Non-vascular plants						
Short-leaved spear moss	*Pseudo-calliergon brevifolium*	SLDTV	Tundra, calcareous wetlands, fen edges and see page sites.	Summer	No	1 historic occurrence near the village

a. According to Tardif et al., (2016), Payette et al., (2013, 2015 and 2018) and Blondeau (2004).

b. SLDTV: Species likely to be designated threatened or vulnerable.

5.5.2 Wildlife

5.5.2.1 Mammals

Sixteen species of terrestrial mammals potentially frequent the extended study area (see Table 5-10). Of these, three have special status: least weasel, wolverine and polar bear. However, the Centre de données sur le patrimoine naturel du Québec (CDPNQ) makes no mention of these species in the extended study area (MFFP, 2020). Caribou are also a species of interest due to their importance to the Inuit and the decline of migratory caribou populations in Nord-du-Québec.

Table 5-10: Terrestrial Mammal Species Likely to Frequent the Extended Study Area

Common name	Latin name	Provincial status	Federal status
Least weasel	*Mustela nivalis*	SLDTV[a]	–
Muskox	*Ovibos moschatus*	–	–
Southern red-backed vole	*Myodes gapperi*	–	–
Meadow vole	*Microtus pennsylvanicus*	–	–
Northern bog lemming	*Synaptomys borealis*	–	–
Wolverine	*Gulo gulo*	SLDTV	At risk
Barren-ground caribou	*Rangifer tarandus*	–	See note[b]
Ermine	*Mustela erminea*	–	–
Ungava lemming	*Dicrostonyx hudsonius*	–	–
Arctic hare	*Lepus arcticus*	–	–
Gray wolf	*Canis lupus*	–	–
River otter	*Lontra canadensis*	–	–
Polar Bear	*Ursus maritimus*	SLDTV	At risk
Black bear	*Ursus americanus*	–	–
Arctic fox	*Vulpes lagopus*	–	–
Red fox	*Vulpes vulpes*	–	–

a. Species likely to be designated threatened or vulnerable.

b. The eastern migratory population is under consideration for addition to Schedule 1 of the *Species at Risk Act*.

According to Desrosiers et al. (2002), Feldhamer et al. (2003), Jutras et al. (2012) and Naughton (2012).

In addition, a family of Arctic foxes was observed during the bird inventory on the periphery of the limited study area. A den of this species was also observed along the access road to the future Innavik hydroelectric power plant, a few hundred metres from the limited study area. It should be noted that no bat species is likely to regularly frequent the extended study area, based on the ranges of this group of species recorded by Jutras et al. (2012).

Barren-ground caribou

Caribou found in the surroundings of the extended study area belong to the Rivière aux Feuilles herd. This herd currently has no legal protection status at the provincial level. Federally, the eastern migratory population to which it belongs was designated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2017 and is being reviewed for addition to Schedule 1 of the *Species at Risk Act*. Inventory data obtained in November 2018 indicate that the Rivière aux Feuilles herd's population is still in decline (MFFP, 2018).

Least weasel

The least weasel, a little-known predator, is a species likely to be designated threatened or vulnerable in Québec. There are few references to this weasel in Québec, and it is considered rare in Canada. This carnivore feeds primarily on micromammals (Feldhamer et al., 2003). The species determines its habitat based on the local distribution of its prey, changing location over time depending on the relative abundance of different micromammal species and their preferred habitats. Its presence is still possible in the extended study area and limited study area, based on micromammal-friendly habitats, but should be considered undetermined due to the lack of data on its regional distribution.

Wolverines and polar bears

A wolverine would be very rare or extinct in Québec (COSEWIC, 2014*a*). This species is designated threatened in Québec and of special concern in Canada. Polar bears are also designated as vulnerable in Québec and of special concern in Canada. Inuit hunters reported an increase in the number of bears in the management unit south of Baie d'Hudson, which includes the extended study area. They also mentioned that bears were rare around Inukjuak (COSEWIC, 2018). In addition, the use of the extended study area by polar bears remains occasional, based on discussions held with elders as part of the impact study for the Innavik hydroelectric development project (RSW, 2010). Considering the scope of their home ranges and movements, as well as their presumed very low numbers, the presence of wolverines and polar bears in the extended study area and limited study area would be infrequent and of very short duration, if any.

5.5.2.2 Birds

The Inukjuak region overlaps two 10-km by 10-km squares of the Québec Breeding Bird Atlas. Consultation of this data indicates that avifauna in the extended study area has been insufficiently inventoried in recent years. Since only a few hours of effort have been put into the breeding bird inventories for the period analyzed in the Atlas (2010–2014), the inventory is considered partial. The list of possible, probable or confirmed breeding species based on this source is presented in Table 5-11; there are only 12 species on the two squares (QBBA, 2020).

Table 5-11: Bird Species Likely to Nest in the Extended Study Area Based on Data from the Breeding Bird Atlas

Species		Breeding status	
Common name	**Latin name**	**Square 17PE68**	**Square 17PE69**
Golden eagle [a]	***Aquila chrysateos***	–	Possible
Horned lark	*Eremophila alpestris*	Possible	–
Canada goose	*Branta canadensis*	Confirmed	Confirmed
White-crowned sparrow	*Zonotrichia leucophrys*	Probable	–
Tundra swan	*Cygnus olor*	–	Probable
Peregrine falcon	***Falco peregrinus***	Possible	–
Common raven	*Corvus corax*	Possible	–
Snow goose	*Chen caerulescens*	Possible	
American pipit	*Anthus rubescens*	Confirmed	–
Snow bunting	*Plectrophenax nivalis*	Possible	–
Lapland longspur	*Calcarius lapponicus*	Possible	–
Common redpoll	*Acanthis flammea*	Possible	–

a. Bold characters indicate bird species having special status in Québec or Canada.

To provide a more representative picture of the local birds (see Table 5-12), historical data from the *Études des populations d'oiseaux du Québec* (ÉPOQ: Larivée, 2018) and the Québec bird population database from 1986 to 2006 (version 2018-04-09; Regroupement QuébecOiseaux, 2018), which lists 1,396 records for 73 species, were also consulted. This is the most comprehensive data for the region, although the most recent numbers date back to 2006. Reproductive potential in the extended study area was determined based on partial knowledge of northern avifauna in Québec (QBBA, 2020). This list of bird species observed includes both confirmed breeders (such as the Canada goose) and unusual visitors (such as Franklin's gull and the ivory gull). Historical records of special-status bird species are not shown on Map A (pocket insert) due to a lack of precision on the exact location. Considering the data from the Atlas and ÉPOQ, it is estimated that there are 74 bird species in the extended study area.

Table 5-12: Bird Species Likely to Nest in the Extended Study Area Based on Data from ÉPOQ

Species		Potential for local reproduction (yes, no or unknown)
Common name	**Latin name**	
Horned lark	*Eremophila alpestris*	Yes
Osprey	*Pandion haliaetus*	Unknown
White-rumped sandpiper	*Calidris fuscicollis*	Unknown
Pectoral sandpiper	*Calidris melanotos*	Yes
Baird's sandpiper	*Calidris bairdii*	Unknown
Least sandpiper	*Calidris minutilla*	Yes
Sanderling	*Calidris alba*	Unknown
Semipalmated sandpiper	*Calidris pusilla*	Yes
Dunlin	*Calidris alpina*	Yes
Wilson's snipe	*Gallinago delicata*	Yes
Canada goose	*Branta canadensis*	Yes
White-crowned sparrow	*Zonotrichia leucophrys*	Yes
White-throated sparrow	*Zonotrichia albicolis*	No
Savannah sparrow	*Passerculus sandwichensis*	Yes
American tree sparrow	*Spizelloides arborea*	Yes
Lapland longspur	*Calcarius lapponicus*	Yes
Snow bunting	*Plectrophenax nivalis*	Yes
Rough-legged hawk	*Buteo lagopus*	Yes
Mallard	*Anas platyrhynchos*	Unknown
American wigeon	*Mareca americana*	Unknown
American black duck	*Anas rubripes*	Yes
Northern pintail	*Anas acuta*	Yes
Spotted sandpiper	*Actitis macularius*	Yes
American crow	*Corvus brachyrhynchos*	Yes
Tundra swan	*Cygnus olor*	Yes
Common eider	*Somateria mollissima*	Yes
European starling	*Sturnus vulgaris*	Unknown
Gyrfalcon	*Falco rusticolus*	Yes
Peregrine falcon [a]	***Falco peregrinus***	Yes
Greater scaup	*Aythya marila*	Yes
Common goldeneye	*Bucephala clangula*	Unknown

Table 5-12: Bird Species Likely to Nest in the Extended Study Area Based on Data from ÉPOQ *(continued)*

Species		Potential for local reproduction (yes, no or unknown)
Common name	**Latin name**	
Barrow's goldeneye	***Bucephala islandica***	No
Iceland gull	*Larus glaucoides*	Yes
Herring gull	*Larus argentatus*	Yes
Glaucous gull	*Larus hyperboreus*	Yes
Great black-backed gull	*Larus marinus*	Yes
Greater yellowlegs	*Tringa melanoleuca*	Unknown
Common raven	*Corvus corax*	Yes
Common merganser	*Mergus merganser*	Unknown
Sandhill crane	*Antigone canadensis*	Unknown
Black guillemot	*Cepphus grylle*	Yes
Long-tailed duck	*Clangula hyemalis*	Yes
Snowy owl	*Bubo scandiacus*	Yes
Red-breasted merganser	*Mergus serrator*	Yes
Short-eared owl	***Asio flammeus***	Yes
Bank swallow	***Riparia riparia***	Unknown
Barn swallow	***Hirundo rustica***	No
Long-tailed jaeger	*Stercocarius longicaudus*	Yes
Pomarine jaeger	*Stercocarius pomarinus*	Unknown
Parasitic jaeger	*Stercocarius parasiticus*	Yes
Rock ptarmigan	*Lagopus muta*	Yes
Willow ptarmigan	*Lagopus mutus*	Yes
Surf scoter	*Melanitta perspicillata*	Unknown
White-winged scoter	*Melanitta deglandi*	Unknown
Black scoter	*Melanitta americana*	Yes
American robin	*Turdus migratorius*	Yes
Ivory gull	***Pagophila eburnea***	No
Franklin's gull	*Leucophaeus pipixcan*	No
Snow goose	*Chen caerulescens*	Unknown
Red-necked phalarope	***Phalaropus lobatus***	Yes
Red phalarope	Phalaropus fulicarius	Yes
American pipit	Anthus rubescens	Yes

Table 5-12: Bird Species Likely to Nest in the Extended Study Area Based on Data from ÉPOQ *(continued)*

Species		Potential for local reproduction (yes, no or unknown)
Common name	**Latin name**	
Red-throated loon	Gavia stellata	Yes
Pacific loon	Gavia pacifica	Yes
Common loon	Gavia immer	Yes
American golden-plover	Pluvialis dominica	Yes
Semipalmated plover	Charadrius semipalmatus	Yes
Green-winged teal	Anas crecca	Yes
Hoary redpoll	*Acanthis hornemanni*	Yes
Common redpoll	*Acanthis flammea*	Yes
Arctic tern	*Sterna paradisaea*	Yes
Ruddy turnstone	*Arenaria interpres*	Unknown
Northern wheatear	*Oenanthe oenanthe*	Yes

a. Bold characters indicate bird species having special status in Québec or Canada.

In addition to the database query, the eBird Québec portal (eBird, 2020) was consulted to verify whether occurrences of other species not included in the previous lists were reported in the vicinity of the extended study area. Recent mentions of the rusty blackbird (*Euphagus carolinus*) and greater white-fronted goose (*Anser flavirostris*) appear. Therefore, the total number of species is 76.

Special-status species potentially present in the extended study area

Golden eagle

The golden eagle is a vulnerable species in Québec under the *Act respecting threatened or vulnerable species* (CQLR, c. E-12.01). Known golden eagle nests in Québec are located primarily on the east coast of Baie d'Hudson (between the Grande rivière de la Baleine and the Rivière Nastapoka), in the coastal area of southern Baie d'Ungava and in the Côte-Nord region (Plan de rétablissement de l'aigle royal au Québec, 2005). Their nests are located on a cliff or escarpment and more rarely in a tree, although this species hunts in open areas.

Since this species was recently observed in Inukjuak during the breeding season (QBBA, 2020), its presence in the extended study area is likely. However, in the absence of imposing cliffs or trees, the potential for its presence in the limited study area should be considered low.

Peregrine falcon

The peregrine falcon is a species vulnerable in Québec and of special concern in Canada. To nest, it searches for escarpments, cliff ledges or tall structures near bodies of water and open areas (Équipe de rétablissement des oiseaux de proie du Québec, 2009). Cliffs 50 to 200 metres high would be preferred (ECCC, 2017).

Since this species was recently observed in Inukjuak during the breeding season (QBBA, 2020), its presence in the extended study area is likely. However, in the absence of cliffs in the limited study area, the potential for its presence should be considered low.

Barrow's goldeneye

Barrow's goldeneye, eastern population, is a species vulnerable in Québec and of special concern in Canada. According to an inventory conducted in Labrador and Québec's Côte-Nord region, the core of the breeding population is found south of the 52nd parallel north (Environment Canada, 2011), mainly north of the Golfe du Saint-Laurent (Gulf of St. Lawrence) and its estuary, in the boreal forest (MFFP, 2010). This species is also found in low numbers in the extreme southern part of Labrador. Adult males moult in the Arctic along the coasts of Baie d'Hudson, Baie d'Ungava, northern Labrador and southern Baffin Island (Environment Canada, 2011).

The only mention of a male in Inukjuak dates back to June 1987 (ÉPOQ) and should be linked to moult migration rather than breeding. Therefore, the potential for its presence in the limited study area should be considered non-existent during the breeding period.

Short-eared owl

The short-eared owl is a species likely to be designated vulnerable in Québec and of special concern in Canada. Its known breeding range covers almost the entire province, with the possible exception of the northern part of the Péninsule d'Ungava (Environment Canada, 2016). As such, the extended study area overlaps with the breeding range of this species. Its preferred nesting habitats are open areas such as wetlands, Arctic tundra, taiga, bogs, coastal wetlands, coastal heaths, natural grasslands dominated by sand sage *(Artemisia filifolia*), estuaries and marshes (MFFP, 2021; ECCC, 2018*a*).

There are some historical records of short-eared owls in Inukjuak according to the ÉPOQ database. The tundra habitat in the limited study area may meet the owl's ecological requirements. The potential for its presence should be considered average.

Bank swallow

The bank swallow is widespread in Québec and nests in large colonies in sand pits and along steep banks (COSEWIC, 2013). This species is considered threatened in Canada. Its habitats primarily include lake and coastal cliffs, banks of watercourses, gravel and sand pits, road cuts and sand piles.

Its range includes certain very localized sites in Nunavik and there are historical records of isolated individuals in Inukjuak dating back to 1988. Given the low probability of finding vertical sandy walls in tundra environments, the potential for its presence should be considered low.

Barn swallow

Barn swallows nest primarily in artificial structures (barns, bridges, etc.) and feed in a variety of open areas, including meadows and agricultural land (COSEWIC, 2011). This species is considered endangered at the federal level.

Its range during the breeding period is normally well south of the study area. However, as with the bank swallow, there are two historical records for Inukjuak dating back to 1988. The breeding of the barn swallow has never been confirmed at this latitude, and it is likely that records are limited to visitors. Therefore, the potential for its presence should be considered low.

Red-necked phalarope

The red-necked phalarope is a species of special concern in Canada. It breeds in the subarctic and Low Arctic wetlands near ponds, lakes or freshwater streams. The drying up of freshwater ponds and the expansion of shrubs and trees in these wetlands due to climate change are expected to have a significant impact on the quality and availability of habitat for this species (COSEWIC, 2014).

The red-necked phalarope is mentioned in the environmental impact study carried out for the Innavik hydroelectric project "as a bird species likely to nest in the study area, Inukjuak region" (Pituvik Landholding Corporation Inukjuak, 2010). This species is also historically reported in the ÉPOQ database for the area. Due to the presence of small tundra ponds, the probability of encountering this species in the limited study area may be considered moderate.

Rusty blackbird

The rusty blackbird is a species likely to be designated vulnerable by the Québec government and considered of special concern in Canada. During the breeding period, it is found in wetlands, such as bogs, low-flow streams, sedge meadows, marshes, beaver ponds, swamps, riparian scrubs, as well as alder and willow thickets

(Environment Canada, 2015; COSEWIC, 2017). Its presence in wetlands is generally associated with persistent and shallow ponds (Environment Canada, 2015). Breeding sites generally include small conifers, especially spruce, which it uses to nest. The Direction de la gestion de la faune du Nord-du-Québec mentions this species as possible in the extended study area (MFFP, 2020), and there is a recent record in Inukjuak (May 23, 2018) according to eBird.

The absence of bogs, muskegs and copses of conifers in the limited study area means the probability of encountering this species is low.

Bird surveys

Bird inventories were conducted on July 20 and 21, 2020, in the limited study area and the extended study area.

Methods

Due to the small surface area of the limited study area (see Map 5-2), breeding passerines were counted using three point counts, spaced at least 250 metres apart. The habitat for each point was briefly described, all located in the shrub tundra. Point counts were conducted using the fixed-radius point count (FPRC) method (Bibby et al., 1992) and the unlimited-distance point count (known as IPA) method (Blondel et al., 1981). The FRPC technique consists in counting all birds seen or heard within an imaginary 50-metre radius circle every 5 minutes over a 10-minute period. The IPA method was used in conjunction with the FRPC method. It differs from the FRPC in that it does not impose any distance limit between the birds counted, and it serves primarily to establish a species list rather than determine bird density. Each of the point counts was visited twice, at least six days apart. The FRPC began after a quiet period of about five minutes which allowed the birds to recover from the disturbance caused by the observers' movements. This inventory was conducted during the breeding period, taking into account the northern latitude. To determine the level of certainty of species nesting, breeding evidence from the Québec Breeding Bird Atlas was used (QBBA, 2020).

To expand the list of species observed, the presence of any other bird species, particularly special-status species, was also noted during movements in the limited and extended study areas.

Results

The various inventories conducted in the limited and extended study areas have identified 20 bird species, i.e., 8 confirmed breeders, 2 probable breeders, 9 possible breeders and 1 non-breeding species (see Table 5-13). One species, the pine siskin, was added to the list of species.

Table 5-13: Bird Species Observed and Breeding Status in the Limited and Extended Study Areas

Species	Field observations July 2020	
	Breeding code [a]	Breeding status
Horned lark (*Eremophila alpestris*)	AT	Confirmed
Least sandpiper (*Calidris minutilla*)	A	Probable
Wilson's snipe	H	Possible
Canada goose	JE	Confirmed
Least sandpiper	JE	Confirmed
American tree sparrow	A	Probable
White-crowned sparrow	AT	Confirmed
Rough-legged hawk	NO	Confirmed
Peregrine falcon [b]	H	Possible
Greater scaup	H	Possible
Herring gull	H	Possible
Glaucous gull	H	Possible
Great black-backed gull	H	Possible
Common raven	H	Possible
American pipit	AT	Confirmed
Lapland longspur	JE	Confirmed
Common loon	H	Possible
Semipalmated plover	JE	Confirmed
Common redpoll	S	Possible
Pine siskin	X	Non-breeder

a. Breeding code (according to the Québec Breeding Bird Atlas):

Species observed – X: Observation of the species during its breeding period, but not in suitable habitat.

Possible breeding – H: Species observed in suitable nesting habitat during its breeding season. **S**: Individual singing or producing other sounds associated with breeding (e.g., calls or drumming) in suitable nesting habitat during the species' breeding season.

Probable breeding – P: Pair observed in suitable habitat during the species' breeding season. **T**: Presumed territory based on the presence of an adult bird […] at the same place, in suitable nesting habitat, on at least two visits, one week or more apart, during the species' breeding season. **C**: Breeding behaviour involving a male and female (e.g., display, courtship feeding and copulation) or antagonistic behaviour between two individuals in suitable nesting habitat during the species' breeding season. **V:** Bird visiting a probable nest site in suitable nesting habitat during the species' breeding season. **A:** Agitated behaviour or alarm call of an adult in suitable nesting habitat during the species' breeding season.

Breeding confirmed – CN: Nest building, including the carrying of nesting material, by all species except wrens and woodpeckers. **DD**: Individual attempting to draw attention away from a nest or young by feigning injury or by using any other distraction display. **NU**: Empty nest used during the atlas survey period, or the shells of eggs laid during the same period. **JE**: Recently fledged (nidicolous species) or downy (nidifugous species) young incapable of sustained flight. **NO**: Adult occupying, leaving or entering a probable nest site (visible or not) and whose behaviour suggests the presence of an occupied nest. **FE**: Adult carrying a fecal sac. **AT**: Adult carrying food for young. **NF**: Nest containing one or more eggs. **NJ**: Nest with one or more young (seen or heard).

b. Bold characters indicate bird species having special status in Québec or Canada.

At the listening stations, the species-specific richness for 12 species was assessed based on the data collected, regardless of the distance (IPA). The number of nesting pairs observed at different stations within a 50-metre radius (FRPC) is presented in Table 5-14.

Table 5-14: Maximum Number of Nesting Pairs at Three Listening Stations in the Limited Study Area

Species	IN01	IN02	IN03
Savannah sparrow	1	1	1
White-crowned sparrow	1	–	1
Semipalmated plover	–	1	–
Lapland longspur	–	1	–
Horned lark	–	–	1

The number and diversity of species in the limited study area is low. The only species with special status observed in 2020 is the peregrine falcon (incidental observation made outside point counts). However, as this species breeds on cliffs, nesting probabilities in the limited study area are non-existent. Cliffs suitable for nesting of this species are present in the Inukjuak area, but several kilometres from the limited study area. As this is an observation of a transient bird and not a potential nesting site, this record has not been mapped. It should be noted that the presence of other aforementioned special-status species has not been confirmed in the limited study area or in the extended study area.

5.5.2.3 Reptiles and amphibians

A search of the Atlas des amphibiens et reptiles du Québec (AARQ) database did not generate any records of amphibians or reptiles in the study areas (AARQ, 2020). At northern latitudes, temperature is the most significant limiting factor for amphibians and reptiles (Bleakney, 1958).

Based on current knowledge, three anuran species may be found in the extended study area: wood frog (*Lithobates sylvaticus*), American toad (*Anaxyrus americanus*) and mink frog (*Lithobates septentrionalis*) (Fortin et al., 2016; AARQ, 2020). The wood frog is believed to be an amphibian whose northern range limit reaches the highest latitudes in Québec, slightly beyond the 58th parallel. The validated records all come from around Kuujjuaq (Fortin et al., 2016). The preferred habitat for these anurans is found in the extended study area, in wetlands, watercourses, lakes, ponds and puddles. The same is true in the limited study area, where marshes and swamps are potential breeding habitats for these species.

The extended study area is also well beyond the range of salamanders, snakes and turtles. The presence of Québec's most northerly salamanders and reptiles is recorded

near Chisasibi and Radisson, close to the 54th parallel (Rodrigue and Desroches, 2018). Therefore, it is highly unlikely for a species of salamander or reptile to be found in the extended study area.

Inventory of reptiles and amphibians

An inventory of anurans was completed on August 31 and September 1, 2020. For anuran inventories in northern environments, the end of summer, i.e., after the peak of tadpole metamorphosis, is a particularly suitable time. In addition to adults, there is a multitude of juveniles, which significantly increases the probability of identifying a particular anuran species, if it is present. Since the three above-mentioned species theoretically breed at different times, it would not have been possible to conduct a spring inventory of the breeding chorus covering all of them during a single field visit.

Two methods were used to carry out the anuran inventory. The first consisted in walking around bodies of water, a stream and wetlands in search of tadpoles, juveniles and adults of all three species. Along a stream, several exposed rocks were turned over in search of juveniles or adults. Active research on land was also conducted within a radius of approximately 300 metres of bodies of water, streams and wetlands, primarily in search of wood frogs and juvenile toads moving, even though adults of these species could also have been observed.

Five active research stations were selected (see Map 5-2), one in the limited study area (ponds in a fen) and four on the periphery of the area. Almost all wetlands within the limited study area were fully or nearly dried up at the time of the inventory, which limited to only one the number of sites with sufficient open water to justify specimen research. The air temperature was 15°C on August 31 and 14°C on September 1. The water temperature ranged from 10°C (stream) to 18°C (fen).

No amphibians were observed during this inventory or during the bird and wetland inventories. These results strongly suggest the absence of amphibians in the limited study area and in the periphery. Reptiles were not observed either, which was expected.

5.5.2.4 Summary of special-status wildlife species

Based on known distribution ranges (Desrosiers et al., 2002; Felhamer et al., 2003; Jutras et al., 2012; Naughton, 2012; AARQ, 2020; QBBA, 2020; MFFP, 2020), habitats considered suitable for species and habitat availability, 12 special-status wildlife species are likely to frequent habitats located in the limited study area (see Table 5-15). Information for each species is presented in Sections 5.5.2.1 and 5.5.2.2. The CDPNQ did not report any occurrence of wildlife species that are threatened, vulnerable or likely to be so designated in Québec within the limited study area (MFFP, 2020).

Table 5-15: Summary of Special-Status Wildlife Species Likely to Be in Habitats Located in the Extended Study Area and Probability of Occurrence in the Limited Study Area

Common Name	Status in Québec [a]	Status in Canada [b]	Probability of occurrence in the limited study area [c]
Mammals			
Least weasel	Species likely to be designated threatened or vulnerable	–	Undetermined [d]
Wolverine	Threatened	At risk	Low
Polar bear	Vulnerable	At risk	Low
Birds			
Golden eagle	Vulnerable	–	Low
Peregrine falcon	Vulnerable	At risk	Low
Barrow's goldeneye	Vulnerable	At risk	None
Bank swallow	–	Threatened	Low
Barn swallow	–	Threatened	Low
Short-eared owl	Species likely to be designated threatened or vulnerable	At risk	Moderate
Ivory gull	–	Endangered	Zero
Red-necked phalarope	–	At risk	Moderate
Rusty blackbird	Species likely to be designated threatened or vulnerable	At risk	Low

a. Designation under the *Act respecting threatened or vulnerable species*.

b. Designation under the *Species at Risk Act.*

c. Subjective assessment based on the species' known distribution range, reported observations around the study area, ecology of the species and the presence and abundance of potential habitats available in the study area.

High probability: the species' distribution range clearly overlaps the extended study area, potential habitats are present in the limited study area and the species is not particularly rare;

Moderate probability: the extended study area is located within the species' distribution range, potential habitats are present in the limited study area and the species is not particularly rare;

Low probability: very few potential habitats are present in the limited study area or the availability of potential habitats is unknown, but appear to be insufficient, or the surface area of the limited study area is particularly small in relation to the range of the species' movements, or the species is present in very low numbers in the project region;

Zero probability: no potential habitat is present in the limited study area.

d. The situation and ecology of this species in Québec remain too little known for a reasonable judgment to be made.

The list of special-status bird species potentially present in the study area was determined using data from the Québec Breeding Bird Atlas (QBBA, 2020), ÉPOQ (Larivée 2018) and eBird (2020). Although the CDPNQ made no mention of this in the extended study area, the Direction régionale du Nord-du-Québec states that five special-status bird species are likely to be found there. According to these various

sources, nine bird species have special status and have previously been in the extended study area (see Table 5-15). Although the peregrine falcon was observed flying over the limited study area in July 2020, its probability of occurrence does not change and remains low due to the absence of cliffs suitable for nesting in the project footprint. The falcon's use of the project footprint is marginal at best. Similarly, the probability of occurrence of the short-eared owl and red-necked phalarope remains moderate despite the lack of sightings of both of these species in 2020, due to the presence of potential nesting habitats.

5.5.2.5 Fish

The habitat potential for fish remains low in the portion of the watercourse located in the limited study area, either for rearing or feeding. Shelters are few in number and not very diversified (some overhanging grasses and a few boulders (see Table 5-16).

Table 5-16: Habitat Characteristics of Targeted Segments

Parameters	Segment 1 (downstream)	Segment 2 (central portion)	Segment 3 (upstream, mouth of stream)
Potential shelters for aquatic wildlife (quantity / type observed)	Boulders (few)	Overhanging vegetation (little), boulders (few)	None
Potential habitat for fish (quality / type observed)	Spawning (nil), rearing (low) and feeding (low)	Spawning (nil), rearing (low) and feeding (low)	Spawning (nil), rearing (nil) and feeding (low)
Fish habitat comment	Watercourses that do not appear to be connected to a body of water or other major watercourse.	Watercourses that do not appear to be connected to a body of water or other major watercourse.	Watercourses that do not appear to be connected to a body of water or other major watercourse.
Issue	Diffuse in the fen	Diffuse in the fen	Diffuse in the fen
Shade around noon (%)	0	0	0

As discussed in Section 5.5.1.2, only one (perennial) watercourse is found in the limited study area. It looks more like a large wetland in which a few small channels form on occasion. The channel in it is not continuous in its upstream portion and diffuses into the grasses of the fen, but it increasingly takes shape downstream. Although some cobbles, pebbles and gravel have been observed in certain sections where the channel is well defined, the substrate is mostly organic. Shelters are few in number and not very diversified. Based on these characteristics, the habitat potential for fish in this watercourse is low in terms of fish rearing and feeding and considered nil for spawning due to the lack of adequate substrate.

5.5.2.6 Habitats and wildlife sites of interest or regulated

No mapped wildlife habitat, within the meaning of the *Regulation respecting wildlife* (CQRL, c. C-61.1, r.18), overlaps the extended study area (MFFP, 2015). However, while not mapped in this area, aquatic environments frequented by fish constitute habitat under this regulation.

The MFFP did not report any wildlife sites of interest (MFFP, 2020) within or near the extended study area.

5.6 Human Environment

5.6.1 Administrative framework and land tenure

5.6.1.1 Land organization

The extended study area is located in the Nord-du-Québec administrative region (10) and is part of Nunavik, a sociocultural region which covers the territory north of the 55th parallel. Nunavik is composed of 14 northern villages (Inuit), some Inuit owned lands, and two unorganized territories with no inhabitants. In the territory of Québec north of the 55th parallel, there are also the Whapmagoostui Cree lands and the Naskapi village of Kawawachikamach. The extended study area largely encompasses the northern (Inuit) village of Inukjuak and a small sector of Inuit Owned Lands at its southeastern end (see Map A, pocket insert). There is no road link between Nunavik and southern Québec; this territory is accessible only by plane or boat.

The *James Bay and Northern Québec Agreement* (JBNQA) and the *Act respecting the land regime in the James Bay and New Québec territories* divided the territory of Nunavik into three categories:

- Category I: lands whose ownership was transferred to Inuit landholding corporations of each of the northern villages for Inuit community purposes and can be used for commercial, industrial, residential or other purposes;
- Category II: provincial lands on which the Inuit have certain rights, including certain exclusive hunting, fishing and trapping rights;
- Category III: public provincial lands available for the use of all in accordance with provincial laws and regulations governing public lands, subject to the rights, conditions and restrictions established by the JBNQA, which the Inuit have exclusive harvesting rights for certain aquatic species and fur-bearing animals.

An Act Respecting Northern Villages and the Kativik Regional Government establishes the jurisdiction of each of the northern villages (Inuit) on its territory and of the Kativik Regional Government (KRG), a supramunicial organization. The KRG exercises its jurisdiction in a range of areas of public administration and promoting

designated Kativik land, meaning all of the territory of Québec north of the 55th parallel, with the exception of the Cree lands of Whapmagoostui.

The extended study area overlaps mostly Category I lands (northern villages and lands reserved for Inuit communities), with the exception of a strip of land along the coast of Baie d'Hudson and the mouth of the Rivière Innuksuac, which are Category II lands. The portion of Baie d'Hudson included in the extended study area falls within Category III lands (see Map A, pocket insert).

5.6.1.2 Administrative framework

Nunavik's current administrative structure stems mainly from the JBNQA and the *Act respecting Northern villages and the Kativik Regional Government*. This act provides for the creation of the KRG, a regional entity, in addition to conditions for constitution of a municipality whose status is that of a northern village (KRG, 2019). The organizations created for Inuit beneficiaries of the JBNQA are the Makivik Corporation and landholding corporations. Other administrative organizations for Nunavik were established under the JBNQA and complementary agreements, including the Kativik School Board (now Kativik Ilisarniliriniq) and the Nunavik Regional Board of Health and Social Services (NRBHSS).

Among others, the KRG's mandate is to provide public services to the people of Nunavik in several areas, including economic development, public security and civil protection, sports and recreation, and airport management. KRG is also responsible for providing technical assistance to the 14 northern villages, particularly in the following areas: legal affairs, municipal management and accounting, engineering and public transit (KRG, 2019). The administrative offices of the KRG are located in Kuujjuaq.

The Makivik Corporation fulfills a number of mandates, including the protection of the rights and interests of the Inuit, in addition to administration of the financial compensation provided under the JBNQA. It is also a major partner in the development of Nunavik (Makivik Corporation, 2019*a*).

The *Act respecting the land regime in the James Bay and New Québec territories* created landholding corporations to hold in full ownership the Category I lands of Nunavik. This act also provides for a certain role for the landholding corporations in the development plan for Category II lands. Since 2002, the Nunavik Landholding Corporation Association (NLCHA) has represented all landholding corporations for the 14 northern villages. The Pituvik Landholding Corporation of Inukjuaq owns close to 558 km^2 of Category I lands and holds certain rights and responsibilities over more than 7,880 km^2 of Category II lands (NLHCA, 2020).

Lastly, local administration is provided by the municipal council of each northern village, which is the mandatary body for management of certain services and municipal and community administration. Municipal services in Inukjuak include public safety, public health and hygiene, town planning and land development, public services (water supply, lighting, heating, municipal roads, traffic and transportation), recreation and culture. The council is composed of a mayor and councillors, elected or appointed. The mayor is head of the council and chief executive of the municipal administration.

5.6.1.3 Land designation and use

Land use in the extended study area was determined based on the Inukjuak land use and zoning plan (KRG, 2016), complemented by photointerpretation using orthophotographs at 50 cm resolution taken in 2019. The land use and zoning plan subdivides the urban environment of Inukjuak into various categories: residential, public and institutional, commercial and services, industrial, special-use areas, airport and communications activities, landing stage and beach, conservation and future development area. Table 5-17 shows the land use categories, along with their respective areas and their proportions in relation to the extended study area. The various land use categories are shown on Map A (pocket insert). The extended study area is dominated by the biophysical environment, which occupies 2,816 ha, or 92.9% of the total area. It is primarily made up of shrub tundra (43.7%, 1,326 ha) and wetlands (16.1%, 489 ha). Dry barren zones occupy 23.0% (696 ha) of the extended study area, and water bodies cover 10.1% of it (305 ha).

The anthropized environment occupies 7.1% (217 ha) of the extended study area. It is dominated by the built environment (3%) which includes residential, institutional and commercial sectors. The industrial environment and mining sites occupy 0.7% (21 ha) and 0.5% (14 ha) of the extended study area, respectively. The public services and infrastructure category, which includes the airport zone, the northern landfill and wastewater treatment lagoons, represents 1.7% (53 ha) of the extended study area. The multi-use banks are areas along the Rivière Innuksuac and Baie d'Hudson near the village, representing 0.4% (11 ha) of the extended study area. Lastly, 0.8% (26 ha) of the total area is occupied by other disturbed environments of unspecified use.

Table 5-17: Distribution of Land Use Categories in the Extended Study Area

Category	Area (ha)	Proportion (%)
Biophysical environment	***2,816***	***92.9***
• Shrub tundra	1,326	43.7
• Wetland	489	16.1
• Dry barrens	696	23.0
• Lake or river	305	10.1
Anthropized environment	***217***	***7.1***
• Built environment (residential. institutional and commercial)	92	3.0
• Industrial environment	21	0.7
• Mining sites	14	0.5
• Public services and infrastructure	53	1.7
• Multi-use banks	11	0.4
• Other disturbed environments	25	0.8
Total	**3,032**	**100.0**

5.6.1.4 Development projects

The Inukjuak community's zoning plan identifies four potential residential development areas, shown on Map A (pocket insert).

The eastern-most area on the left bank of the Rivière Innuksuac is reserved for potential long-term development.

5.6.1.5 Land use by the Inuit

Due to the public health situation (COVID-19), a specific method had to be designed to document the use of the territory by the Inukjuak community. To this end, with the agreement of the local authorities, Hydro-Québec mailed a short questionnaire to collect the Inukjuak residents' concerns about the project. As the questionnaire was self-administered and not targeted, it was comprised of a few, simple questions. It was accompanied by a map of the study area, on which the respondents could make note of their activities, in addition to writing answers in a space reserved for each question. As the questionnaire was anonymous, addressed to all the inhabitants of the house and included no personal questions, no consent form was required. The objective was to validate the information already obtained by a member of a local institution (through email exchanges) and to establish a general portrait of the current occupancy and use of the study area.

The questionnaires were sent by Hydro-Québec personnel and distributed to the post office boxes of the community residents (one questionnaire per household). They were delivered with documents describing the project (see Section 3.3).

To complement this documentation and answer any questions, a radio show was broadcast in Inukjuak on November 9, 2020. A Hydro-Québec staff member born and living in Kuujjuaq attended. Inukjuak residents phoned in to the show with a few concerns. Those related to land use primarily involved the location of the planned generating station (too close to the airport and the river).

It bears noting that none of the Inukjuak residents responded to the questionnaire.

The information received to date through email exchanges with local authorities indicates that the extended study area is rarely used due to its extreme proximity to the village and the airport. When it is used, the identified activities are berry picking and fishing in nearby lakes. There is also a game processing site. Snowmobile and ATV trails cross this area. As is the case in most Inuit villages, traffic using this type of motorized vehicle is random, but some routes are used more than others. The trail next to the work area is used by ATVs from spring to fall to access the territory.

5.6.2 Public services and infrastructure

5.6.2.1 Transportation

The extended study area includes an airport, located between the target construction site for the new backup facility and the Rivière Innuksuac (see Map A, pocket insert).

The Inukjuak community is served by a local network of paved roads for driving only within the community. The road network does not connect with any other communities. A few unpaved roads can be used to access sites outside the village (mining sites, landfill site, site of future Innavik generating station).

The extended study area also includes marine infrastructures in Baie Akilliviniit, including a dock and two breakwaters, which provide safety for the marine operations of fishing boats and supply boats. Another breakwater and a boat ramp are located near the Qallunaaq mouth of the Rivière Innuksuac (see Map A, pocket insert).

5.6.2.2 Electrical energy

Inukjuak's existing thermal generating station is located in the center of the urban area. An oil pipeline carries fuel from the village supply boat to the tank farm next to the generating station (see Map A, pocket insert). The Innavik project will build a run-of-river hydroelectric generating station with an installed capacity of 7.5 MW, located 10.3 km from the mouth of the Rivière Innuksuac. The construction of the generating station began in late summer 2019 and it is expected to be commissioned in December 2022. The purpose of this project is to switch the community from the use of diesel and fuel oil to a renewable energy source.

The site of the Innavik project is outside the extended study area.

5.6.2.3 Telecommunications

There are nine telecommunications towers in the extended study area, seven inside the village and two near the Inukjuak airport (see Map A, pocket insert).

5.6.2.4 Drinking water and sewage

Inukjuak's water intake is in the Rivière Innuksuac. The extended study area straddles part of the watershed for this water intake (see Map A, pocket insert). The water is pumped to the drinking water production facility located in the village. As most Nunavik communities are built on permafrost or rock outcrops, they have no water supply or sewage system, as it is impossible to build underground conduits. Once the water is disinfected, it is pumped into tanker trucks to be distributed to all the buildings in the Inukjuak community, which is equipped with a drinking water reservoir and another reservoir for wastewater. When the wastewater reservoirs are full, they are also emptied by tanker truck (N360, 2019). The wastewater is sent to two water treatment lagoons located northwest of the village (see Map A, pocket insert).

5.6.2.5 Waste management

The KRG is responsible for implementing the waste management plan for Nunavik. It is also in charge of infrastructure improvements for northern landfill sites and wastewater treatment lagoons across the entire territory of Nunavik. Every Nunavik community has to manage the operations of its own northern landfill, however, as well as waste collection. Household and commercial waste is collected weekly, and all the waste materials are combined and deposited in the community's landfill. Inukjuak's landfill site is to the northwest of the village, near the wastewater treatment lagoons (see Map A, pocket insert). Household waste stored at the landfill is burnt in the open air and then roughly compacted by machine. Covering materials may be included, depending on their local presence and the time of year (KRG, undated).

Less than 5% of waste materials are recovered or reused in Nunavik. The distance from major centers, the lack of roads connecting the communities in Nunavik and the high cost of marine freight transportation constitute major logistical constraints for recycling, as does the lack of human resources working on recycling projects. There are, however, programs to recover tires, industrial batteries and vehicle batteries, for shipment by boat (KRG, undated).

5.6.2.6 Quarries and gravel pits

The extended study area includes three quarries and gravel pits located near the wastewater treatment lagoons, south of the airport and north of the village. There is also an active surface mineral extraction claim for the area southwest of the wastewater treatment lagoons (see Map A, pocket insert).

5.6.2.7 Public safety

In Nunavik, police services are provided by the Kativik Regional Police Force (KRPF). The KRPF has a police station in each village, and the number of officers working in the stations depends on the size of the population. In addition to a police station, Inukjuak has a fire service with a fire station and a vehicle for ambulance services.

5.6.2.8 Cultural and religious heritage

The headquarters of the Avataq Cultural Institute is in Inukjuak. This organization protects and promotes the Inuit culture and language of Nunavik for the benefit of future generations (Avataq Cultural Institute, 2020*a*).

There are two places of worship in the urbanized part of Inukjuak. There are also two cemeteries, one on the left bank of the Rivière Innuksuac and one north of the urbanized area.

5.6.2.9 Recreational activities

The recreational infrastructures in Inukjuak include an arena, golf courses, a community center and playgrounds. The village also has three picnic areas north of the village and two swimming areas along the Rivière Innuksuac. Across from Innalik School, the Daniel Weetaluktuk Museum houses a collection of Inuit arts and crafts and traditional hunting and fishing equipment (Makivik Corporation, 2019*b*).

5.6.2.10 Tourism

Inuit Adventures offers tourism packages in Nunavik, including a tour of the Nuvvuagittuq Greenstone Belt in the Inukjuak region. This tour allows participants to explore and study the unique geological treasure of the oldest surviving rock formation on earth (Inuit Adventures, 2018).

Pituvik Landholding Corporation also operates an outfitting operation in Inukjuak that offers a high potential for ecotourism, as well as hunting and fishing activities. It also offers tours of nearby archeological and historical sites.

5.6.3 Socioeconomic profile

Population

According to Statistics Canada, Inukjuak had a population of 1,757 inhabitants in 2016, 51% men and 49% women (see Table 5-18; 2017*a*; 2017*b*). From 2011 to 2016, the population increased by 10%, similar to the overall population of Nunavik for the same period (9.1%) but higher than Québec as a whole (3.3%). Inukjuak is one of four Nunavik communities with over 1,000 inhabitants, the others being Kuujjuaq, Puvirnituq and Salluit (KRG, undated).

The average age of the Inukjuak population (25.8 years) is almost the same as that of Nunavik as a whole (32.0 years) but lower than that of the province (41.9 years; see Table 5-18). It is similar for the women (25.9 years) and the men (25.7 years) of this community. Inukjuak has a higher proportion of people under the age of 15 (37.0%) and a lower proportion of people 65 and over (about 3.7%) than Québec as a whole (16.3% and 18.3%, respectively). Men are slightly more numerous in the 0- to 14-year category, and the proportion of women is slightly higher in the 65-and-over category. The distribution of the population of Nunavik based on age is the same as that of the community of Inukjuak (Statistics Canada, 2017*a*; 2017*b*).

Table 5-18: Sociodemographic Data of Inukjuak Compared to that of Nunavik and Québec

Parameter	Inukjuak			Nunavik	All of Québec
	Men	Women	Total		
Population in 2016	895	860	1,755	13,188	8,164,361
Population in 2011	–	–	1,597	12,090	7,903,001
Change in population from 2011 to 2016 (%)	–	–	10.0	9.1	3.3
% of population aged 0 to 14	37.6	36.4	36.8	33.5	16.3
% of population aged 15 to 64	60.2	60.5	60.2	62.8	65.4
% of population aged 65 or over	2.3	3.1	2.7	3.9	18.3
Average age	25.1	26.0	25.6	26.8	41.9

Source: Statistic Canada, 2017*a*; 2017*b*.

5.6.3.1 Households and housing

The average size of a household in Inukjuak in 2016 was 4.0 people. This average is basically equivalent to that of Nunavik, at 3.6 people, but higher than that of Québec as a whole, which was 2.3 people per private household in 2016. The percentage of single-parent families was higher in Inukjuak and in all of Nunavik—44.2% and 38.0% of the total number of families—than in Québec as a whole (16.8%). Over 70% of single-parent families counted in Inukjuak were headed by women. In all of

Québec, that percentage was 16.8%. The majority of Inuit in Nunavik rent their homes, at a rate of 97.8%, compared to 100% in Inukjuak (Statistics Canada, 2017*a*, 2017*b*). Table 5-19 presents the available data on households and housing for Inukjuak, Nunavik and Québec as a whole.

Table 5-19: Characteristics of Private Households and Housing in Inukjuak Compared to Nunavik and Québec

Parameter	Inukjuak	Nunavik	All of Québec
Total number of people in private households	1,760	13,115	7,965,455
Total number of private households	440	3,630	3,531,665
Average number of people in private households	4.0	3.6	2.3
Single-parent families (%)	44.2	38.0	16.8
Total number of private dwellings	440	3,625	3,531,660
Rented dwellings (%)	100.0	97.8	38.7

Source: Statistic Canada, 2017*a*; 2017*b*.

5.6.3.2 Demographic projections

According to the Institut de la statistique du Québec (ISQ), the population of the KRG (considered by the ISQ to be a regional county municipality (MRC)) will increase from 13,300 inhabitants in 2016 to 16,700 in 2041, an increase of 25.5%. This MRC is one of those that will see the biggest increase in population by 2041. While Québec will be subject to an overall ageing of its population in the next 25 years, KRG territory will have one of the lowest proportions of people aged 65 or over, at 8.6% compared to 26.3% for Québec as a whole. In 2041, the proportion of the population aged 0 to 19 is projected to be 36.8% for the KRG, and 19.5% for Québec. According to the ISQ's demographic projections, in 2041, the KRG will have the lowest average age of all MRCs in Québec—31.4 years—compared to 45.7 years for all Quebecers (ISQ, 2019).

5.6.3.3 Education and training

Kativik Ilisarniliriniq (formerly the Kativik School Board) is the school board that manages educational services in Nunavik. In Inukjuak, Innalik School offers primary and secondary education to over 500 students. An early childhood center (CPE) and a childcare service are also located in the school. Inukjuak also has an adult and vocational training center, the Nunavimmi Pigiursavik Vocational and Technical Training Centre, which offers a variety of vocational programs leading to a diploma of vocational studies or an attestation of vocational specialization, including carpentry/joinery, professional cooking, northern building maintenance, construction equipment maintenance, recreational leadership and IT support (Kativik Ilisarniliriniq, 2020). Lastly, there are two daycares in Inukjuak, one in the northern

neighbourhood of the village (Natturak Daycare Centre) and one in the southern neighbourhood (Tasiurvik Daycare Centre), as well as a youth center across from the police station (see Map A, pocket insert).

In terms level of education, Inukjuak and Nunavik have similar percentages of people with no certificate, diploma or degree (54.3% and 58.3%, respectively); this proportion is 19.2% for the province of Québec (see Table 5-20). This percentage is slightly lower for women in this community (52.3%) than for men (55.7%).

The percentage of the population with a high school diploma or equivalency certificate is fairly similar for Inukjuak (20.8%), Nunavik (15.6%) and Québec (22.3%). While 58.5% of the population of Québec holds a postsecondary certificate, diploma or degree, that percentage is 24.9% for Inukjuak and 26.1% for Nunavik (Statistics Canada, 2017*a*; 2017*b*). In Inukjuak, the percentage of men with an apprenticeship, trade, college, CEGEP or other non-university certificate or diploma is higher, and the percentage of women with a university certificate or diploma is higher (see Table 5-20).

Table 5-20: Level of Education (Population Aged 15 and Up) in Inukjuak, Compared to Nunavik and Québec (%)

Highest level of education achieved	Inukjuak			Nunavik	All of Québec
	Men	Women	Total		
No certificate, diploma or degree	55.7	52.3	54.3	58.3	19.2
High school diploma or equivalency certificate	20.3	21.1	20.8	15.6	22.3
Postsecondary certificate, diploma or degree	24.9	25.7	24.9	26.1	58.5
Apprenticeship or trades certificate or diploma [a]	82.1	53.6	69.1	47.7	22.3
College, CEGEP or other non-university certificate or diploma [a]	7.1	25.0	18.2	21.8	19.5
University certificate or diploma below bachelor level [a]	0	10.7	5.4	6.2	6.1
University certificate, diploma or degree at bachelor level or above [a]	0	7.1	5.4	24.2	35.1

a. Data from "Postsecondary certificate, diploma or degree" category.

Source: Statistics Canada, 2017*a*; 2017*b*.

5.6.3.4 Economy and employment

The Statistics Canada data (2017*a*; 2017*b*) presented in Table 5-21 show that the labor market participation in Inukjuak is similar to that in all of Québec, at 62.4% and 64.1% respectively, but lower than that in Nunavik, at 70.9%. At 48.4%, Inukjuak's employment rate is lower than that of Nunavik as a whole (60.1%) and Québec (59.5%), which are similar. The unemployment rate is clearly higher in Inukjuak (22.5%) and Nunavik (15.4%) than in Québec as a whole (7.2%). The employment rate is higher for women than for men in Inukjuak (48.6% to 46.9%), while labor market participation is slightly higher for men than for women in this community (62.8% to 61.5%). Men have an unemployment rate of 25.4%, compared to 19.4% for

women. The women in Inukjuak have a higher average annual income ($39,272) than men ($31,052). Nunavik has the highest total average annual household income, at $93,444. This figure is $86,052 in Inukjuak and $77,306 for Québec as a whole.

Table 5-21: Labor Market Participation Rate, Employment Rate, Unemployment Rate and Average Annual Income in Inukjuak in 2015, Compared to Nunavik and Québec

Parameter	Inukjuak			Nunavik	All of Québec
	Men	Women	Total		
Participation rate (%)	62.8	61.5	62.4	70.9	64.1
Employment rate (%)	46.9	48.6	48.4	60.1	59.5
Unemployment rate (%)	25.4	19.4	22.5	15.4	7.2
Total average annual income for population aged 15 and up ($)	31,052	39,272	35,108	–	–
Total average annual household income ($)	–	–	86 052	93 444	77 306

Source: Statistics Canada, 2017*a*; 2017*b*.

The local economy in Nunavik is characterized by a high cost of living and doing business, lower consumer purchasing power and a low level of education in the active population. For the last few years, the Nunavik economy has been heavily influenced by the mining sector, which has been the biggest employer since 2011. The public administration sector also plays an important role in the regional economy (Makivik Corporation et al., 2014).

In Nunavik, the primary sector relies mainly on mining exploration and operations. In 2010 and 2011, it represented 21.6% of all economic activities, but it was only 2.0% for Québec as a whole (Robichaud and Duhaime, 2015). Hunting, fishing and trapping activities are rarely carried out for the purpose of trade, but it is difficult to evaluate the proportion of the Nunavik economy they currently comprise and how many Inuit take part in them regularly or part time (Makivik Corporation et al., 2014).

The secondary sector is far less important in Nunavik than in the rest of Québec. In 2010 and 2011, it represented 3.7% of the Nunavik economy, compared to 18.7% for Québec as a whole. Construction is the main area of activity, and the manufacturing industry is barely present (Duhaime et al., 2015).

The tertiary sector represented 74.7% of all economic activity in Nunavik in 2010 and 2011, similar to the percentage in Québec as a whole (Duhaime et al., 2015). The role played by public administration is crucial to the regional economic vitality of Nunavik. Funds channelled by the public administration to the purchase of goods and services, to investment and to transfer payments to individuals fuel this economy, in sums far higher than the personal expenditures of the inhabitants of the region (Duhaime & Robichaud, 2007).

In Nunavik's 14 villages, there are cooperatives that are members of the Fédération des coopératives du Nouveau-Québec (FCNQ). In addition to serving as grocery stores and general stores, they offer other services such as banking, post office and hotel management (FCNQ, 2018). In some villages, stores from the Northern/North Mart chain also offer food products, clothing and other general merchandise (Northern/North Mart, 2020). These two businesses are important employers in the villages.

In Inukjuak, more specifically, jobs are primarily in the fields of teaching, health and social services and public administration (Statistics Canada, 2017*a*). The Inukjuak cooperative is active in the following sectors: retail sales, distribution of petroleum products, hotel services, cable broadcasting and adventure tourism (FCNQ, 2018).

5.6.3.5 Health and social services

In Nunavik, the health and social service network is comprised of the Nunavik Regional Board of Health and Social Services (NRBHSS) and two institutions, the Inuulitsivik Health Centre and the Ungava Tulattavik Health Centre. The NRBHSS is responsible for overseeing the health and social service programs in Nunavik's 14 villages, and the health centers offer social services at the local community service center (CLSC), the child- and youth-protection center (CPEJ), the acute-care hospital center (CH), the residential and long-term care center (CHSLD) and the rehabilitation center for youth with adjustment difficulties (CRJDA). The Inuulitsivik Health Centre, in Puvirnituq, is responsible for the villages along the coast of Baie d'Hudson (including Inukjuak), and the Ungava Tulattavik Health Centre, in Kuujjuaq, is responsible for the villages along the coast of Baie d'Ungava (NRBHSS, 2020).

The health care institutions in Inukjuak include a CRJDA, for girls aged 12 to 18, and a community dispensary, which offers the services of a CLSC and a CPEJ. The Inukjuak dispensary has a doctor, nursing staff and a dentist. The Anaraaluk Reintegration Centre offers lodging and services to residents with chronic mental health problems (see Map A, pocket insert). These institutions report to the Inuulitsivik Health Centre (Inuulitsivik Health Centre, 2019; NRBHSS, 2020).

5.6.4 Cultural context

Inuit culture is rooted in a semi-nomadic past of hunters, fishers and gatherers. It was only beginning in the 1950s that the modern world upset this way of life. Prior to that, the Inuit lived in small camps with their extended families. Although the location of these camps changed with the seasons, they were within a hunting territory, and life was governed by the availability and movement of wildlife resources. Over time, the Inuit developed the skills and knowledge required to exploit the resources in their territory, which was shaped by a very harsh polar climate. The seasonal rhythms of life for the Inuit, unfolding in this unpredictable environment, allowed them to

develop flexible adaptation strategies for unforeseeable situations (Stilwell, 2012, in SNC-Lavalin, 2015).

Despite a now-sedentary lifestyle, the relationship with the land and with open spaces is still at the heart of Inuit culture. The values, social organization, traditions, skills and knowledge that define Inuit culture have been deeply influenced by the geography and the northern climate (Association Inuksuk, 2020; Qumaq, 2010).

Community and family life today differs greatly from life in the past. The Inuit have had to adapt to many social changes, most of which were imposed on them by neocolonial government policies of sedentation. These changes included the introduction of new religions, the imposition of education, justice and health systems, federal residential schools, the displacement of Inuit families into villages, the arrival of new diseases, the slaughter of sled dogs and more. Furthermore, with the establishment of villages, the Inuit had to adapt to new legal and decision-making organizational structures (Labrèche, 2012).

Despite sedentation—which led to a profound change in the Inuit way of life—mutual aid, sharing and solidarity still form the core of Inuit values. Harvesting and sharing traditional foods remain an intrinsic part of societal organization for the Inuit (Roche ltée, 1992, in SNC-Lavalin, 2015).

5.6.5 Quality of life

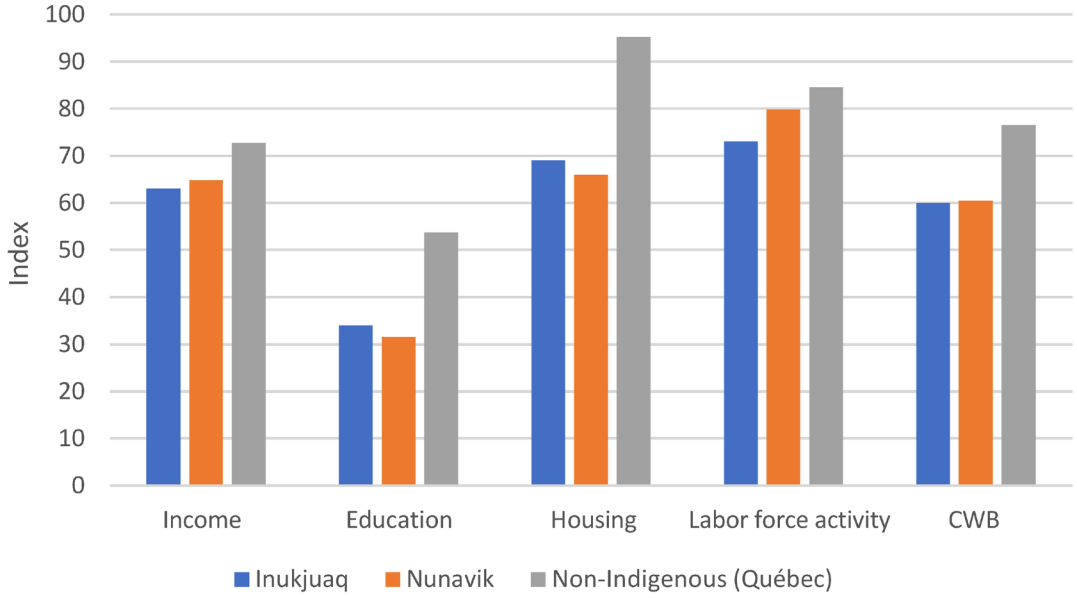
Social determinants of health are a set of social and economic factors that influence people's health and their living and working conditions (Canadian Public Health Association, 2020). An analysis of the social determinants of health for the Inuit people demonstrates that health and quality of life are independent concepts. Life balance, life control, education, material resources, social resources and environmental/cultural connections are some of the key determinants of health (Canadian Polar Commission, 2014). For the Inuit, health and well-being are tied to cultural values. This means that their attachment to the land and its use are two of the main factors that contribute to their overall health (SNC-Lavalin, 2015).

The Inuit of Nunavik are grappling with many social problems, including food insecurity, which affects a significant number of households, and seniors in particular. According to the Parnasimautik Consultation Report (Makivik Corporation et al., 2014), 44% of annual income is dedicated to food. Furthermore, living in a remote and isolated area leads to additional transportation costs for most goods, which, in turn, leads to a higher cost of living in Nunavik than in the rest of Québec (Duhaime, 2008). Daily household items are 97% more expensive than in southern Québec. This has even more serious consequences for certain groups, such as children and pregnant women (Makivik Corporation et al., 2014).

Many Inuit families are also affected by a lack of housing, which leads to the phenomenon of overcrowding. Due to prohibitive construction costs and climate constraints, the real estate market has been unable to meet the growing housing needs of Inuit families (Dutil, 2010), which has a major effect on the quality of life of the Inuit. Overcrowding and lack of privacy are closely tied to social and health problems in families living in these conditions. For example, tuberculosis is 25 times more prevalent in Nunavik than elsewhere in Québec, and the lack of space and personal privacy is desperate. This issue is often cited as a factor that increases social tension and violence, undermines mental health and affects school performance and retention (Makivik Corporation et al., 2014; Duhaime, 2009).

This reality is reflected in the Community Well-Being (CWB) index for 2016. The CWB index has four components—education, labor force activity, income and housing—and the index score ranges from 0 to 100.[1] It is calculated using census data collected by Statistics Canada. Figure 5-3 shows the CWB scores for Inukjuak, Nunavik and non-Indigenous communities. The graph shows significant differences, especially in terms of education and housing, when the data are compared with those of Quebec's non-Indigenous population.

Figure 5-3: Community Well-Being Index for Inukjuak, Nunavik and Non-Indigenous Communities in Québec in 2020



Source: Indigenous Services Canada, 2020.

1. Education is made up of two variables: high school education or more and university studies. The "labor force activity" component includes two equally weighted variables: job market participation and employment. The "income" component is defined based on total income per inhabitant. Lastly, housing includes quantity and quality scores (dwelling requiring major repairs) (Indigenous Services Canada, 2020).

The Inuit are also facing high rates of violence (physical and sexual violence and property crimes), as well as a significant increase in crime in the communities over the past several years. The main reported crime is conjugal and family violence, strongly correlated with drug and alcohol consumption problems. In this regard, 80% of criminal incidents reported in Nunavik appear to be related to consumption problems (Anctil, 2008).

Lastly, one of the most worrisome aspects of Inuit health is the high rate of psychological distress and suicide attempts: Nunavik has the highest suicide rate in Québec, representing 24% of deaths, or about 10 times higher than the other regions of the province (INSPQ, 2008).

5.6.6 Air quality

There is no government air quality monitoring station in Inukjuak or anywhere else in Québec's far north. Due to the distance from major urban or industrialized areas, the air quality is good most of the time. The oil used to heat homes and domestic hot water and the diesel generators used to run the electricity-producing thermal generating station are the main sources of atmospheric pollution that could affect the local air quality, mainly due to nitrogen oxides (NO_X) and fine particular matter ($PM_{2.5}$).

As Inukjuak is located at 58° north latitude, it is highly likely for the region to be affected by periods of arctic haze during the winter. According to Phillips (2013), this haze is composed mainly of sulphur and nitrogen compounds (as a gas, fine liquid or solid particles called aerosols) of human origin, along with naturally occurring substances such as sea salt, wildfire ash and soil dust carried by the wind all over the planet. Arctic haze covers almost the entire region north of 60° north latitude. Concentrations tend to reach a maximum near the top of the inversion layer (400 to 800 metres above ground) and decrease above it. Arctic pollution levels are also generally 10 to 20 times higher than those over Antarctica and 10 times greater than over non-industrial areas of North America. This phenomenon results from the combination of at least three mechanisms: wintertime inversions form invisible barriers through which accumulated pollution cannot escape; large weather systems that control the movement of pollutants into, through and out of the Arctic are quite vigorous in winter and usually have a northward flow; and in winter, the air passes over what is essentially a frozen desert, so there is little rain or snow to wash out pollutants.

5.6.7 Sites of cultural, heritage or historical interest

As part of an environmental impact study for the plan to build a backup thermal generating station in Inukjuak, Hydro-Québec mandated the Avataq Cultural Institute to assess the archaeological potential of the study area. The resulting analysis, summarized below, is drawn from its archaeological potential report (Avataq Cultural Institute, 2020*b*).

5.6.7.1 Regional and historical context

The human occupation of Nunavik is relatively recent, because most of North America was covered in ice from 80,000 years to 6,000 years before the present (BP). About 4,500 years ago, the settlement of the Eastern Arctic began with groups of hunters from the Bering Strait (Eastern Siberia and Alaska), who were travelling eastward in search of game. Two major cultural groups are represented in Nunavik: the pre-Dorset and Dorset peoples, of the Arctic small-tool tradition, and the Thule culture Inuit, who are the ancestors of the present-day Inuit.

The pre-Dorset people occupied Nunavik from 4,400 years to 2,400 years BP. The oldest known site in the region, KcFr-5, is located in Ivujivik and dates back to 4,400 BP. The Dorset people, descendants of the pre-Dorset people, occupied Nunavik from 2,400 to 900 BP. Their disappearance is not explained and has generated debate in the Arctic archaeological community. In Nunavik, however, the end of the Dorset period seems to have preceded the arrival of the Thule culture Inuit or to have occurred at the same time. The Thule culture Inuit arrived in the Eastern Arctic around 750 BP. Their subsistence economy was essentially based on the whale hunt, as their settlement pattern its tied to this practice. To date, the oldest Inuit site in Nunavik, JeGn-2, was discovered on Île Smith (in Akulivik) and dates from 1270 AD (740 ± 2 BP).

The historical period officially began in the 15th century with the first contact between the Inuit and the English, French and Danish explorers seeking a passage to Asia. This period is linked to the development of trading posts and religious missions. The first trading post in Nunavik, Fort Richmond, was established by the Hudson's Bay Company (HBC) in 1750 on Lac Guillaume-Delisle, but it was closed soon thereafter, in 1756, due to low profitability.

In Ungava, the trading post at Fort Chimo (former name of Kuujjuaq) was opened in 1830, closed in 1842 and reopened in 1866. In Inukjuak, the Révillon Frères company established a trading post in 1909, followed by HBC in 1921. The rivalry between the two trading posts ended in 1936 when HBC bought out Révillon Frères. In 1939, another company set up shop in Inukjuak, the Baffin Trading Company; it closed 10 years later. The growing number of trading points and the establishment of religious missions in the 19th and 20th centuries had a lasting impact on the Inuit way

of life. Later, the establishment of villages and the creation of communities in the 1950s marked the end of the traditional lifestyle.

5.6.7.2 Archaeological potential

The area around Inukjuak has been the focus of many archaeological studies in the last 40 years, with 28 reports counted. A total of 66 archaeological sites have been discovered, making this one of the richest locations for archaeological data in Nunavik. The analysis of the archaeological potential was used to assess the sensitivity of the study area.

To fully understand the ways the region was occupied in former times, it was divided into nine sectors. Each sector underwent a detailed analysis. For the purposes of this study, we are presenting only the results of sector 1, north of the airport, which is expected to be the site of the planned generating station.

There are eight archaeological sites in sector 1 (north of the airport), four of which were seriously affected by the road expansion work in the late 1980s (IcGm-35, 36, 37 and IcGm-38). This sector also bears witness to pre-Inuit occupation, especially on the large marine terrace between the lake and the landing strip.

Four areas of archaeological potential (A, B, C, D) have been found near the construction site, mainly based on the presence of known archaeological sites and topography conducive to human settlement (see Map 5-3).

Area A features two pre-Dorset sites on a sand and gravel marine terrace, at an elevation of 35 metres above current sea level. Although they are registered separately, they may be a single large occupation zone, with IcGm-38 being an encampment and IcGm-35 a principal site.

Area B is the location chosen for the construction of the backup generating station. This area is bounded on the east and west by wetlands and on the south by the landing strip. This shelf offers good archaeological potential, because it is the continuation of the Area A marine terrace. It would not be surprising for the pre-Dorset occupation documented in Area A to continue into Area B. The part planned for the access road to the facility in Area B was excluded on purpose, as it is a highly disturbed area (nearly a dozen construction trailers and other vehicles were left on site, apparently as part of a local caribou herding experiment). As IcGm-35 is a surface site, the highly disturbed area offers less archaeological potential.

The marine terrace continues into Area C, which has a small historical Inuit encampment site (IcGm-39) established at the foot of a rocky escarpment. Based on an analysis of satellite images, Areas B and C seem to be separated by a poorly drained stretch of sandy deposits or a low-lying shrub zone.

Archaeology

- Known archeological site
- Area of archaeological potential

Hydrography

- Perennial watercourse
- Indeterminate watercourse
- Water body

Project components

- Planned backup thermal generating station
- Planned platform and infrastructure (generating station)
- Planned platform and infrastructure not in scope (station and access road)
- Limited study area

Inukjuak backup thermal generating station

Archaeology

Sources:

Orthoimage (Pléiades-1B), 50-cm resolution, Airbus, 2019
Adresses Québec, MERN Québec, January 1, 2020
BDVA, 1:2,000, MRN Québec, November 2013
Inventaire des sites archéologiques du Québec (ISAQ), MCC Québec, 2019
Project data, Hydro Québec, February 2021

Mapping: SNC-Lavalin
Inventory: Avataq Cultural Institute
File: 3406_eic5_3_slq_019_archeo_210315a.mxd

0 35 70 m
MTM, Zone 10, NAD83 (CSRS)
Contour interval: 2 m

Map 5-3

March 2021

Hydro Québec

Area D has a Dorset site on the far northwest edge of the IcGm-35/IcGm-38 marine terrace. It offers some archaeological potential but is far enough away from the construction zone that it will not be endangered by the work on the facility.

5.6.8 Landscape

5.6.8.1 Regional landscape

Based on the reference ecological classification developed by the MELCC, the extended study area is part of the natural province of the Péninsule d'Ungava. Surrounded by Baie d'Ungava, Baie d'Hudson and Détroit d'Hudson (Hudson Strait), this natural province forms an immense, gently undulating plateau, comprised of very rocky soil and bedrock dating back to the formation of the Earth. The summits rarely exceed 400 metres, other than in the far northeast of the natural province, near Détroit d'Hudson, where they may reach 650 metres. A great many small bodies of water are scattered across the plateau. Located on continuous permafrost, this natural province has the harshest climate in Québec, a semi-arid polar climate with a very short growing season. It is dominated by lichen, grasses and low-growing, prostrate woody vegetation. Shrub tundra is present in sheltered areas, as well as a few conifer stands on the floor of large valleys in the southern part of the natural province (Li et al., 2019).

5.6.8.2 Landscape of the extended study area

Inukjuak is very close to the mouth of the Rivière Innuksuac, on the shores of Baie d'Hudson. This river is known for its turquoise water and turbulent rapids. The village faces the Îles Hopewell and their steep cliffs, which shelter summer nesting grounds for many migratory birds. The land around Inukjuak is marked by gently rolling hills and open spaces. The village, the small port, the Îles Hopewell and Baie d'Hudson are visible from the hills. In spring, the pack ice between these islands and the mainland is moved by the action of tides and currents to create a spectacular field of immense, upraised blocks of ice (Makivik Corporation, 2019*b*).

Three particular parts of the extended study area stand out: the village itself, the airport area and the area around the northern landfill site and water treatment lagoons. The village is composed mainly of residential, institutional and commercial areas, as well as a few industrial areas. The landfill, treatment lagoons and quarry or sandpit, in the northwest of the extended study area, form a disturbed area dedicated to public utilities and the extraction of granular materials.

5.6.8.3 Observers

Fixed observers located in certain residential areas of the village of Inukjuak are likely to have a permanent, albeit distant, view of the planned thermal generating station. The lack of forest cover offers direct, open views from these areas. Mobile observers on the road to the airport and the access road to the planned facility may have a direct, open view of it. These are occasional observers, however. Furthermore, the residents who use the land for hunting, fishing, trapping, snowmobiling, riding ATVs and berry picking around the planned facility are mobile observers who are likely to see it occasionally, year-round. Lastly, the facility will be occasionally and temporarily visible from the airport.

6 Impact analysis

This chapter describes the impacts that the new thermal generating station could have on the biophysical and human environments during the construction and operation phases. First, the impact assessment method is explained (Section 6.1). Next, the issues are analyzed (Section 6.2), the valued environmental components are identified (Section 6.3), the sources of impact are described (Section 6.4) and the general mitigation measures are outlined (Section 6.5).

Sections 6.6, 6.7 and 6.8 describe the environmental components that will be affected by the proposed facility, including survey results, and present an impact analysis along with specific mitigation and compensation measures for each component.

6.1 Impact assessment method

The impact assessment is based on the description of the project and the host environment, on information gathered from the public participation process, on scientific literature and on lessons learned from previous projects:

- The description of the project serves to determine the sources of impact, i.e., the aspects that, during construction or operation, could have a positive or negative effect on an environmental component.
- The description of the host environment explains the natural and social setting for the project.
- The public participation process exposes the concerns expressed by the affected groups.
- The scientific literature and lessons learned from earlier projects help determine the sources of impact, assess certain impacts that recur from one project to the next, and select appropriate mitigation and compensation measures.

The impact analysis consists of four stages:

- Describe the current conditions pertaining to each affected environmental component, with the appropriate level of detail.
- Describe sources of impacts connected with building and operating the proposed facility.
- Determine the potential impacts on each affected environmental component and select the appropriate general and specific mitigation measures.
- Describe and assess the residual impacts, i.e., the impacts remaining after the implementation of mitigation measures, and describe any compensation measures.

Only the valued components of the environment for which an impact is anticipated are assessed. The rationale for the selection of components for assessment (or not), which is also based on the project issues, is stated prior to the application of the impact assessment method.

General mitigation measures and project-specific measures are identified prior to the assessment of residual project impacts. These measures are designed to reduce negative impacts. Hydro-Québec has a number of tools to determine the general or specific mitigation measures to be applied in the context of a project, including Standard Environmental Clauses (SECs), which group together a series of measures that contractors responsible for carrying out construction work must put in place. Hydro-Québec also incorporates mitigation measures into project tender documents to ensure that they are applied on the jobsite.

The impact assessment carried out according to the method outlined in Appendix D is aimed at determining the significance of a project's residual impacts on environmental components during its construction or operation. The assessment takes general and special mitigation measures into account, and covers both the positive and negative impacts of the project. The significance of an impact is determined based on three criteria: intensity, scope and duration. Impacts are classified according to their significance as major, moderate or minor.

6.2 Issues

The proposed project, the available knowledge on the biophysical and human environments and the meetings held by Hydro-Québec with the Inuit communities and other stakeholders were taken into account to determine the main issues of the Inukjuak backup thermal generating station, namely:

- maintaining the quantity and quality of wildlife habitats
- maintaining air quality, reducing greenhouse gases and fighting climate change (MELCC)
- preserving the soundscape
- maintaining resident safety and quality of life
- preserving archaeological resources

The valued environmental components targeted for impact analysis are related to project issues. They are presented in the paragraphs below.

Maintaining the quantity and quality of wildlife habitats

The destruction or alteration of land animal and bird habitats is one of the components identified in the project directive for which impacts must be assessed.

Migratory birds were selected as a valued component, as migratory bird nests, eggs and chicks are protected under the *Migratory Birds Convention Act, 1994* and are likely to be adversely affected by construction activities. Habitat loss is one of the primary threats to this group.

Therefore, birds are a valued component of the project to be considered in our study.

Maintaining air quality, reducing greenhouse gases and fighting climate change

The reduction of greenhouse gas (GHG) emissions is one of the main measures recommended in the Québec *2013–2020 Climate Change Action Plan*. The plan's GHG reduction objectives concern the entire industrial sector. In addition, players in this sector must demonstrate that their projects preserve air quality by complying with standards and criteria specified in provincial regulations.

The operation of the generating station is likely to emit GHGs and to generate the emission of substances that can affect air quality.

Maintaining air quality, reducing GHGs and fighting climate change are objectives that contribute to the protection of the environment and species, human health and quality of life. This environmental and social impact assessment statement analyzes these valued environmental components for the backup generating station project.

Preserving the soundscape

Each living environment has its own soundscape, which comes from environmental noise, neighborhood noise and activity noise. The presence of noise is considered a potential source of nuisance that can affect the quality of life and, in the worst cases, have repercussions on human health in general and psychosocial health in particular. Québec and many municipalities have therefore adopted standards and criteria to control the population's exposure to noise.

Operation of the thermal generating station will be a source of noise. This noise will come primarily from generators and heaters that will operate occasionally, since the generating station will serve only as a backup to the Innavik hydroelectric facility. It will be perceptible mainly around the periphery of the facility.

The valued environmental components of soundscape (physical environment), quality of life, health and safety (human environment) must be considered when addressing this issue in the impact assessment.

Maintaining resident safety and quality of life

The Directive issued for this project, which outlines the nature, scope and extent of the environmental and social impact assessment to be conducted, stipulates, among other things, that the environmental assessment is to protect human life, health, safety, welfare and comfort.

For the Inukjuak backup generating station project, compliance with applicable government criteria, requirements and standards is a primary factor in promoting public safety and physical health. This compliance is also fostered by the introduction of additional best practices or mitigation measures, as well as the application of an appropriate environmental monitoring and follow-up program.

The issue of public safety and quality of life for residents is associated with the valued component of the human environment discussed in this study, namely quality of life, health and safety.

Preserving archaeological resources

Although most known archaeological sites are recorded, not all are legally protected. However, the *Cultural Heritage Act* provides for the possibility of assigning legal status to archaeological properties and sites. The analysis of archaeological potential carried out for the generating station project has identified four archaeological sites at the facility site and in its vicinity. The construction work is therefore likely to uncover artifacts.

As such, this study must take the valued component of sites of cultural, historical and archaeological interest (human environment) into account.

6.3 Identification of valued environmental components

The valued environmental components were identified by taking into account elements of the environment deemed important by the various project stakeholders, as well as the considerations of government agencies and those expressed by the MELCC in the project directive.

The following valued environmental components were selected for the analysis of the anticipated impacts of the project:

- Soil
- Surface water
- Birds
- Air quality
- Greenhouse gases and climate change
- Sound environment
- Land use
- Services and infrastructure
- Health and safety
- Economic spinoffs
- Sites of cultural, historical or archaeological interest
- Landscape

Some environmental components were excluded from the impact analysis for the reasons explained below.

Wetlands and aquatic environments

Seven wetlands and one intermittent watercourse are identified at some distance from the project site. The construction of the generating station will have no impact on these wetlands as permanent or temporary encroachment is avoided. The closest wetlands to the site are located at a distance of more than 45 metres from the generating station (Phase II). Since the location of the generating station is higher than the nearby wetlands, the facility will not interfere with the natural drainage into them. In addition, water inflow into the wetlands is primarily due to rain and snowmelt. Wetlands and aquatic environments are therefore not considered as valued components for the purposes of the impact assessment.

Special-status vegetation and plant species

The project site is a shrub tundra and an area already disturbed by previous activities. The shrub tundra, which is also very common in the region, represents almost 44% of the extended study area. No tree species are present, shrubs do not exceed 2 metres in height, and no special-status plant species have been confirmed in the limited study area. Accordingly, these components were not included in the impact assessment.

Aquatic wildlife

The inventories carried out for this project confirmed that no perennial watercourses or water bodies are located within the limited study area. Only one intermittent watercourse is located within the limited study area, but it will not be affected by the project. The construction of Phase II of the station will avoid any permanent or

temporary encroachment on the aquatic environment. In addition, Hydro-Québec's Standard Environmental Clauses will be applied during construction (see Section 6.5). They include several protection measures applied to sensitive areas and the aquatic environment, and all work carried out near watercourses is managed in such a way as to minimize the impact on aquatic wildlife. The mitigation measures planned for the construction and operation phases will ensure the protection of the aquatic environment and its wildlife. As no direct or indirect impacts on aquatic wildlife are anticipated, this component was not included in the impact assessment.

Land wildlife

No amphibian, reptile or bat species were confirmed to be present in the limited study area or even in the project area, either through inventories conducted as part of this project (amphibians) or through existing data from other sources. Common terrestrial mammal species were excluded from the impact analysis because they were not associated with any particular issue during the consultations, and none of the anticipated impacts (e.g., habitat disturbance, loss and alteration, mortality due to machinery and vehicles) are likely to substantially alter the abundance of these species in the project area. Furbearers have good movement and dispersal capabilities, while small mammals have reproductive rates that make them insensitive to minor environmental changes. In the vast majority of cases, the individuals affected will move to neighboring habitats, and mortality (due to road collisions or the movement of machinery) will be compensated for by local recruitment of populations or by individual migration.

Caribou were not included in the detailed impact analysis for several reasons. First, at most, a few transient individuals are likely to use the extended and limited study areas. No tracks, droppings or individuals were observed in the limited study area during the land wildlife inventory. The close proximity of the limited study area to the access road leading to the future Innavik hydroelectric generating station reduces the risk of frequenting the study site, since caribou, particularly females accompanied by their young, are sensitive to human disturbance. Second, the limited study area does not present any particular interest in terms of caribou habitats (e.g., no lichen concentration); it should also be noted that the extended study area does not overlap with any calving or wintering areas of the Rivière aux Feuilles herd. Third, although the species may frequent the project area during the construction phase, the project footprint occupies a very small area compared to the size of the caribou's home ranges, which further reduces the potential for significant impacts on the population, both in terms of the percentage of the population affected and the magnitude of disturbance to the individuals concerned.

With respect to special-status land mammal species, the least weasel, even if present, would experience negligible impacts: it occurs at low densities in North America, and the few individuals concerned would move to the many suitable habitats located in the periphery. In addition, this small member of the weasel family is versatile in terms

of habitat use and has high reproduction rates when its prey is abundant, which would make its population relatively insensitive to the environmental changes associated with the project. Considering the scope of their home ranges and movements, as well as their presumed very low numbers, the presence of wolverines and polar bears in the extended study area and limited study area would be infrequent and of very short duration, if any. The potential impacts of the project on these two predators are therefore low. Furthermore, the limited study area does not present any particular interest for these species, an interest that is all the more reduced because the surface area of the site under study is very small.

6.4 Sources of impact

The sources of impact are related to the project implementation stages that could alter the environment in whole or in part, either temporarily or permanently. The main construction, operation and maintenance activities that could constitute sources of impact are as follows:

Construction

- Preparatory work and site facilities
- Levelling, backfilling and earthwork
- Installation of gensets, buildings and associated infrastructures
- Waste management
- Transport and traffic
- Housing and worker presence
- Employment and purchases of goods and services

Operations, servicing and maintenance

- Presence of infrastructures
- Operation of the generating station and fuel management
- Employment and purchases of goods and services
- Servicing and maintenance of generating station

The project implementation stages are presented in Chapter 4. The matrix of impacts (see Table 6-1) presents the interaction between the sources of impact and the valued environmental components.

Table 6-1: Matrix of Potential Impacts of the Project

Environmental components	Construction						Operations and maintenance			
	Preparatory work and site facilities	Levelling, backfilling and earthwork	Installation of groups, buildings and associated infrastructures	Waste management	Transport and traffic	Housing and worker presence	Presence of infrastructures	Operation of the generating station and fuel management	Employment and purchases of goods and services	Servicing and maintenance of generating station
Physical environment										
Soils	X	X	–	X	–	–	–	X	–	X
Surface water (quality and drainage)	X	X	–	X	X	–	–	X	–	X
Biological environment										
Birds	X	X	–	–	X	–	–	–	–	–
Human environment										
Air quality	X	X	–	–	X	–	–	X	–	X
GHG emissions and climate change	X	X	–	–	X	–	–	X	–	–
Sound environment	X	X	X	X	X	–	–	X	–	–
Land use	–	–	X	X	X	–	–	–	–	–
Infrastructure and services	–	–	–	X	X	–	–	–	–	–
Economic spinoffs	–	–	–	–	–	–	–	–	X	–
Health and safety	–	–	–	X	X	X	–	–	–	–
Sites of cultural, historical or archaeological interest	X	X	–	X	–	–	–	–	–	–
Landscape	–	–	–	–	–	–	X	–	–	–

6.5 General mitigation measures

Hydro-Québec automatically applies general mitigation measures to reduce, at the source, the impact of its operations on the environment. These measures are described in Hydro-Québec's Standard Environmental Clauses (SEC) (Hydro-Québec Innovation, équipement et services partagés, 2018). General mitigation measures are particularly effective in limiting or preventing potential impacts on the physical environment (contamination, disturbance of soils and surface drainage, restoration of the environment). Protection measures are applied to sensitive areas, and all work carried out near watercourses is managed in such a way as to minimize the impact on aquatic wildlife and environmental components. The SECs are outlined in Appendix E.

Although Hydro-Québec is committed to systematically implementing all of the SECs in its projects, the following sections apply specifically to the Inukjuak backup generating station project:

- Section 1 – General
- Section 2 – Noise
- Section 3 – Quarries and sandpits
- Section 5 – Snow removal
- Section 6 – Accidental contaminant spills
- Section 7 – Drainage
- Section 8 – Raw and drinking water
- Section 9 – Wastewater
- Section 10 – Excavation and earthwork
- Section 11 – Drilling and boring
- Section 15 – Plant and traffic
- Section 16 – Hazardous materials
- Section 17 – Waste materials
- Section 19 – Heritage and archaeology
- Section 20 – Air quality
- Section 21 – Site restoration
- Section 22 – Petroleum product tanks and storage facilities
- Section 23 – Blasting
- Section 24 – Contaminated soil
- Section 26 – Work in wetlands

Besides the measures listed in the SECs, Hydro-Québec will implement specific mitigation measures to further reduce the impacts of the project on the environment. The following sections describe the impacts on the physical environment (6.6) and on the biological environment (6.7), as well as the specific mitigation measures applicable to each. The significance of the impacts on the components of these two environments has been assessed, since they are affected (negatively or positively) by the changes generated by the project.

Table 7-1 in Chapter 7 specifies the applicable SECs (general mitigation measures) and the specific mitigation measures applicable to the environmental components potentially affected by the project.

6.6 Impacts on the physical environment and mitigation measures

As indicated in the impact assessment method presented in Appendix D, the changes caused to the physical components of the environment are described by specifying their intensity, scope and duration, but without qualifying their significance. It should be remembered that the application of general or specific mitigation measures can reduce them.

6.6.1 Soils

6.6.1.1 Present conditions

The future generating station will be built on rock, covered by a layer of medium to coarse sand and gravel approximately 50 to 100 cm thick with, in places, a thin layer of topsoil approximately 5 to 15 cm thick. The site has gentle slopes with no unstable conditions.

6.6.1.2 Anticipated construction-phase impacts and mitigation measures

Soil surface and profile

The work scheduled for the construction phase will require the expansion of the Phase 1 platform over a surface area of 0.53 ha of natural terrain. Preparatory work, levelling, backfilling and earthwork could alter the composition, profile and quality of the surface soil or lead to erosion of bare soil. The site facilities will be located on the existing platform, and the jobsite will be reached via the access road to be built in Phase 1. This will avoid the impacts of both activities on the soil. Levelling, backfilling and earthwork will be carried out gradually from the existing platform, limiting them as much as possible to the area of the future generating station platform. Work that cannot be avoided on the periphery of the future platform is more likely to disturb soils.

Machinery transport and traffic is not expected to cause rutting, given the predominant type of surface deposits (rock, sand and gravel) and the absence of areas with low bearing capacity in the work area. In addition, the work will take into account the presence of permafrost, although the issue of permafrost is limited to the generating station site itself due to the predominance of rock.

Before proceeding with earthwork, the surface layer of organic soil will be stripped if necessary, piled in the work area and used when the work is completed to cover the exposed mineral soil before restoration of the site.

Hydro-Québec and the construction contractor will work together to establish the measures to be put in place to prevent and control soil erosion and manage sediment in order to protect nearby wetlands and aquatic environments. Once the work is completed, exposed surfaces will be restored.

While the work is in progress, Hydro-Québec will apply the general measures in SECs 10 and 15 regarding excavation and earthwork, as well as equipment and traffic, so as to limit the impact on the soil (see Appendix E). Once the work is completed, work areas and exposed surfaces will be restored in accordance with SEC 21.

Soil quality

Accidental spillage of petroleum products from the use of machinery and inadequate management of construction waste pose risks of soil contamination during construction.

In addition to the measures regarding accidental contaminant spills and contaminated soil, the contractor is required to apply the measures regarding equipment, traffic, hazardous waste management and waste materials (see SECs 6, 15, 16 and 17, Appendix E).

General mitigation measures

The mitigation measures included in Hydro-Québec's SECs (see Table 7-1 in Chapter 7) will greatly reduce impacts on soils during the construction phase.

Specific mitigation measures

In addition to the SECs, the following specific measures will be implemented:

- Establish the measures to be put in place to prevent and control soil erosion and manage sediment in the work area.
- Once the work is completed, proceed with the restoration of the temporarily affected areas. Use the most appropriate revegetation technique for the affected area.

Given the SECs as well as the general and specific mitigation measures planned during construction, the intensity of these impacts will be low. Their scope will be limited because they will be restricted to a small area, and their duration will be moderate since it will be limited to the construction period.

6.6.1.3 Anticipated operation-phase impacts and mitigation measures

Soil surface and profile

No impact on soil stability is anticipated during the operation of the station. The platform to hold the future generating station will be designed in accordance with the design standards for such infrastructures in a northern environment. It will also be built on rock, which will guarantee its stability, as permafrost is continuous in the area. Furthermore, the presence of the station will have no effect on the permafrost.

Soil quality

Fuel storage and refueling activities at the generating station and the management of used oil during the operation phase pose risks of soil contamination in the event of an accidental spill.

The transport, storage and management of petroleum products during the operation of the station will be carried out in accordance with the applicable provincial and federal regulations.

Fuel will be transported to the generating station from the port of Inukjuak by tanker truck over a distance of approximately 4.8 km. Given the purpose of the station (backup), the frequency of fuel deliveries will be low (two to three times per month), which will help reduce the risk of contamination.

Specific mitigation measures

Fuel will be stored in outdoor tanks in compliance with regulations. Used oil will be recovered and stored in sealed containers inside the main building and in the hazardous material recovery center (HMRC) located near the generating station building, and then sent south to treatment facilities authorized by the MELCC.

Hydro-Québec will implement safety measures and an emergency measures plan to prevent accidental spills and take the required action, if necessary (see Section 8.3).

With the application of these various measures, the impact on soil during the operation phase will be low. The scope of the impact, restricted to the generating station, will be limited, and its duration will be long, as operation is expected to last 40 years.

6.6.1.4 Assessment of residual impact

During construction, the soil will be disturbed and then restored in the work areas; only the surface area occupied by the infrastructures will remain permanently altered.

Given the general and specific mitigation measures to be implemented during construction and operation, the risks of soil contamination are low.

The intensity of the impact will be low and its scope will be limited because it will be restricted to a small area, and the duration will be long, as the generating station will be in operation for 40 years. The significance of the residual impact on the soil is thus minor.

6.6.2 Quality and drainage of surface water

6.6.2.1 Anticipated construction-phase impacts and mitigation measures

Preparatory work and site facilities, levelling, backfilling and earthwork, as well as machinery transport and traffic during the work, are likely to alter water quality through the input and suspension of sediment and the risk of water contamination in the event of accidental petroleum product spills. Inadequate management of construction waste is also likely to alter water quality.

The input of suspended solids in the nearest aquatic environment during backfilling, levelling and earthwork could occur as a result of the erosion of bare soil. Machinery traffic and use could also locally alter drainage, increase erosion and lead to an increase in suspended solids entering the aquatic environment. The breakdown of a piece of construction equipment near an aquatic environment or the runoff from an accidental spill could lead to water contamination by hydrocarbons.

The impact on the aquatic environment by the input of suspended solids will remain very low during the construction work, given the 150-metre distance from the nearest watercourse and its location on the slope opposite the backfilling work.

The work required to expand the platform over an area of 0.53 ha of natural terrain will have little impact on local drainage, given the configuration of the site during the construction work, the presence of a gentle slope near the work site and the type of soil.

General mitigation measures

Hydro-Québec's SECs already include several general mitigation measures that have been successfully implemented in similar projects (see Table 7-1 in Chapter 7 and Appendix E). They will greatly reduce the project's impact on water quality during construction.

Specific mitigation measure

The implementation of measures to prevent and control soil erosion and manage sediment in the work area will constitute a specific mitigation measure that will complement the SECs.

This measure will also control sediment transport to the wetlands closest to the work site.

6.6.2.2 Anticipated operation-phase impacts and mitigation measures

Fuel storage and refueling activities at the generating station during the operational phase represent the main risk of contamination of surface water in the event of an accidental spill.

General mitigation measures

The mitigation measures described in Hydro-Québec's SECs 6, 7, 9, 10, 15, 16, 17, 21, 22 and 24 (see Table 7-1 in Chapter 7 and Appendix E) will be applied.

Specific mitigation measure

Hydro-Québec will implement safety measures and an emergency measures plan that will specify the measures to deploy to prevent accidental spills and take the required action, if necessary.

6.6.2.3 Assessment of residual impact

Given the SECs and the specific mitigation measures to be applied during the construction phase, the intensity of the impact will be low. Its scope will be limited because the impact will be restricted to a small area and the duration will be moderate, as it will only occur during the construction phase.

With the application of the various measures described, the impact on the soil during the operation phase will be of low intensity. The scope is limited, as it is restricted to the generating station, but the duration will be long, as the generating station will be in operation for 40 years.

The significance of the residual impact on the soil is therefore deemed to be minor.

6.7 Impacts on the biological environment and mitigation measures

6.7.1 Vegetation

The generating station will entail the loss of about 0.53 ha of shrub tundra and other environments that are already disturbed. The project has been optimized to avoid negative impacts on the wetlands or aquatic environments. The planned location of the generating station is on a rock outcrop, and no special-status plants have been observed in this location. The impact is thus considered negligible.

6.7.2 Wildlife

6.7.2.1 Anticipated construction-phase impacts and mitigation measures

Birds are the main wildlife component that will be affected by the project.

The principal impacts during the construction phase are related to the loss of habitat (about 0.53 ha of shrub tundra and other environments that are already disturbed). The nests, eggs and chicks of migratory birds are protected by the *Migratory Birds Convention Act, 1994*.

The habitat loss will force some species to seek a new habitat, but the small area affected means that the impact will be negligible considering the abundance of similar habitats in the surrounding area. The various construction activities and transport and traffic may also disturb the birds and encourage them to move temporarily. Nevertheless, those that use the habitats affected during the work period will be able to settle nearby, as the kinds of habitats that will be disturbed are not uncommon locally. Moreover, no special-status bird species has been observed to nest in the limited study area. A peregrine falcon has been observed in flight, but it probably nests on the cliffs located several kilometres away from the planned location of the generating station.

Specific mitigation measure

The vegetation will be removed, to the extent possible, outside of the reproduction season (nesting period), that is, from May 25 to August 15. If it is impossible to comply with this restriction, in light of the small area that is to be cleared, it would be possible to have a professional conduct a nest search after July 15, when the majority of young birds have left their nests. If there are no active nests, the work will be able to begin before August 15.

6.7.2.2 Operation phase – Anticipated impacts

No impact on birds is expected during the operation phase.

6.7.2.3 Assessment of residual impact

The intensity of the impact on birds will be low, as the removal of vegetation and clearing work will be carried out outside of the nesting period.

The scope of the impact will be limited, as the use of the environment by the different bird species will be altered only within the project footprint. The duration of the impact is deemed to be short for bird species that currently nest in the limited study area, as they will be able to use the tundra environments after the construction is completed. The disturbance of birds during the construction phase will also be short term.

The significance of the residual impact on birds is therefore considered minor.

6.8 Impacts on the human environment and mitigation measures

6.8.1 Air quality

6.8.1.1 Anticipated construction-phase impacts and mitigation measures

Preparatory work and site facilities, levelling, backfilling and earthwork, as well as transport and traffic, are likely to generate dust during the work.

General mitigation measure

Section 20 of Hydro-Québec's SECs will be implemented during the work, which will mitigate this impact. Other standard dust control measures will also be applied during the construction work.

6.8.1.2 Operation phase – Anticipated impacts

An atmospheric dispersion study was conducted to assess the compliance of the emission of atmospheric contaminants by the planned generating station's engines with the emission standards set out in Québec's *Clean Air Regulation* (RAA). Appendix F presents the detailed study results.

The contaminants targeted by the study are nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), total particulate matter (TPM) and fine particulate matter ($PM_{2.5}$). A dispersion study was conducted based on the requirements of the *Guide de la modélisation de la dispersion atmosphérique* (Richard Leduc, April 2005) published by the MELCC Direction du suivi de l'état de l'environnement, and Schedule H of the RAA. A level-2 dispersion model (AERMOD) was used to estimate the maximum concentration of the target pollutants in the ambient air. The odor level around the generating station likely to be generated by the engines was also verified and compared with the MELCC criteria.

The duration of use of the generating station is estimated at the equivalent of one month per year, as a backup for the Innavik hydroelectric generating station, and one hour per month for synchronization with the network. The concentrations calculated in the ambient air, at ground level, are within the RAA standards and MELCC criteria everywhere in the modeling domain for both scenarios and for all the study's target contaminants except NO_2, for which high hourly and daily concentrations are likely in a small area around the levelled zone of the generating station site. The RAA standards would be met at a distance of 60 metres away from the levelled surface, however.

Furthermore, we calculated the maximum hourly and daily concentrations of NO_2 for receptors of concern (or sensitive receptors) that are representative of the environment: the airport, the school, the local community service center (CLSC), the early childhood centers (CPEs) and the vocational training center (CFP). All the results at the receptors of concern are clearly below the RAA standards and MELCC odor criteria.

In conclusion, the analysis of the emissions of the new engines shows that the RAA emissions standards will be met for all operating regimes considered for this project.

6.8.1.3 Assessment of residual impact

During the construction stage, the intensity of the residual impact on air quality is deemed to be low, and its scope will be limited, since most of the work will take place at the site of the planned generating station. The duration of the impact will be short, as it will stem from certain construction activities.

Overall, during the operation period, the project's impact on air quality is deemed to be positive. As the existing thermal generating station, located inside the village of Inukjuak, will be dismantled after the new thermal generating station and the Innavik hydroelectric generating station are commissioned, a significant improvement is expected in the air quality in the village. The intensity of the positive impact of operating the new generating station on the air quality is deemed to be moderate, the scope is local and the duration is long.

The significance of the residual impact on the air quality is considered moderate.

6.8.2 Greenhouse gases and climate change

6.8.2.1 Construction phase – Anticipated impacts

Most of the GHG emissions in the atmosphere will come from the exhaust of land vehicles (on- and off-road) used for the excavation and earthworks at the site and for various activities related to the construction of the infrastructures for the new generating station.

Table 6-2 presents the sources of GHG emissions related to the new thermal generating station.

Table 6-2: Sources of Greenhouse Gas Emissions during the Various Stages of the Construction of the Planned Backup Generating Station

Stage of construction	Source of GHG emissions	Type of fuel
Transportation of construction materials and excavated materials	Transport and traffic of heavy and light-duty trucks	Diesel and gasoline
Construction of the foundation, underground ducts, troughs and trenches	Use of machinery	Diesel and gasoline

An estimate was established for the GHG emissions related the construction of the backup generating station. The consumption of fossil fuels (gasoline and diesel) was estimated based on the projected number of work hours for fuel-consuming equipment. It should be noted that the number of hours represents the total hours required to do the work, not the number of hours during which the vehicles and other equipment will be in operation. For this reason, the project's GHG emissions are overestimated.

The consumption data for each type of equipment were used, based on the manufacturers' technical specifications. Due to a lack of available consumption data, we matched the average hourly fuel consumption drawn from Figure 3 of the 2008 Canadian Vehicle Survey Update Report with each type of equipment, depending on whether it is similar to a light-duty vehicle, a mid-sized truck or a heavy truck (see Table 6-3).

Table 6-3: Average Consumption by Type of Equipment

Type of equipment	Consumption (l/h) at a speed of 100 km/h [a]	Consumption (l/h) at a speed of 80 km/h
Light-duty vehicle	11.4	10
Mid-sized truck	23.0	19
Heavy truck	35.3	30

a. 2008 Canadian Vehicle Survey Update Report

We calculated the GHG emissions related to the project (ECCC, 2018*b*) using the emission factors from Part 2 of Annex 6 of the ECCC's *National Inventory Report 1990–2016*. For the purposes of this calculation, we used the global warming potentials drawn from the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC).

The consumption of fossil fuels by the generating station construction project is estimated at 100,688 litres of gasoline and 131,408 litres of diesel (see Table 6-4). The combustion of these volumes will emit, respectively, 246.22 and 353.28 t CO_2 eq. into the atmosphere, for a total of 609.5 t CO_2 eq. over the entire duration of the project.

Table 6-4: Summary of Hours, Total Fuel Consumption and GHG Emissions during the Construction of the New Backup Generating Station in Inukjuak

Activity	Estimated hours	Total consumption (l)	GHG emissions (t CO_2 eq.)
Equipment (gasoline)	8,702.42	100,687.99	256.22
Equipment (diesel)	7,332.76	131,407.93	353.28
Total	**16,035.08**	**232,095.92**	**609.5**

Table 6-5 shows the detailed GHG emissions for the project.

Table 6-5: GHG Emissions during the Construction of the New Backup Generating Station in Inukjuak

Type of equipment	Estimated hours	Type of fuel	Total consumption (l)	GHG emissions (t CO_2 eq.)
Pickup trucks				
1/2 MT 4x4 pickup truck	330.59	Gasoline	2,648.03	0.2
3/4 MT 4x2 pickup truck	4,080.99	Gasoline	36,382.03	66.5
3/4 MT 4X4 pickup truck	0.85	Gasoline	8.47	0.02
Graders				
CAT 12H grader, 110 kW 147 HP	3.25	Diesel	47.80	0.13
CAT 14H grader, 155 kW 207 HP	193.21	Diesel	4,001.31	10.76
Crusher				
Pioneer 2036-3024 gravel crusher	269.10	Diesel	7,942.14	21.36
Bulldozers				
CAT D3-C tracked bulldozer, 50 kW 67 HP	4.34	Diesel	32.37	0.09
CAT D6-H tracked bulldozer, 123 kW 165 HP	14.43	Diesel	238.13	0.64
CAT D7-H tracked bulldozer, 160 kW 215 HP	60.23	Diesel	1,292.91	3.48
Hydraulic shovel				
- Hitachi EX 1200-6 tracked hydraulic shovel, 5.00 M3	32.40	Diesel	2,398.71	6.45
- CAT 330CL tracked hydraulic shovel, 1.60 M3	94.61	Diesel	1,912.01	5.14
- CAT 320CL tracked hydraulic shovel, 1.05 M3	123.32	Diesel	1,702.61	4.58
- CAT 345B tracked hydraulic shovel, 2.10 M3	124.24	Diesel	3,604.63	9.69

Table 6-5: GHG Emissions during the Construction of the New Backup Generating Station in Inukjuak *(continued)*

Type of equipment	Estimated hours	Type of fuel	Total consumption (l)	GHG emissions (t CO_2 eq.)
Compactor				
CAT-CS-433B vibratory roller compactor ±9 MT	24.36	Diesel	497.17	0.2
Trucks				
Bulk truck, 12 wheel, 4 axle 17 MT	156.24	Diesel	2,343.60	6.40
Concrete mixer, 6.1 M3	112.32	Diesel	1,684.80	4.60
Dump truck, 12 wheel	716.85	Diesel	27,186.54	74.19
Manitex 1440 platform truck + crane, 12.7 MT	3.80	Diesel	72.23	0.19
Platform truck + crane, 17.0 MT	69.67	Diesel	2,159.07	5.81
Tractor truck, 20 MT 200HP	280.00	Diesel	5,602.60	15.07
Compressor				
Compressor, 250 CFM (117.9L/S)	50.00	Diesel	395.25	1.34
Backhoes				
CAT 416-D or CASE 580 backloader, 1.00 M3	106.38	Diesel	567.93	1.53
Cranes				
- Terex CD 220 AUTO. hydraulic crane, 18.1 MT 4X4	3.43	Diesel	75.50	0.20
- Grove RT-640E AUTO. hydraulic crane, 36.3 MT 4X4	161.53	Diesel	2,795.63	7.52
- Grove RT-700E AUTO. hydraulic crane, 50.0 MT 4X4	40.00	Diesel	960.62	2.58
Aerial lift and platform				
Telescopic aerial lift, gasoline-powered, 40’	4,189.48	Gasoline	58,359.46	156.93
Telescopic aerial lift, gasoline-powered, 85’	87.08	Gasoline	3,280.30	8.82
Lift trucks				
Lift truck, 1500 to 3000 KG	122.63	Diesel	1,200.55	3.23
Lift truck, 5600 to 7300 KG	3,005.00	Diesel	39,230.28	105.49
Loader				
CAT 963C track loader, 2.45 M3	280.00	Diesel	4,426.06	11.90
CAT 962G wheeled loader, 3.5 M3	705.09	Diesel	14,602.15	39.27
Vibratory plates				
Comp. vibratory plate comp., 7,000 LB (22")	0.44	Diesel	0.92	0.00
Vibratory plate comp., 13,5000 LB (28")	13.33	Diesel	8.40	0.02
Rollers				
Bomag BW 161AD-4 HF tandem roller, 8.7 MT	198.49	Diesel	2,263.84	6.09
Bomag BW-160-AD vibratory roller, 9.0 MT	1.62	Diesel	16.92	0.05

Table 6-5: GHG Emissions during the Construction of the New Backup Generating Station in Inukjuak *(continued)*

Type of equipment	Estimated hours	Type of fuel	Total consumption (l)	GHG emissions (t CO_2 eq.)
Other				
Pulling line winch	195.00	Diesel	975.00	2.62
Portable tracked grout plant	144.67	Diesel	682.12	1.83
Manual pneumatic drill rig, 19 KG RH	8	Gasoline	0.68	0
Total	**16,035.08**	**–**	**232,095.92**	**609.50**

6.8.2.2 Operation phase – Anticipated impacts

The operation of the generating station will require servicing and maintenance activities that will sporadically demand the use of certain machinery and vehicles (lift trucks, snow remover, etc.). The emissions related to the consumption of fuel by the machinery cannot be quantified as this work is very variable. It is deemed negligible, however.

The construction of the generating station will emit GHGs, but on a small scale. The project will actually lead to a reduction in GHG emissions compared to the current situation, as the new generating station will only be used as a backup, should the Innavik hydroelectric generation station become unavailable.

The current thermal generating station emits about 8,000 t of GHGs annually to produce about 10,000 MWh. It is hard to estimate the emissions of the new generating station as they will be related to its utilization rate. There is reason to believe that the annual GHG emissions of the backup generating station will be significantly below 1,000 tons per year if there are no operating problems with the hydroelectric station. These emissions will be related to the monthly synchronization of the thermal generating station.

6.8.2.3 Assessment of residual impact

During the construction phase, the intensity of the residual impact is deemed to be low and its scope limited, since most of the work will take place at the site of the planned generating station. Its duration is expected to be short, as it will stem from certain construction activities.

During the operation phase, the reduction of GHG emissions caused by the use of the thermal generating station as a backup for the Innavik hydroelectric generating station is expected to have a positive impact of low intensity. Given that its scope will be local and its duration long term, the significance of the residual impact on GHGs and climate change is considered to be minor.

6.8.3 Sound environment

6.8.3.1 Anticipated construction-phase impacts and mitigation measures

The preparatory work and site facilities, levelling, backfilling, earthwork, transport and traffic, as well as placement of the equipment, will lead to a short-term increase in the ambient noise during the work. No permanent or secondary residences are located in or near the work zone. The soundscape in certain residential neighborhoods of the village will be temporarily disturbed during the truck transport of the materials and equipment from the Inukjuak dock or borrow pits.

General mitigation measures

Section 2 of Hydro-Québec's SECs will be implemented during the work, which will mitigate this impact. The work will be carried out during daytime and in compliance with applicable regulations.

6.8.3.2 Operation phase – Anticipated impacts

The soundscape was modeled to assess the sound compliance of the project during the operation period and, if necessary, to propose design optimizations or specific mitigation measures to reduce the negative impact of the project on the sound environment. The results of this study are presented in the following sections.

Initial soundscape

The sound environment of a location is the cumulative result of sounds from a multitude of nearby and more distance sources, each with its own characteristics of stability, duration and content.

No sound measurements were taken on the land for this study. Given the context and characteristics of the project implementation area, and based on instructions from Health Canada (2017),[1] the initial soundscape for the sector under study is considered to be quiet.

According to Health Canada (2017), the day-night sound level representative of a quiet area ("quiet rural") is 45 dBA Ldn, or 45 dBA in the day and 35 dBA at night.

Health Canada (2017) defines a quiet rural area as having no heavily traveled roads and/or rail lines, not being subject to frequent aircraft flyovers and having an occupation density of 28 inhabitants/km^2. The study area, which includes the village of Inukjuak, generally matches this description, except that it is more densely occupied and there may be aircraft flyovers due to the presence of the airport, whose

1. *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise*, Health Canada, H129-54/3-2017E-PDF, January 2017.

landing strip points toward the village. It is reasonable and safe to consider that a day-night level of 45 dBA Ldn is representative of the initial situation for this study.[1]

Calculation method for the projected soundscape

The noise from the operation of the planned generating station, which is technically designated as specific noise,[2] was assessed using the ISO 9613-2 method,[3] which calculates the attenuation of sound during propagation in a free field and predicts sound levels in weather conditions that are conducive to the propagation of sound toward an assessment point. These conditions entail propagation by wind or propagation due to a moderate temperature inversion, as commonly happens at night. The method takes into account geometric divergence due to distance, atmospheric absorption, the effect of the soil, surface reflections and the screen effect.

The calculations were performed using SoundPLAN®, version 8.2, for specific assessment points, i.e., those deemed most likely to be subject to the most significant impacts due to their proximity to the planned generating station. The results are representative of the noise perceived at the assessment points, expressed as the A-weighted equivalent continuous sound pressure level (LAeq in dBA) at 1.5 m from the ground.

Noise limits considered

The MELCC has no specific regulations on noise emissions around thermal generating stations. For this type of industrial activity, it relies on policies or instruction notes instead. In this study, the generating station is unique in that it is a backup facility, it will operate only a few hours a month—only during the day—for a monthly preventive startup, and it will only be used to supplement Inukjuak's energy needs during a temporary shutdown of the hydroelectric generating station. It therefore appears that the MELCC noise criterion most appropriate in such circumstances is the one for construction sites (*Lignes directrices relativement aux niveaux sonores provenant d'un chantier de construction industriel*, MDDELCC, 2015), or a non-continuous, non-permanent activity.

1. An assessment of the initial sound level is deemed safe if it is an under-assessment. A higher level may, on one hand, lead to an increase in the noise limit to be applied and, on the other, reduce the assessed noise impact of the project, as it will be more significant if the difference between the initial sound level and the sound level due to the project is large. Since the village of Inukjuak is more densely populated than the reference point established by the Health Canada document, it would, in fact, be more likely to have a higher Ldn than the 45 dBA Ldn that was chosen to be representative of the initial soundscape.
2. Specific noise is noise that comes from the specific source under study, in this case, the planned generating station. Ambient noise is the noise perceived in a location, composed of noise from many sources, and residual noise is all noise attributable to all sources other than those related to the planned generating station (ambient noise = specific noise + residual noise). Ref.: Instruction note 98-01, *Traitement des plaintes sur le bruit et exigences aux entreprises qui le génèrent*, Ministère de l'Environnement et de la Lutte contre les changements climatiques, February 1998, updated June 2006.
3. ISO 9613-2:1996, International Standard, *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation*, December 1996.

These guidelines provide limits pertaining to noise reception sites, not the emission site. These limits take into account the time of day (day: 7 a.m. to 7 p.m.; evening: 7 to 10 p.m.; and night: 10 p.m. to 7 a.m.), the noise already present in the receiving environment ("residual noise") and the characteristics of the noise from the target source (noise with tone, impact, low frequencies and verbal, musical or information-bearing components [sound signals]).

Table 6-6 presents the maximum sound levels allowed outside a residence, based on the criterion retained.

Table 6-6: MELCC Noise Limits Retained

Day (7 a.m. to 7 p.m.)	Evening (7 to 10 p.m.)	Night (10 p.m. to 7 a.m.)
LAr,12 h ≤ 55 dBA or initial noise level if higher	LAr,1 h ≤ 45 dBA or initial noise level if higher or LAr, 3 h ≤ 55 dBA	LAr,1 h ≤ 45 dBA or initial noise level if higher

Only sound levels that can be attributed to noises emanating from the target activity must comply with these limits, not the total noise perceived in a location.

These limits are for an "assessment noise level" LAr, which takes into account the use of corrective terms, based on the type of noise emitted. In this case, we consider that the noise produced by the planned generating station during operation will not have characteristics that will require the application of corrective terms. This will have to be validated during the follow-up.

Based on the initial soundscape of the study area, the noise limits for this case are 55 dBA LAr for 12 hours a day and 45 dBA LAr for 1 hour in the evening and night.

Expected sound levels during the operation of the generating station

Noise compliance during operation

The noise compliance of the planned generating station was verified on the basis of the full-capacity operation of two of the three generating sets.

The position of the six assessment points is shown on Map 6-1. These points cover existing residential neighborhoods and two potential development areas: B-1 and B-2 (see Map A, pocket insert).

The envelope of the generating sets is the source of the noise emissions considered, the noise being transmitted to the outside through the walls of the generating station and through ventilation openings; this is the noise emitted by fuel combustion exhaust, the ventilation of cooling air intake and exhaust and, lastly, the radiators. These parameters were used to calculate the expected sound levels using SoundPLAN®. The expected sound levels, with the relevant limits, are presented in Table 6-7.

Table 6-7: Expected Sound Levels from the Generating Station during Operation

Assessment point	Expected sound levels (dBA)	Noise limits (dBA)		Compliance with retained criterion (Yes/No)	
		Day (7 a.m. to 7 p.m.)	Evening/Night (7 p.m. to 7 a.m.)	Day (7 a.m. to 7 p.m.)	Evening/Night (7 p.m. to 7 a.m.)
1	43	55	45	Yes	Yes
2	42			Yes	Yes
3	40			Yes	Yes
4	43			Yes	Yes
5	46			Yes	No
6	56			No	No

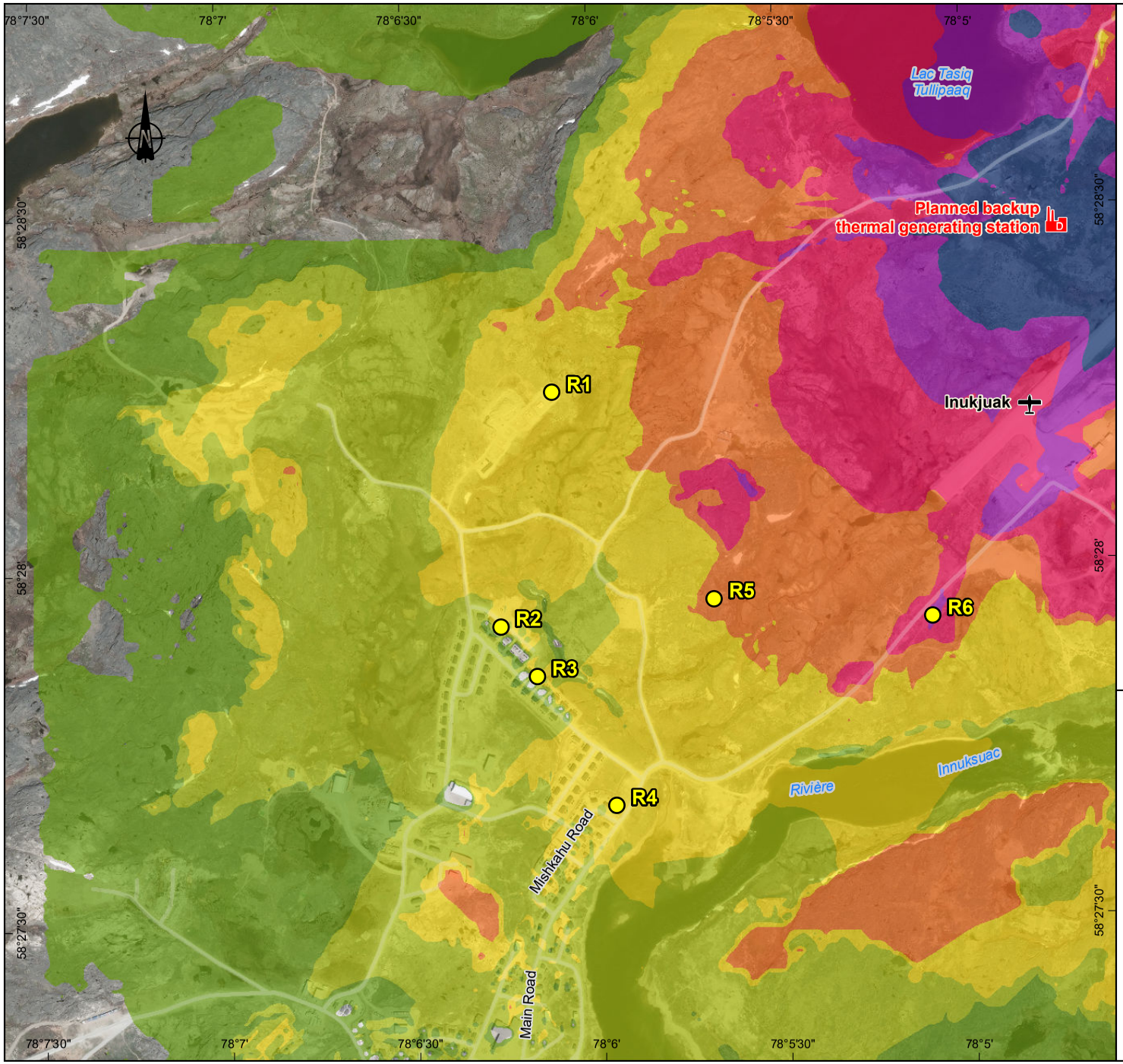
The sound modeling based on the initial configuration indicates expected non-compliance at two assessment points at night and at one assessment point during the day. These two points, numbers 5 and 6, are currently in unbuilt areas where housing developments are being considered.

Modeling was also carried out to draw noise curves (see Map 6-1). The results show that the noise limits retained were met for all existing residences in Inukjuak.

Mitigation measures

The results presented in Table 6-7 show that the expected levels at points 5 and 6 are not compliant. Although housing developments are being considered for these locations, they are currently uninhabited, so no additional mitigation measures are required at present.

A two-part follow-up will be carried out after the new generating station is in service, however. The first part will measure the sound level of the equipment to verify the modeling used in the present study, based on the actual sound power. The second part will consist in monitoring the receiving points when the generating station is in operation. Based on the results, mitigation measures may be considered if non-compliance is observed with relation to the noise criterion retained for built and inhabited environments.



Project component

Planned backup thermal generating station

Noise level at 1.5 m above ground in dB(A)

60
55
50
45
40
35
30

Receiver

Inukjuak backup thermal generating station

Expected sound levels during generating station operation

Sources:

Orthoimage (Pléiades-1B), resolution 50-cm, Airbus, 2019
Adresses Québec, MERN Québec, January 1, 2020
Adresses Québec réseau+, MERN Québec, December 1, 2019
Project data, Hydro-Québec, January 2021

Mapping: SNC-Lavalin
File: 3406_eic6_1_slq_013_bruit_210315a.mxd

0 150 300 m

MTM, Zone 10, NAD83 (SCRS)

Map 6-1

March 2021

Hydro Québec

Document for information purposes only. For any other use, please contact Géomatique at Hydro-Québec.

Assessment of the significance of the noise impact of the operation of the planned generating station on the soundscape

Method for assessing noise impact significance

As we have done with the other valued environmental components, we determine the significance of the perceived impact on the sound environment based on a combination of its intensity, its scope and its duration. However, the method for assessing the significance of the noise impact includes additional factors not considered for the other valued components of the environment.

The intensity of the perceived effect, based on the difference between the initial noise and the projected ambient noise, is determined by the extent of the change (relative approach) and by target sound levels (absolute approach). We determine the projected ambient noise by adding the specific noise to the initial noise.

The dose-response relationships outlined in ISO 1996-1,[1] based on the Schultz curve and many other studies, were used to assess the community's response to the potential acoustic nuisance related to the addition of noise from the planned generating station. The day/night rating level (LAr dn) was determined by applying corrective terms to initial noise and specific noise, to account for the type of noise (e.g., impact noise, tonal noise and noise in special situations), the time of day (day/night) and the environmental features. The corrective term for nighttime is +10 dB, between 10 p.m. and 7 a.m., to account for the fact that noise is more likely to be bothersome during this period.

A detailed description of the method for assessing the significance of the noise impact is presented in Appendix G.

The perceived effect of noise emissions from the operation of the generating station in inhabited areas, based on the day/night rating level (LAr dn) over 24 hours, is presented in Table 6-8.

Lastly, it bears reiterating that, unlike the existing generating station located in the village of Inukjuak, the new backup generating station will not operate permanently. It will be used only a certain number of days each year. Its operation is expected to be the equivalent of one month per year, as a backup for the Innavik hydroelectric generating station, and one hour per month for synchronization with the network. As such, the project will improve the current situation once the existing generating station has been dismantled by eliminating that source of noise in the center of the village.

1. ISO 9613-2:1996, International Standard, *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation*, December 1996.

Table 6-8: Significance of Perceived Noise Impact of the Generating Station during Operations

Assessment point	Day/night rating level LAr dn (dBA) [a]					Significance of impact [g]
	Initial noise [b]	Specific noise [c]	Correction made [d]	Corrected specific noise	Projected ambient noise [e, f]	
1	45	50	0	50	51	Low
2	45	48	0	48	50	Low
3	45	47	0	47	49	Low
4	45	49	0	49	50	Low
5	45	52	0	52	53	Low
6	45	62	0	62	62	High

Notes:
a. LAr dn = LAeq T + corrective terms (Kt, Ki and Ks), rounded to the nearest unit.
b. See Section 6.8.3.2.
c. Specific noise is calculated based on the rating levels in Table 6-7.
d. Corrective terms, when applicable.
e. The projected ambient noise is the logarithmic sum of the initial noise and the correction made.
f. The sound levels in this column correspond to the day/night rating levels (LAr dn dBA) and are therefore higher than the sound levels that would be measured on site, since they include the application of adjustment factors (penalties).
g. In keeping with the method described in Appendix D, when the scope of the disturbance is local and the duration is long, the significance is determined directly based on the intensity of the impact.

6.8.3.3 Assessment of residual impact

During the construction phase, the intensity of the residual impact on the soundscape is expected to be low and its scope limited, as most of the work will take place at the generating station site. The duration of the impact will be short, as it stems from certain construction activities.

During the operation phase, the intensity of the impact on the general soundscape of the northern village of Inukjuak is expected to be low, as the sound levels will be lower than those emitted by the current generating station, located in the center of the village. The scope of the impact will be limited and local, as it is restricted to specific areas of the village that are not yet built. The duration of the impact will be short, as it is restricted to one hour per month and about 30 days per year.

The residual impact of the project on the soundscape is expected to be minor.

6.8.4 Infrastructure and services

6.8.4.1 Construction phase – Anticipated impacts

The transport and traffic generated by the construction activity may disrupt local traffic and contribute to the deterioration of roads used by residents and land users. The level of disruption will depend primarily on the location of the borrow pits to be used during the project and the route the trucks will have to take to transport materials to the generating station site. The existing borrow pits are located primarily to the north and northwest of the village of Inukjuak. Using the borrow pits to the northwest of the village will force the trucks to drive a distance of over 8 km and to travel through the village. To a lesser degree, the transport of equipment and construction materials from the Inukjuak dock will also contribute to the disturbance of local traffic.

Local traffic disruptions will be felt by residents and land users, and may temporarily and occasionally interfere with certain public services (police, fire, drinking water supply, wastewater transport, waste transport, etc.).

Outside workers employed at the site during the construction phase will be housed at a camp built near the generating station. Their presence will have no effect on the community's existing housing infrastructures.

The waste materials and residual hazardous waste materials generated in the construction and operation phases will be sent to southern Québec to facilities authorized by the MELCC.

General mitigation measure

The application of Section 15 of the SECs will mitigate the impact on traffic and guarantee the maintenance and protection of roadways for the duration of the work.

Specific mitigation measures

The following specific mitigation measures will be applied:

- Inform the municipal council of the work schedule and the number of workers expected in the community.
- Establish a plan for transporting equipment and materials, in collaboration with the municipal council.
- Ensure that signage is adequate and that the vehicles are clearly visible.
- If necessary, use signalers or a safety escort during maneuvers by trucks or oversize loads.

6.8.4.2 Operation phase – Anticipated impacts

There will be no increase in traffic during the generating station's operating phase, as tanker trucks supplying the facility will be making fewer trips than they do for the existing generating station. The capacity of Inukjuak's other infrastructures and services (housing, landfill site, etc.) will be sufficient to meet the project's future needs, given the nature and scope of activities at the backup generating station, the number of employees involved and the end of operations at the current thermal generating station. No impact is expected on Inukjuak's infrastructures and services during the operation, servicing and maintenance phases.

6.8.4.3 Assessment of residual impact

Given the general and specific mitigation measures to be applied during construction, the intensity of the impact on the community's infrastructures and services will be low. The extent of the impact will be local and its duration moderate, as it will be limited to the construction phase.

The significance of the residual impact is therefore deemed to be minor.

6.8.5 Land use

6.8.5.1 Construction phase – Anticipated impacts

The planned site for construction of the generating station is nearly 2 km from the center of Inukjuak, between the landing strip and the access road leading to the future Innavik hydroelectric generating station. No specific zoning applies to this area. The limited study area is not conducive to fishing due to the absence of water bodies and, based on the information collected, it is rarely, if ever, used for hunting or gathering due to its proximity to the village and the airport. Only a picnic area was observed near the site, between the access road and Lac Tasiq Tullipaaq.

Note that the Inukjuak municipal council and Pituvik Landholding Corporation have already officially agreed to the proposed site for the future generating station. The municipal council passed a resolution to this effect on January 28, 2020.

No direct impact is expected on land use in the limited study area, since this area is not used by the local population for traditional activities. An increase in truck traffic in and around the village is expected, however, due to the transport of equipment and materials from the dock and borrow pits to the construction site. This increase may temporarily hinder access to land use areas but will not prevent it.

Specific mitigation measures

The following specific mitigation measures, already outlined in the previous section, will be applied:

- Inform the municipal council of the work schedule and the number of workers expected in the community.
- Establish a plan for transporting equipment and materials, in collaboration with the municipal council.

6.8.5.2 Operation phase – Anticipated impacts

The presence of the generating station will not interfere with current land use in the limited study area since the choice of the proposed site for the generating station was officially approved by the Inukjuak municipal council and Pituvik Landholding Corporation and the site offers little interest to those practising traditional fishing, hunting and gathering activities.

Ongoing activities—primarily vehicle and truck traffic to the site to allow for the operation, servicing and maintenance of the generating station and fuel supply—will be on a small scale and limited to the village and its immediate surroundings. Note that community members will still be able to use the picnic area located near the generating station, if they so wish.

No impact is therefore expected for land use during the operation phase.

6.8.5.3 Assessment of residual impact

The intensity of the impact is deemed to be low, as the construction activities will have little to no effect on the community's access to or use of the land. The scope of the impact will be local, as it will be felt by a limited portion of the population and in a small area. Its duration will be moderate, as the impact will be felt only during the construction phase.

The significance of the residual impact of the construction activities on land use is deemed to be minor.

6.8.6 Economic spinoffs

6.8.6.1 Anticipated construction-phase impacts and mitigation measures

The construction of the new generating station is expected to employ 25 workers during the first construction season (July to December 2023, or six months) and 20 workers during the second season (April to December 2024, or nine months). Most

of these workers will come from outside the village of Inukjuak, but local workers will be hired, based on their availability.

The presence of workers from outside the community may generate indirect spinoffs related to the purchase of goods and services in the community. It can be expected that outside workers will frequent local businesses during their time at the site. Furthermore, local suppliers hired for goods and services during the construction phase will boost local economic spinoffs. Local suppliers will be required primarily for the use of heavy machinery and for the transport and supply of granular materials. The local economic spinoffs of the project will be maximized.

Enhancement measures

The following enhancement measures will be applied:

- Implement measures (transportation, information, work schedules, frequency, etc.) to facilitate local workers' access to job and business opportunities created by the project and to foster retention of those workers.
- Encourage the hiring and training of local employees.
- Include incentives for hiring Indigenous people in calls for tenders issued to subcontractors.
- Give preference to local goods and services providers.

Construction of the generating station will have a positive impact in terms of economic spinoffs generated in the community. The project will lead to local jobs and contracts for local businesses, and it will have indirect and induced spinoffs for other businesses and services in the community.

6.8.6.2 Operation phase – Anticipated impacts

The operation and servicing phase of the generating station will not generate additional jobs. The new generating station will be operated by the two people who currently operate the existing generating station, both of whom are Inukjuak residents. Maintenance of the site will be carried out by specialized employees from outside the community, based on pre-established schedules or in response to outages or breakdowns. Once construction of the generating station has been completed, certain services will be required to maintain the site, including snow removal on the access road and the grounds around the station and fuel supply. As mentioned earlier, the transportation of diesel fuel will be entrusted to the Fédération des coopératives du Nouveau-Québec (FCNQ), which will deliver the fuel to the station by tanker truck.

Enhancement measures

The following enhancement measures will be applied:

- Give preference to local workers for the operation and servicing of the generating station and prepare for replacements for the two current employees.
- Give preference to local businesses to meet the servicing needs of the generating station site.
- If necessary, offer training to the generating station operators so that they, too, can contribute to maintenance activities.

The operation, maintenance and servicing activities for the generating station will have a positive impact on the economic spinoffs generated in Inukjuak. The project will maintain current jobs and generate contracts for local businesses without leading to major changes to the existing generating station's operations.

6.8.6.3 Assessment of residual impact

During the construction phase, the intensity of the impact is deemed to be moderate, the scope local and the duration moderate. During the operation phase, the intensity of the impact is deemed to be low, the scope limited and the duration long. Consequently, the significance of the project's residual impact is deemed to be minor.

6.8.7 Health and safety

6.8.7.1 Construction phase – Anticipated impacts

Transporting equipment and materials needed to build the new generating station will increase truck traffic in the community. This also includes transporting generating sets by truck from the port to the generating station, as well as various materials and equipment required for their installation. The temporary increase in transport on village roads poses a greater risk of accidents for residents and road users and may cause some noise and dust-related inconveniences due to trucking. Depending on the route the trucks will take to get to the jobsite, from the Inukjuak dock or from the borrow pits, they will have to drive at times on residential roads or near areas that are more at risk (schools, child care services, playgrounds, etc.).

Construction of the generating station will require the hiring of 20 to 25 workers, mostly from outside the village of Inukjuak. This will take place over two periods of approximately six and nine months. The presence of outside workers could lead to additional pressure on health services in the Inukjuak, as well as negative social impacts, particularly regarding alcohol and drug use or smuggling. However, the village of Inukjuak has a municipal bylaw regarding the consumption and sale of alcohol that outside workers will be required to comply with while in Inukjuak. Their

presence may also raise fears based on past negative experiences related to the presence of outside workers in the community (sexual abuse, physical or verbal abuse, etc.).

Specific mitigation measures

The following specific mitigation measures will be applied:

- Inform the municipal council of the work schedule and the number of workers expected in the community.
- Establish a plan for transporting equipment and materials, in collaboration with the municipal council. The plan will take into account the location of the most sensitive areas such as schools, playgrounds and childcare services, as well as school attendance periods and routes taken by school students.
- Implement appropriate road signs to improve user safety.
- If necessary, use signalers or a safety escort during maneuvers by trucks. Ensure that vehicles are clearly visible.
- Ensure the maintenance and cleaning of public roads used by heavy vehicles and use certified dust suppressants as needed.
- Educate workers from outside the community about the issues tied to their presence, provide them with a code of conduct and ensure that they read it.
- Ensure that external contractors read the code of conduct.
- Inform workers about the village of Inukjuak's alcohol regulations.
- Encourage workers to avoid alcohol or drug use during their construction stay.
- Develop a protocol to follow in the event of a worker's worsening health problem or a serious accident.

6.8.7.2 Operation phase – Anticipated impacts

Other than truck traffic for the supply of diesel to the generating station, no other potential impacts on the health and safety of Inukjuak residents are anticipated during the operation phase. Maintenance of the site will be carried out by specialized employees from outside the community, based on pre-established maintenance schedules or in response to outages or breakdowns. These stays will be of short duration and will involve very few employees.

As described in Section 6.6.2.2, Hydro-Québec will implement safety measures and an emergency measures plan during operation. Also, a technological risk analysis was conducted to assess the consequences of an accident on sensitive environmental elements (see Chapter 8).

Given their proximity to the Inukjuak airport (250 metres), the generating station's facilities will also have to meet Transport Canada's requirements regarding land use in the vicinity of aerodromes. Measures such as marking or lighting certain pieces of equipment have been included in the project design phase.

No impact on the health and safety of Inukjuak residents is anticipated, as there will be no significant increase in traffic in the village, the operation of the generating station will be carried out by local employees and visits by specialized personnel will be infrequent.

6.8.7.3 Assessment of residual impact

Given the specific mitigation measures put in place during the construction period, the intensity of the construction activities impact on the health and safety of Inukjuak residents is deemed to be low, its scope local and its duration moderate. The significance of the residual impact is considered moderate.

6.8.8 Sites of cultural, historical or archaeological interest

6.8.8.1 Construction phase – Anticipated impacts

Other than archaeological sites, no sites of cultural or historical interest were brought to Hydro-Québec's attention during consultations with the community.

Potential impacts on archaeological heritage are primarily related to the preparatory work and site facilities, levelling, excavation and earthwork, as well as waste management. These activities could damage or destroy archaeological remains.

An archaeological site was identified in the limited study area, which overlaps two areas of archaeological potential. The jobsite is located in an area of archaeological potential (Area B; see Map 5-3 in Chapter 5). Therefore, a systematic archaeological inventory (visual inspections and surveys) will be required prior to beginning construction work to validate the presence or absence of archaeological sites in the target area. This work is indispensable to ensure the absence of archaeological remains in the construction area.

General mitigation measures

The application of Section 19 of the SECs will ensure the integrity of the archaeological heritage, if any. Therefore, work will be halted in the event of a chance discovery of remains during excavation. Hydro-Québec, with the support of the concerned authorities, will then determine the necessary protective measures to be taken.

Specific mitigation measures

The following specific mitigation measures will be applied:

- If archaeological remains are found at the generating station site, salvage excavation will be considered.
- If archaeological remains are found near the generating station site, the remains will be marked to indicate their presence and their "sensitivity" to traffic and activities outside the site.

6.8.8.2 Operation phase – Anticipated impacts

No impacts on sites of archaeological interest are anticipated during the operation phase.

6.8.8.3 Assessment of residual impact

Given the mitigation measures put in place, the intensity of the construction activities' impact on sites of cultural, historical or archaeological interest is deemed to be low, its scope will be limited and its duration moderate. The significance of the residual impact is deemed to be minor.

6.8.9 Landscape

6.8.9.1 Method

Assessing a project's impact on the landscape is based on a distinct and adapted approach to this valued component of the environment. The method adopted here is based on the core principles of Hydro-Québec's recommended method for analyzing the impacts of its activities on the landscape.

A visual impact can be defined as a disturbance to the landscape as a result of changes caused by a project. This is determined based on an assessment combining the notions of landscape resistance and blending capacity of the intervention. The blending capacity is the physical compatibility of the project with the physical components of the landscape unit and is based on the potential to embed a new element into the landscape without compromising or altering the fundamental character of the initial landscape context. The degree of resistance of the landscape to changes caused by a project is determined by the relationship between visual accessibility, visual interest and landscape value. Damage to the integrity of the landscape is equivalent to a disturbance. The significance of the disturbance reflects the degree of visual impact.

Visual simulation is an analysis tool that helps decision makers, regional administrators and the public to better understand the nature of the project and visualize it to get an accurate picture of the changes to the landscape. The assessment of residual impacts is determined by the method of absorption and blending, taking into account the addition of mitigation measures to the project.

6.8.9.2 Construction phase – Anticipated impacts

The construction of the generating station will not have a significant impact on the landscape.

6.8.9.3 Operation phase – Anticipated impacts

The landscape of the extended study area is relatively homogeneous, consisting primarily of shrub tundra, wetlands, bodies of water and barren areas.

The generating station will be built near the airport, in a landscape already disturbed by airport infrastructures, industrial areas, the access road to the future Innavik generating station, an extraction site and other undefined disturbed environments. It will include a building housing the generating sets and smaller associated buildings. The future generating station (phase 2) will also be adjacent to the distribution substation built before the generating station (phase 1). Its location therefore aligns well with the industrial character of the existing landscape, which offers a positive absorption capacity.

The construction area does not include any site or point of visual interest. Observers most likely to have direct visual access to the new generating station are users of the access road leading to the future Innavik generating station and those using the airport, i.e., mobile and casual observers. As a result, the degree of landscape resistance is moderate.

No specific mitigation measures are anticipated during the operation phase.

6.8.9.4 Assessment of residual impact

The intensity of the project's impact on the landscape is deemed to be low, its scope limited and its duration long. The significance of the residual impact on the landscape is deemed to be minor.

6.9 Cumulative impacts

The Inukjuak generating station project will provide backup in the event of a planned outage or interruption of the Innavik generating station. During the operation phase, the generating station will have a positive effect on some impacts by moving a source of air pollution and noise from the heart of the village to a site nearly 3 km away. In addition, the project will lead to a reduction in GHG emissions compared to the current situation, as the new generating station will only be used as a backup, should the Innavik hydroelectric generation station become unavailable, and it will be equipped with the latest generation of gensets, which are more powerful and efficient.

With its design that incorporates best practices, compliance with environmental standards, optimization of its location to avoid sensitive environments and the implementation of mitigation measures during the construction and operation phase, the Inukjuak backup thermal generating station project will have no residual negative impact, of major or moderate significance, on the valued environmental components targeted in this study.

Given that the project's residual (negative) impacts are all deemed to be of minor residual significance, no cumulative effect is anticipated. In fact, it is believed that the project's impacts, all of minor significance, will have no significant cumulative effect on the potential residual impacts of other past, current and future projects, activities and events.

7 Environmental overview

The residual impacts on the various components of the biophysical and human environments are all of minor significance.

The impacts of the project will be felt primarily during construction. Given that the work will be localized, small in scale and carried out over a period of approximately 18 months, and that mitigation measures will be put in place, the impacts of the project will be rather low.

During operation, activities related to the generating station, its maintenance, servicing and fuel management will not cause any significant negative impacts. Instead, they will have positive impacts on air quality and economic spinoffs. Furthermore, the project will promote the reduction of GHG emissions, as the new generating station will only be used as a backup, should the Innavik hydroelectric generation station become unavailable.

Table 7-1 identifies potentially affected components of the biophysical and human environments, potential sources of impact, the project's environmental impacts, mitigation measures and residual impacts.

Table 7-1: Impact Assessment Overview

Environmental component	Main sources of impact	Description of impact	Mitigation measures	Assessment of residual negative impact
Biophysical environment				
Soils	Preparatory work and site facilities Levelling, backfilling and earthwork Waste management Operation of the generating station and fuel management Servicing and maintenance of generating station	Change in the soil surface and profile at platform location Erosion of bare soil Risk of soil contamination in the event of an accidental petroleum product spill Risk of soil contamination due to inadequate waste management	SEC: Sections 6, 10, 15, 16, 17, 21, 22, 24 Implement erosion control and sediment management measures for the work area in collaboration with the contractor. Once the work is completed, proceed with the restoration of the temporarily affected areas. Use the most appropriate revegetation technique for the affected area (seeding with a mixture adapted to the environment, etc.).	Construction Intensity: low Scope: limited Duration: moderate Operation Intensity: low Scope: limited Duration: long **Significance: minor**
Surface water (quality and drainage)	Preparatory work and site facilities Levelling, backfilling and earthwork Waste management Transport and traffic Operation of the generating station and fuel management Servicing and maintenance of generating station	Input and suspension of sediments in the aquatic environment Risk of water contamination in the event of an accidental petroleum product spill	SEC: Sections 6, 7, 9, 10, 15, 16, 17, 21, 22, 24 Implement erosion control and sediment management measures for the work area in collaboration with the contractor.	Construction Intensity: low Scope: limited Duration: moderate Operation Intensity: low Scope: limited Duration: long **Significance: minor**
Birds	Preparatory work and site facilities Levelling, backfilling and earthwork Transport and traffic	Habitat loss (approximately 0.53 ha of shrub tundra and disturbed environments) Disturbance of birds during construction work	Avoid carrying out construction work during the bird nesting period, which runs from May 25 to August 15. If this period cannot be respected, have a professional conduct a nest search after July 15.	Construction Intensity: low Scope: limited Duration: short **Significance: minor**
Human Environment				
Air quality	Preparatory work and site facilities Levelling, backfilling and earthwork Transport and traffic Operation of the generating station and fuel management Servicing and maintenance of generating station	Increase in dust during construction work Emissions of air contaminants during operation of the generating station Improvement in air quality in the village of Inukjuak after dismantling of the existing generating station	SEC: Section 20	Construction Intensity: low Scope: limited Duration: short Operation (positive impact) Intensity: moderate Scope: local Duration: long **Significance: moderate**

Table 7-1: Impact Assessment Overview *(continued)*

Environmental component	Main sources of impact	Description of impact	Mitigation measures	Assessment of residual negative impact
GHG emissions and climate change	Preparatory work and site facilities Levelling, backfilling and earthwork Transport and traffic Operation of the generating station and fuel management	GHG emissions during construction work Reduction of GHGs during operation of the generating station	None	Construction Intensity: low Scope: limited Duration: short Operation (positive impact) Intensity: low Scope: local Duration: long **Significance: minor**
Sound environment	Preparatory work and site facilities Levelling, backfilling and earthwork Installation of gensets, buildings and associated infrastructures Waste management Transport and traffic Operation of the generating station and fuel management	Increased ambient noise during construction (construction equipment, heavy vehicles and noisy equipment) and operation of the generating station	SEC: Section 2	Construction Intensity: low Scope: limited Duration: short Operation Intensity: low Scope: limited Duration: short **Significance: minor**
Infrastructure and services	Waste management Transport and traffic	Temporary traffic disruption on local roads Deterioration of local road conditions Temporary and limited interference with certain public services	SEC: Section 15 Inform the municipal council of the work schedule and the number of workers expected in the community Establish a transportation plan for the equipment and materials, in collaboration with the municipal council Ensure that signage is adequate and that the vehicles are clearly visible If necessary, use signalers or a safety escort during maneuvers by trucks or oversize loads	Construction Intensity: low Scope: local Duration: moderate **Significance: minor**
Land use	Installation of gensets, buildings and associated infrastructures Waste management Transport and traffic	Temporary disruption of access to land use sites	Inform the municipal council of the work schedule and the number of workers expected in the community Establish a transportation plan for the equipment and materials, in collaboration with the municipal council	Construction Intensity: low Scope: local Duration: moderate **Significance: minor**

Table 7-1: Impact Assessment Overview *(continued)*

Environmental component	Main sources of impact	Description of impact	Mitigation measures	Assessment of residual negative impact
Economic spinoffs	Employment and purchases of goods and services	Hiring of local workers and suppliers during construction work Indirect economic spinoffs through the purchase of goods and services in the community	Enhancement measures Implement measures (transportation, information, work schedules, attendance, etc.) to facilitate territory workers' access to job and business opportunities created by the project and to foster retention of those workers. Develop and implement an action plan to promote the hiring and training of local employees. Include incentives for hiring Indigenous people in calls for tenders issued to subcontractors. Give preference to local goods and services providers.	Construction (positive impact) Intensity: moderate Scope: local Duration: moderate Operation (positive impact) Intensity: low Scope: limited Duration: long **Significance: minor**
Health and safety	Waste management Transport and traffic Housing and worker presence	Temporary increase in traffic in the village of Inukjuak Increased risk of accidents with local road users Noise and dust-related inconveniences due to trucking Additional pressure on health services due to the presence of outside workers Negative social impacts caused by the presence of outside workers	Inform the municipal council of the work schedule and the number of workers expected in the community. Establish a plan for transporting equipment and materials, in collaboration with the municipal council. The plan will take into account the location of the most sensitive areas such as schools, playgrounds and child care services, as well as school attendance periods and routes taken by school students. Implement appropriate road signs to improve user safety. If necessary, use signalers or a safety escort during maneuvers by trucks. Ensure that vehicles are clearly visible. Ensure the maintenance and cleaning of public roads used by heavy vehicles and use certified dust suppressants as needed. Educate workers from outside the community about the issues tied to their presence, provide them with a code of conduct and ensure that they read it. Ensure that external contractors read the code of conduct. Inform workers about the village of Inukjuak's alcohol regulations. Encourage workers to avoid alcohol or drug use during their construction stay. Develop a protocol to follow in the event of a worker's worsening health problem or a serious accident.	Construction Intensity: low Scope: local Duration: moderate **Significance: moderate**

Table 7-1: Impact Assessment Overview *(continued)*

Environmental component	Main sources of impact	Description of impact	Mitigation measures	Assessment of residual negative impact
Sites of cultural, historical or archaeological interest	Preparatory work and site facilities Levelling, excavation and earthwork Waste management	Alteration of archaeological remains during construction	SEC: Section 19 If archaeological remains are found at the generating station site, salvage excavation will be considered. If archaeological remains are found near the generating station site, mark the remains to indicate their presence and their "sensitivity" to traffic and activities outside the site.	Construction Intensity: low Scope: limited Duration: moderate **Significance: minor**
Landscape	Presence of infrastructures	Change to landscape		Operation Intensity: low Scope: limited Duration: long **Significance: minor**

8 Technological accident risk management

8.1 Operation phase – Risk analysis

8.1.1 Objective

The purpose of analyzing the technological risks of the Inukjuak backup generating station during the operation phase is to determine accidental events that may occur, assess the potential consequences and determine the project's acceptability in terms of technological risks. It also serves to verify and optimize, if necessary, the protection measures put in place to avoid such accidents or reduce their frequency and consequences.

8.1.2 Scope of analysis

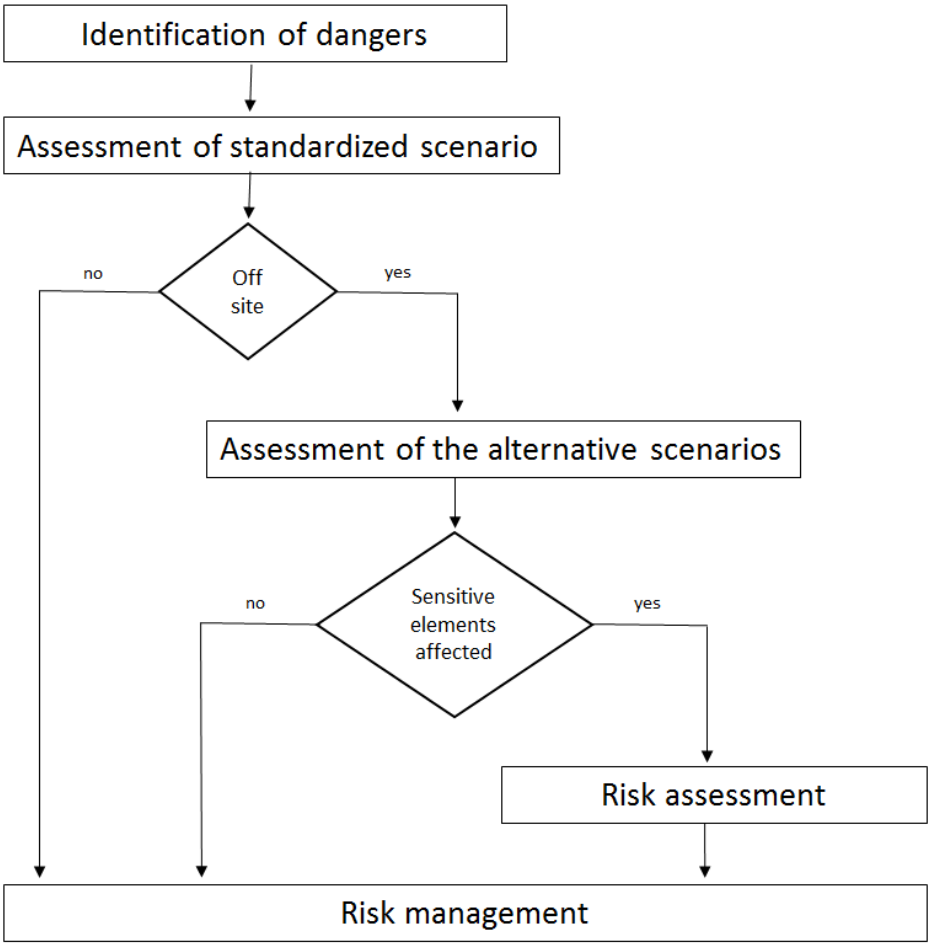
The risks covered by this analysis are major accidental events that could have consequences beyond the site of the planned generating station and damage the human or biophysical environment. This analysis does not cover:

- Risks related to industrial accidents
- Risks to the health of workers in the normal course of activities (occupational diseases)

8.1.3 General procedure

The general risk analysis procedure for the project meets the requirements of the Ministère de l'Environnement et de la Lutte contre les changements climatiques technological risk analysis guide (MENV, 2002). As Figure 8-1 shows, the first stage is to determine the dangers: hazardous substances involved in the project, sensitive elements near the construction site, sources of external risk, history of past accidents for similar facilities and accident scenarios applicable to the project. Then the potential consequences are assessed on the basis of standardized accident scenarios. If the assessment of these standardized accident scenarios shows that the consequences will remain within the site, the next part of the analysis focuses on risk management measures. Otherwise, the analysis continues with the assessment of alternative scenarios. If the accident scenarios assessed may affect the population, an additional assessment may be required on their frequency and risks. Lastly, the security measures in place are targeted and optimized to eliminate or reduce the risks, and a risk management plan is established, including an emergency measures plan, to manage the residual risks that cannot be eliminated.

Figure 8-1: Technological risk analysis procedure



8.1.4 Safety characteristics of the project

The intrinsic characteristics of the project make the risks for the human and biophysical environment low. The following characteristics will help reduce the risks related to this project:

- Relatively low quantity of diesel stored on the site
- Double-walled outdoor diesel tanks
- Retention and storage of waste from other equipment and tanks located inside the main building

8.1.5 Determination of sensitive elements in the environment

Sensitive elements in the environment are those that, due to their proximity, could be affected by a major accident at the site of the generating station. Table 8-1 provides a list of the main sensitive elements in the study zone environment. The location of these sensitive elements is presented on Map A (pocket insert).

As the project is in an isolated location, the nearby sensitive elements in the human environment are comprised primarily of the airport, which is immediately south of the site, the drinking water intake, which is in the Rivière Innuksuac by the airport, and the village of Inukjuak, the closest existing residences of which are located about 1.3 km from the site (the closest planned residential area is about 1 km from the site). There is also a road and a picnic area about 150 m to the north. As for the sensitive elements in the biophysical environment, to the southeast of the site there is the Rivière Innuksuac, and to the northwest, Lac Tasiq Tullipaaq, which flows into the river.

Table 8-1: Main Sensitive Elements in the Extended Study Area

Category	Description	Distance from generating station site
Population	Northern village of Inukjuak	Closest residences about 1.3 km
Infrastructure	Airport	200 m southeast of the runway 600 m south of the airport
	Drinking water intake	950 m southeast
	Road	150 m northwest
	Picnic area	200 m north
Environmental components	Rivière Innuksuac, running into Baie d'Hudson (Hudson Bay)	450 m southeast
	Lac Tasiq Tullipaaq	250 m northwest

8.1.6 Determination of external risks

External risks are natural or anthropogenic events with no connection to this project that are likely to interfere with the operation of the generating station or the integrity of the facilities.

8.1.6.1 Earthquakes

Eastern Canada (Ontario, Québec and the Maritime provinces) is located in a stable continental region of the North American tectonic plate, where seismic activity is generally low (Landry, 2013).

Eastern Canada has five zones with seismic activity that is relatively higher:

- Western Québec
- Charlevoix-Kamouraska area
- Bas-Saint-Laurent
- Northern part of the Appalaches (Appalachian Mountains)
- Southeast continental margin

As the construction area is not in any of these zones, the seismic risk can be deemed to be very low. The buildings and facilities will be built in compliance with the *National Building Code of Canada* (NBC), which sets standards for every seismic zone to ensure that buildings resist seismic loads.

8.1.6.2 Extreme weather conditions

Extreme weather conditions may take the form of heavy rain and violent wind. In winter, these conditions may take the form of heavy snowfall, violent wind, glaze ice or very low temperatures. The consequences of these extraordinary weather conditions may be direct or indirect. For example, wind, precipitation, snow and ice may lead to loads that can directly affect the integrity of the buildings or equipment.

The NBC (2015) defines local weather data as the hourly wind pressure, maximum depth of precipitation, maximum load due to combined snow and rain, which will be taken into consideration in the design of the generating station buildings and equipment. They will be built in compliance with the codes and regulations in effect so they are able to resist extreme weather conditions.

8.1.6.3 Flooding

Flooding usually occurs upstream of ledges (raising of the watercourse or narrowing of the banks) that hinder the flow of the water. The formation of ice jams can also contribute to flooding by obstructing the flow of the water, especially at narrow points in the watercourse.

The construction site is above the level of the Rivière Innuksuac and Lac Tasiq Tullipaaq, the two closest components of the water system. They therefore present no risk of flooding at the project site.

8.1.6.4 Instability of the terrain

The construction of the buildings and equipment will be adapted to the characteristics of the terrain (primarily rock) and the presence of permafrost to prevent instability due to climate change or heat released into the soil through the operation of the generating station.

8.1.6.5 Air transport

The Inukjuak airport, used only by small aircraft, is directly south of the construction site of the generating station. The main generating station building will be located just over 200 m away from the side of the runway, outside the approach and takeoff zone, where the risk of aircraft accidents is higher. As it is outside this zone, and due to the low traffic, the generating station will be exposed to a low risk of aircraft accident.

The height of the generating station buildings and smokestacks will be low. Transport Canada will be consulted to verify whether marking is required due to the proximity of the airport (Standard 621 – Obstruction Marking and Lighting – Canadian Aviation Regulations).

8.1.6.6 Industrial and commercial activities

The site of the generating station is in a place without significant industrial or commercial activities that may represent an external risk.

8.1.7 Hazardous substances present at the generating station and type of storage

This section describes the hazardous substances that could have negative consequences for the human and biophysical environments in the event of an accidental release, as well as the equipment in which they are stored. The hazardous substances are confined to the generating station powerhouse (small indoor tanks), the HMRC shelter in the yard (barrels) or outdoor tanks adjacent to the building (diesel). Table 8-2 summarizes the information about these substances, the safety data sheets for which can be found in Appendix H.1.

Table 8-2: Presentation of Main Hazardous Substances

Name	Storage [a]	Maximum quantity on site [a]
Diesel	2 outdoor tanks	2 x 50 m^3
	1 indoor day tank	2.5 m^3
Lubricating oil for generating sets	1 indoor tank and 24 barrels	3 m^3 (tank) 4.9 m^3 (24 205-l barrels)
Coolant and antifreeze (ethylene glycol) for generating sets	1 indoor tank and 8 barrels	2 m^3 (tank) 1.6 m^3 (8 205-l barrels)
Insulation oil for transformers	7 oil transformers	11.2 m^3
Residual hazardous materials	2 indoor tanks and 52 barrels	4.5 m^3 (tanks) 10.7 m^3 (52 205-l barrels)

a. These data are approximate. The number of barrels will vary depending on the frequency and actual use of the generating station. The tanks and barrels are not normally all full at the same time.

8.1.7.1 Diesel

The generating station's generating sets operate using Arctic Fuel diesel. This is a low-volatility product made from the distillation of petroleum and classified as a class-II combustible. Its flash point ranges from 40º to 90ºC, which means it emits no vapor at room temperature. As its relative density ranges from 0.78 g/ml to 0.88 g/ml, it is lighter than water, in which it is considered to be very slightly soluble.

Diesel can be stored in two horizontal double-walled tanks with a capacity of 50 m^3 each. The storage capacity will be sufficient to supply the generating station for a minimum period of seven days. Diesel will also be held in a day tank, located inside the powerhouse and used for the daily supply of the generating sets. The diesel consumption is expected to be about 350 m^3/year.

8.1.7.2 Lubricating oil

Oil will be used for the lubrication system of the generating sets. Made from heavy petroleum fractions, oil is a combustible liquid but not very volatile (flash point > 200ºC). With a relative density of about 0.88 g/ml, oil is lighter than water, in which it is very slightly soluble.

The lubricating oil, which must be replaced periodically, will be delivered to the generating station in barrels and then transferred to a tank with a capacity of 3 m^3. Its capacity will be sufficient to allow for a minimum of three oil changes without refills from the barrels. This tank will be stored in the powerhouse.

8.1.7.3 Coolant and antifreeze

The generating units will be equipped with a cooling system that uses an industrial-use liquid (ethylene glycol) as a coolant and antifreeze. Ethylene glycol is a viscous liquid, slightly volatile (flash point around 116ºC) and completely miscible with water.

Delivered to the generating station in barrels, the liquid will be transferred to a tank with a capacity of 2 m^3, stored in the powerhouse.

8.1.7.4 Insulating oil

Oil is used in transformers as a coolant and dielectric insulator. The general features of insulating oil are similar to those of lubricating oil: it has a high flash point and is not water-soluble.

The insulating oil will be present in two power transformers containing approximately 5,000 l each and six auxiliary service transformers containing approximately 200 l each.

8.1.7.5 Residual hazardous materials

The operation of the generating station will generate used oil, either from the lubricating oil in the generating sets, which must be replaced periodically, or from waste oil, mixed with water, which may accumulate in the sumps inside the station building. Spent coolant will also be generated as it is periodically replaced in the cooling system.

This waste material will be temporarily stored in drums and tanks for disposal in accordance with applicable regulations.

Other substances will be present, such as cleaning products, degreasers and solvents. These substances will be used and stored in small quantities so that they do not pose a significant risk.

8.1.8 Transport of hazardous materials

The modes of transport and delivery frequencies for hazardous materials are summarized in Table 8-3. These data are estimates and may vary somewhat during operation.

Table 8-3: Transport of Hazardous Substances from the Inukjuak Dock to the Backup Thermal Generating Station

Substance	Mode of transport	Delivery frequency [a]
Diesel	Tank truck	35 times/year
Lubricating oil	Barrels transported by truck	Once a year
Coolant and antifreeze (ethylene glycol)	Barrels transported by truck	Once a year
Residual hazardous materials	Barrels transported by truck	Once a year

a. These data are approximate. The number of barrels will vary depending on the actual frequency and use of the generating station.

The diesel used as fuel will be transported to the generating station in tank trucks that will be supplied from the fuel depot located in the center of the village of Inukjuak. The distance between this depot and the site of the generating station is approximately 3 km. Lubricating oil, coolant, antifreeze and other substances will be delivered in drums or cans via containers brought to Inukjuak by sea and then transported by truck from the dock to the generating station. Residual hazardous materials will be drummed and trucked to the dock to be sent by ship to Hydro-Québec's hazardous material treatment center via the Port of Bécancour.

The volume of dangerous goods transported will change little, since the backup generating station will replace the existing one. This transport should in fact decrease with the presence of the Innavik hydroelectric generating station.

8.1.9 Accident history

The history of accidents that have occurred at similar facilities can be used to better define the nature of the problems that may occur and thus establish and analyze accident scenarios. It can also be used to improve the design of the generating station and its equipment, to determine the safety equipment required, and to better define the risk management plan.

Table 8-4 summarizes the incidents that have occurred at the existing generating station in the village of Inukjuak. Of these, three are considered significant due to diesel releases of 400 or 500 l. A fourth, classified as very significant, consists of a diesel release of 13,500 l. Other small, inconsequential incidents are not summarized in this table (< 100 l).

Table 8-4: Summary of Diesel Spills (> 100 l) that Occurred at the Inukjuak Generating Station

Date	Quantity (l)	Equipment involved	Cause
April 2003	500	Tank yard	Human error
November 2004	400	Pipe	Equipment failure
June 2010	400	Undefined	Equipment failure
August 2015	13,500	Tank yard	Incorrect switching operation during work

Equipment failure and human error were the causes of these incidents involving storage tanks or other related equipment containing diesel fuel. Most of the releases remained contained and had no effect on the environment. In the larger 2015 incident, the diesel remained in a very small area in the immediate vicinity of the generating station and did not reach any bodies of water.

Table 8-5 shows the major diesel spills that occurred at other Hydro-Québec thermal generating stations. Only the 2015 incident at Ivujivik can be considered very significant. Part of the spill reached a stream and Baie d'Hudson.

Table 8-5: Summary of Diesel Spill (> 100 l) that Occurred at other Hydro-Québec Thermal Generating Stations

Year	Generating station	Quantity (l)	Cause
2012	Kuujjuaq	113	Human error
2012	La Romaine	100	Human error
2013	Salluit	1,000	Equipment failure
2015	Ivujivik	14,200	Equipment failure

The major release that occurred at the Iles-de-la-Madeleine thermal generating station in 2014 is not included in this history because it involved the pipeline, a type of equipment that will not be found at the Inukjuak backup generating station.

8.1.10 Identification of potential accidental events

The potential accidental events at the station are essentially a loss of containment or a hazardous material spill (diesel, various oils, coolant and antifreeze) which could be caused by the following:

- equipment failure (design or construction error, wear or corrosion, activities outside of boundaries)
- human error (incorrect procedure, incorrect switching operation)
- external risks (earthquake, extreme weather conditions, aircraft accidents, malicious acts)

This loss of containment or spill could result in any of the following:

- soil, groundwater or surface water contamination
- fire in the event the spilled liquid ignites
- explosion in the event of the formation of flammable vapor and ignition in a confined environment (inside a building)
- transformer fire or explosion

A spill without ignition is the most likely event. The probability of ignition of a liquid or vapor spill is relatively low because these substances have low volatility and high flash points. The possibility exists for lubricating oil, coolant, and insulating oil in transformers operating at high temperatures, or if the spilled liquid touches a very hot surface.

The main protective measures to control these accidental events primarily involve various retention systems to catch potential spills and a fire protection system.

8.1.10.1 Spills

Table 8-6 shows the various equipment and activities that could be the source of a spill, as well as the main measures planned to prevent or protect against it, several of which are retention systems.

Table 8-6: Sources of Potential Spills and Main Safety Measures

Equipment or activity at source of spill	Preventive or protective measures
Diesel	
Main outdoor tanks	• Double-walled tanks • Manual isolation gate at each tank, accessible from the walkway • Monitoring of level variation with alarm • Emptying of tanks with piping entering from above • Bollards
Overfilling of tanks (unloading from tank truck to main tanks)	• Filling enclosure • Level indicator with high level alarm • Constant presence of an operator during unloading
Flexible hose (unloading from tank truck to main tanks)	• Manual shut-off valve on the tank truck • Constant presence of an operator during unloading • Regular inspection and replacement of flexible hoses • Recovery kit nearby
Pipelines between the main tanks and the day tank	• High level pipelines (above the maximum level in the tanks) to the interior, as the tanks cannot be emptied by gravity • Corrosion protection • Impervious floor with sumps and detection probes (inside)
Indoor day tank	• Double-bottom tank • Impervious floor with sumps and detection probes
Overfilling of the indoor day tank	• Level indicators (magnetic level indicator and analog level probe) • Impervious floor with sumps and detection probes
Circuit between the day tank and the generating sets	• Impervious floor with sumps and detection probes
Lubricating oil	
Indoor tank	• Double-bottom tank • Impervious floor with sumps and detection probes
Indoor tank overfill / Barrel transfer to the tank	• Visual level indicator and high level switch connected to the pump • Push button to stop pumping • Continuous monitoring • Impervious floor with sumps and detection probes
Filling of generating sets from the tank	• Push button to stop pumping • Continuous monitoring • Regular inspection and replacement of flexible hoses • Impervious floor with sumps and detection probes
Storage and movement of barrels	• Storage of barrels in an HMRC shelter • Recovery kits

Table 8-6: Sources of Potential Spills and Main Safety Measures *(continued)*

Equipment or activity at source of spill	Preventive or protective measures
Coolant and antifreeze	
Indoor tank	• Impervious floor with sumps and detection probes
Indoor tank overfill / Barrel transfer to the tank	• Visual level indicator and high level switch • Push button to stop pumping • Continuous monitoring • Impervious floor with sumps and detection probes
Circuit	• Welded piping • Impervious floor with sumps and detection probes (indoor circuit)
Filling of the circuit from the tank or barrels	• Push button to stop pumping (manual hold) • Continuous monitoring • Impervious floor with sumps and detection probes
Drainage from tank to barrels or drainage from circuit directly to barrels	• Push button to stop pumping • Manual valve • Continuous monitoring • Impervious floor with sumps and detection probes
Storage and movement of barrels	• Storage of barrels in an HMRC shelter • Recovery kits
Used oil	
Indoor tank	• Double-bottom tank • Impervious floor with sumps and detection probes
Indoor tank overfill / Emptying of generating sets to the tank	• Visual level indicator and high level switch • Push button to stop pumping • Continuous monitoring • Impervious floor with sumps and detection probes
Emptying of the tank to the barrels or emptying of generating sets directly to the barrels	• Push button to stop pumping • Manual valve • Continuous monitoring • Regular inspection and replacement of flexible hoses • Impervious floor with sumps and detection probes
Storage and movement of barrels	• Storage of barrels in an HMRC shelter • Recovery kits
Waste oil	
Indoor tank	• Double-bottom tank • Impervious floor with sumps and detection probes
Indoor tank overfill / Emptying of sumps to the tank	• Level detection probe • Impervious floor with sumps and detection probes
Emptying of tank to the barrels	• Push button to stop pumping • Manual valve • Continuous monitoring • Regular inspection and replacement of flexible hoses • Impervious floor with sumps and detection probes
Storage and movement of barrels	• Storage of barrels in an HMRC shelter • Recovery kits

Table 8-6: Sources of Potential Spills and Main Safety Measures *(continued)*

Equipment or activity at source of spill	Preventive or protective measures
Insulating oil	
Transformers	• Contained storage area under the transformer with firewall
Other	
Oil or fuel leakage from machinery or vehicles outside	• Recovery kits

8.1.10.2 Fires

Some of the spills described in the previous section could create a fire if ignited, especially for combustible liquids used at high temperatures or if the spilled liquid touches a very hot surface.

Fire protection for the new Inukjuak generating station will be provided primarily by an active (automated) protection system to safeguard the following rooms:

- generating set compartment
- indoor tank room
- pump room

The active protection system has not yet been selected as the detailed engineering is not yet finalized. In addition to the fire panel and associated detection accessories, three active protection systems are currently under consideration: Novec 1230 (gaseous extinguishing agent), Monarch (dry chemical) and GreenEx (aerosol).

Fire protection will also be provided through strategically located portable fire extinguishers and various passive measures (equipment separation, fire retardant materials, etc.).

8.1.11 Effect of air emission plume on aviation activities

Air emission plumes or exhaust trails can, in some cases, pose a hazard to aviation operations. The main effects can be reduced visibility, oxygen depletion and, in the case of high-temperature exhaust trails, air disturbance such as turbulence and vertical shear. These hazards are most critical during low-level flight, particularly during takeoff and landing (Transport Canada, 2013).

The generating station's smokestacks will be located just over 200 m from the nearest part of the runway and at least 500 m from its ends. In addition, the station will be located outside the airport's approach and takeoff zone. Given the location and relatively small capacity of the generating station, it is anticipated that the plume emitted from the stacks will not interfere with aviation operations. Transport Canada will be consulted to further determine these effects.

8.1.12 Assessment of the consequences of accidental events

The methodology guides for technological risk analysis (MENV, 2002; CRAIM, 2017), which include lists of hazardous materials and their threshold quantities, will be used to determine whether accident scenarios should be assessed for these substances. These guides also indicate that hazardous materials should be considered if they may have off-site consequences. Note that diesel is not mentioned.

Therefore, a standard scenario for determining the potential for off-site consequences must be assessed. This scenario is as follows: evaluation of an emission of the largest quantity of a hazardous substance contained in the largest container, with the greatest distance of impact, based on passive protective measures.

For diesel, double-walled tanks are considered a passive protective measure. In the event of a leak from the tanks, the diesel would remain contained by the second wall so that there would be no consequences outside the site boundaries.

For other hazardous substances, the planned passive protection measures also ensure that there will be no off-site consequences in the event of an accidental spill: a holding room with sumps or contained storage areas for indoor tanks and contained storage areas under the oil transformers.

As per the general approach explained in Section 8.1.3, the remainder of the analysis in the following sections is limited to risk management, since potential accidents cannot have off-site consequences.

8.2 Accident prevention measures and facility safety in the operation phase

To ensure the safety of people and places during operation of the generating station, applicable laws, regulations and codes will be followed in the design of equipment and construction of facilities. In addition, protective equipment and a risk management program will be in place to eliminate or reduce the risk of accidents.

8.2.1 Safety equipment and measures

A number of safety equipment items and measures have been provided to eliminate or reduce the risk of accidents. Most of these have already been detailed in Section 8.1.10, and this section will simply recall the main ones:

- fenced site and controlled access
- design and construction that take into account northern conditions and the presence of permafrost
- double-walled outdoor diesel tanks
- indoor equipment and tanks located in basin rooms with sumps
- HMRC shelter for barrel storage
- automated fire protection system to protect the genset bay, indoor tank room and pump room
- response equipment for spills (recovery kits) and small fires (portable extinguishers)

8.2.2 Risk management program in the operation phase

To ensure the safety of the public, the environment and workers during operating activities, a program will be implemented to manage risks that cannot be eliminated with the planned means of protection. Based on practices already in place at other Hydro-Québec thermal generating stations, this program will include the following elements:

1. Monitoring during construction and operation of the generating station
2. Commissioning and start-up procedures
3. Safe operating procedures, including continuous monitoring of activities
4. Regular equipment inspection, maintenance and replacement programs
5. Documenting and updating information on:
    a. dangers associated with operating activities and hazardous materials
    b. hazardous material inventories (quantities stored, delivered or shipped off site)
    c. equipment design and changes
    d. operating procedures, normal operating conditions and safety systems in place
    e. electrical systems, instrumentation, etc.
6. Visual identification of stored hazardous materials, pipes and connections to the unloading area

7. Safety training for all employees covering the following main elements:
   a. generating station operation and organization
   b. the risks inherent in the generating station's activities
   c. safe work methods
   d. personal protection through the means available to workers
8. External services subject to a specific authorization and informed of the safety instructions
9. Safety procedures developed for the delivery of diesel and the unloading of tank trucks (use of reserved area, prior verification of the level in the tank, presence of an operator at all times, etc.)
10. Safety procedures developed for the delivery, unloading and loading of substances transported in barrels or other containers (oils, coolant and antifreeze, etc.)
11. Measures to control the activities of contractors performing work at the generating station:
    a. knowledge of safety rules
    b. verification of competency (contractors certified and familiar with codes)
    c. inspection of work performed
12. Investigation of accidents and incidents to determine causes and implement corrective measures
13. Regular verification of safety management system compliance
14. Change management and continuous improvement process

8.3 Operation phase – Emergency measures plan

An emergency measures plan will be prepared for the new generating station's operation phase. This plan will be incorporated into the one already in place for all Hydro-Québec thermal generating stations, which takes into account their location in small, isolated communities.

The plan's objectives will be to:

- ensure the safety of the public, employees and external stakeholders
- reduce the risk of property damage and environmental impacts in the event of an accident
- plan emergency procedures to minimize response and recovery time and costs
- define the responsibilities of employees and external responders in planning and executing emergency response

This emergency measures plan will include:

- the appointment of an emergency measures plan director
- emergency plan training for each employee
- training for staff on response equipment (fire extinguishers, spill kits) and first aid materials
- the posting of the evacuation plan and safety instructions in the workplace

A preliminary version of this emergency measures plan is presented in Appendix H.2. A final emergency measures plan, including scenarios for each type of major accident considered, will be developed before operations begin. It will incorporate key information from the project risk analysis. In addition, the Inukjuak municipal council and other public authorities that may be affected will be consulted.

8.4 Construction phase – Risk analysis

During construction, the hazards will mainly be spills or fires involving hydrocarbons at the jobsite.

Specifically, the following accidental events could occur:

- fuel leakage during the refueling of rolling stock and construction machinery
- hydraulic oil leaks from rolling stock and construction machinery
- spill or fire from temporary fuel tanks at the jobsite
- spill or fire at residual hazardous material storage sites at the jobsite

Explosives will not be used during the construction phase.

8.5 Safety equipment and measures during the construction phase

Various pieces of equipment will be available to respond to any accidental event that occurs during construction:

- emergency response kits located at strategic points at the jobsite to respond quickly to any spills
- portable fire extinguishers to control small fires

Although not intended for this purpose, machinery available at the jobsite may be used to limit the extent of a major spill by constructing trenches or embankments. The use, maintenance and refueling of machinery at the jobsite will be subject to the following measures:

- Refueling shall be conducted under continuous supervision and at dedicated locations.
- If fuel tanks are present at the jobsite, they shall be double-walled or have a retaining basin.
- Transportation of fuel and other hazardous substances shall be in accordance with the *Transportation of Dangerous Goods Regulations*.
- A temporary storage area to facilitate consolidation (e.g., filling barrels) will be provided to allow contractors to finalize packaging and labeling prior to shipment to authorized sites.
- The temporary area will be set up to meet the requirements of the *Regulation respecting hazardous materials*.

The requirements mentioned in this section will be specified in the environmental specifications that all contractors will be contractually bound to follow. A Hydro-Québec environmental supervisor will ensure their application during the construction phase.

8.6 Construction phase – Emergency measures plan

A specific emergency plan will be developed to address emergency situations during the construction period. As is the case on most construction sites, the contractor assigned to the construction will be contractually obliged to put in place its own emergency measures plan, adapted to the hazards inherent to its work. Hydro-Québec will ensure this emergency plan is compliant.

The emergency response measures will allow for the rapid and effective deployment of personnel and equipment to limit the consequences of an emergency. In the event of a spill, the contaminated material and soil will be recovered and disposed of in accordance with the regulations in effect.

A preliminary version of the emergency measures plan that will be required of the contractor is included in Appendix H.3.

9 Environmental monitoring and follow-up

9.1 Environmental monitoring

Hydro-Québec conducts environmental monitoring at all stages of a project. It adapts its environmental monitoring programs to the specific characteristics of the project and its host environment, and ensures that mitigation measures are applied in the field.

Before the work begins, the environmental project manager produces the environmental monitoring program in which they compile all the environmental commitments in a table and makes sure that each commitment will be taken care of either by the person in charge at the jobsite or by different persons in charge within the company. The environmental project manager drafts the environmental clauses of the calls for tenders so that the contractors comply with the environmental commitments.

At the beginning of the construction phase, the construction manager, the site environmental supervisor and the construction contractor receive the environmental monitoring program.

The construction manager and the site environmental supervisor are responsible for protecting the environment at the jobsite. They ensure that the contractor complies with the environmental protection provisions of the contract and that the contractor is fully aware of the SECs in the contract and any special provisions for the project.

At the end of the construction work, the environmental supervisor ensures that the site is restored, proceeds with the environmental acceptance of the work and certifies the application of the mitigation measures.

9.2 Environmental follow-up

During the operation phase, the proponent must ensure that the environment is protected in all its activities. Due to the analysis of the project's impacts on the environment, monitoring of the sound environment is proposed during the first year of operation.

Monitoring of the sound environment will be conducted once the new generating station is in operation. This monitoring will have two objectives:

1. Measure the sound level of the equipment to verify the modeling used in the present study, based on the actual sound power
2. Monitor the receiving points when the generating station is in operation

Based on the results, mitigation measures may be considered if exceedances of the noise criterion retained for built and inhabited environments are noted.

10 References

ALLARD, M. AND M. K.-SÉGUIN. 1987. "Le pergélisol au Québec nordique : bilan et perspectives." *Géographie physique et Quaternaire.* Vol. 41, No. 1, pp. 141-152.

ALLARD, M., F. CALMELS, D. FORTIER, C. LAURENT, E. L'HÉRAULT and F. VINET. 2007. *Cartographie des conditions de pergélisol dans les communautés du Nunavik en vue de l'adaptation au réchauffement climatique.* Ouranos and Natural Resources Canada. 42 p.

ALLARD-MARTIN, D. 2019. *La longue route vers Kuujjuaq*. Lab N360. Online. [https://www.n360.uqam.ca/v02-eau-sous-zero, viewed on May 11, 2020.]

Anctil, M. 2008 *Les faits saillants de l'enquête. Enquête de santé auprès des Inuits du Nunavik 2004, Qanuippitaa ? How will we manage this information?* Institut national de santé publique du Québec (INSPQ) and Régie régionale de la santé et des services sociaux du Nunavik (RRSSSN). 7 p.

ASSOCIATION INUKSUK. 2020. *Introduction au monde inuit.* Online. [https://espace-inuit.org/introduction-au-monde-inuit/, viewed on November 4, 2020.]

ATLAS DES AMPHIBIENS ET DES REPTILES DU QUÉBEC (AARQ). 2020. *Atlas des amphibiens et reptiles du Québec : banque de données active depuis 1988 alimentée par des bénévoles et professionnels de la faune.* Société d'histoire naturelle de la vallée du Saint-Laurent. Viewed on June 25, 2020.

AVATAQ CULTURAL INSTITUTE. 2020*a*. *Institute*. Online. [http://www.avataq.qc.ca/en/L-institut, viewed on July 2, 2020.]

AVATAQ CULTURAL INSTITUTE. 2020*b*. *État des connaissances archéologiques dans l'aire d'étude du projet de centrale de réserve à Inukjuak (Nunavik).* Report prepared for Hydro-Québec, Direction Environnement. 50 p.

BAZOGE, A., D. LACHANCE AND C. VILLENEUVE. 2015. *Identification et délimitation des milieux humides du Québec méridional.* Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, Direction de l'expertise en biodiversité and Direction de l'aménagement et des eaux souterraines. 64 p.

BIBBY, C. J., N. D. BURGESS AND D. A. HILL. 1992. *Bird census techniques*. London, British Trust for Ornithology and Royal Society for the Protection of Birds, Academic Press. 257 p.

BIRDS CANADA. 2020. *Nesting Calendar Query Tool.* Online. [https://www.birdscanada.org/apps/rnest/index.jsp?lang=EN, viewed in June 2020.]

BLEAKNEY, S., 1958. *A zoogeographical study of the amphibians and reptiles of eastern Canada*. Ottawa, National Museum of Canada, Bulletin 155, Biological Series 54. 119 p.

BLONDEAU, M. 2004. *Atlas des plantes des villages du Nunavik.* Montréal, Éditions MultiMondes.

BLONDEL, J., C. FERRY AND B. FROCHOT. 1981. "Point counts with unlimited distance." in C. J. Ralph and J. M. Scott (ed.). *Estimating the numbers of terrestrial birds. Studies in Avian Biology No.* 6. pp. 414-420.

CANADIAN POLAR COMMISSION. 2014. *Health and Well-being in the Canadian North: Recent Advances and Remaining Knowledge Gaps and Research Opportunities.* 65 p.

CANADIAN PUBLIC HEALTH ASSOCIATION. 2020. *What are the social determinants of health?* Online. [https://www.cpha.ca/what-are-social-determinants-health, viewed on November 4, 2020.]

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC). 2018. *COSEWIC Assessment and Status Report on the Polar Bear (Ursus maritimus) in Canada*. Ottawa, Committee on the Status of Endangered Wildlife in Canada . 129 p.

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC). 2017. *COSEWIC Assessment and Update Status Report for the Rusty Blackbird (Euphagus carolinus) in Canada*. Online. [https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/rusty-blackbird-2017.html, viewed in November 2019.]

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC). 2014*a*. *COSEWIC Assessment and Update Status Report for the Wolverine (Gulo gulo) in Canada*. Ottawa. 87 p.

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC). 2014*b*. *COSEWIC Assessment and Update Status Report for the Red-necked phalarope (Phalaropus lobatus) in Canada.* Ottawa. 59 p.

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC). 2013. *COSEWIC Assessment and Status Report on the Bank swallow (Riparia riparia) in Canada*. Ottawa. 59 p.

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC). 2011. *COSEWIC Assessment and Status Report on the Barn swallow (Hirundo rustica) in Canada*. Ottawa. 45 p.

CONSEIL POUR LA RÉDUCTION DES ACCIDENTS INDUSTRIELS MAJEURS (CRAIM). 2017. *Guide de gestion des risques d'accidents industriels majeurs*. 7th edition.

CONSEIL POUR LA RÉDUCTION DES ACCIDENTS INDUSTRIELS MAJEURS (CRAIM). 2017. *Les valeurs de référence de seuils d'effets pour déterminer des zones de planification des mesures d'urgence et d'aménagement du territoire.* 2nd edition.

DESROSIERS, N., R. MORIN AND J. JUTRAS. 2002. *Atlas des micromammifères du Québec*. Québec, Société de la faune et des parcs du Québec, Direction du développement de la faune. 92 p.

DUHAIME, G. 2008. *Profil socioéconomique du Nunavik. Edition 2008*. Québec, Université Laval, Chaire de recherche du Canada sur la condition autochtone comparée. 128 p.

DUHAIME, G. 2009. *La pauvreté au Nunavik. État des connaissances*. Québec, Université Laval, Chaire de recherche du Canada sur la condition autochtone comparée. 46 p.

DUHAIME, G. AND V. ROBICHAUD. 2007. *Portrait économique du Nunavik en 20*03. Québec, Université Laval, Chaire de recherche du Canada sur la condition autochtone comparée. 52 p.

DUHAIME, G., S. LÉVESQUE AND A. CARON. 2015. *Le Nunavik en chiffres 2015 version intégrale*. Québec, Université Laval, Chaire de recherche du Canada sur la condition autochtone comparée. 133 p.

DUTIL, D. 2010. "La situation du logement et des ménages dans la région administrative du Nord-du-Québec." *Bulletin d'information de la Société d'habitation du Québec*. Vol. 4, No. 3, pages 1-12.

EBIRD. 2020. *eBird: An online database of bird distribution and abundance*. The Cornell Lab of Ornithology. Online. [http://ebird.org/home, viewed in June 2020.

ENGLOBE. 2020*a*. *Évaluation environnementale de site phase 1. Propriété vacante. Nouveau poste électrique, Inukjuak, Nord-du-Québec*. Rapport final. Montréal. 61 p.

ENGLOBE. 2020*b*. *Étude géotechnique. Nouvelle centrale Inukjuak, Nunavik*. Rapport final. Montréal. 67 p.

ENGLOBE. 2021. *Caractérisation environnementale de sols. Nouvelle centrale et poste électrique, Inukjuak, Nunavik*. Rapport final. Montréal. 138 p.

ENVIRONMENT AND CLIMATE CHANGE CANADA (ECCC). 2017. *Management Plan for the Peregrine Falcon anatum/tundrius (Falco peregrinus anatum/tundrius) in Canada*. *Species at Risk Act* Management Plan Series. *Environment and Climate Change Canada (ECCC)*. Ottawa. 28 p.

ENVIRONMENT AND CLIMATE CHANGE CANADA (ECCC). 2018*a*. *Management Plan for the Short-eared Owl (Asio flammeus) in Canada. Species at Risk Act* Management Plan Series. Ottawa. 42 p.

ENVIRONMENT AND CLIMATE CHANGE CANADA (ECCC). 2018*b*. *National inventory report 1990-2016: greenhouse gas sources and sinks in Canada*. Canada's official national greenhouse gas inventory submission to the United Nations Framework Convention on Climate Change. Online. [http://www.publications.gc.ca/site/eng/9.506002/publication.html, viewed on February 17, 2021.]

ENVIRONMENT CANADA. 2011. *Management Plan for the Barrow's goldeneye (Bucephala islandica), eastern population, in Canada [Proposed]*. *Species at Risk Act* Management Plan Series. Ottawa, 15 p.

ENVIRONMENT CANADA. 2014. *Ivory gull (Pagophila eburnea) recovery strategy in Canada*. *Species at Risk Act* Management Plan Series. Ottawa. 23 p.

ENVIRONMENT CANADA. 2015. *Management Plan for the Rusty Blackbird (Euphagus carolinus) in Canada. Species at Risk Act* Management Plan Series. Ottawa. 25 p.

ENVIRONMENT CANADA. 2016. *Management Plan for the Short-eared Owl (Asio flammeus) in Canada [Proposed]*, *Species at Risk Act* Management Plan Series. Ottawa. 38 p.

ÉQUIPE DE RÉTABLISSEMENT DE L'AIGLE ROYAL AU QUÉBEC. 2005. *Plan de rétablissement de l'aigle royal (Aquila chrysaetos) au Québec 2005-2010*. Ministère des Ressources naturelles et de la Faune du Québec, Secteur Faune Québec. 29 p.

ÉQUIPE DE RÉTABLISSEMENT DES OISEAUX DE PROIE DU QUÉBEC (EROP). 2009. *Bilan du rétablissement du faucon pèlerin de la sous-espèce anatum (Falco peregrinus anatum) pour la période 2002-2009.* Québec, Ministère des Ressources naturelles et de la Faune, Secteur Faune Québec. 22 p.

FÉDÉRATION DES COOPÉRATIVES DU NOUVEAU-QUÉBEC (FCNQ). 2018. Online. [http://www.fcnq.ca/en/accueil, viewed on June 17, 2020.]

FELDHAMER, G. A., B. C. THOMPSON AND J. A. CHAPMAN (EDS.). 2003. *Wild mammals of North America. Biology, management, and conservation*. Second edition. Baltimore, The Johns Hopkins University Press. 1,216 p.

FORTIN, C., C. MARTINEAU AND J. POIRIER. 2016. "Absence d'amphibiens dans la péninsule d'Ungava?" *Le Naturaliste canadien.* Vol. 140, No. 1, pp. 53-59.

GERARDIN, V. AND D. MCKENNEY. 2001. *Une classification climatique du Québec à partir de modèles de distribution spatiale de données climatiques mensuelles : Vers une définition des bioclimats du Québec.* Québec, Ministère de l'Environnement, Direction du patrimoine écologique et du développement durable. 40 p.

GOUVERNEMENT DU QUÉBEC. 1998. *Convention de la Baie-James et du Nord québécois et conventions complémentaires.* Québec, Les Publication du Québec. 754 p.

GOVERNMENT OF CANADA. 2019. *Historical Data*. Online. [https://climate.weather.gc.ca///historical_data/search_historic_data_e.html, viewed on May 27, 2020.]

HYDRO-QUÉBEC INNOVATION, ÉQUIPEMENT ET SERVICES PARTAGÉS ET SOCIÉTÉ D'ÉNERGIE DE LA BAIE JAMES. 2018. *Clauses environnementales normalisées* [Standard Environmental Clauses]. Direction Environnement. 40 p.

INDIGENOUS SERVICES CANADA. 2020. *The Community Well-Being Index, 2016*. Online. [https://www.sac-isc.gc.ca/eng/1100100016579/1557319653695, viewed on November 5, 2020.]

INSTITUT DE LA STATISTIQUE DU QUÉBEC (ISQ). 2019. *Perspectives démographiques des MRC du Québec, 2016-2041*. Online. [https://www.stat.gouv.qc.ca/statistiques/conditions-vie-societe/bulletins/sociodemo-vol24-no1.pdf, viewed on June 11, 2020.]

INSTITUT NATIONALE DE SANTÉ PUBLIQUE DU QUÉBEC (INSPQ). 2008. *Contextual Study of Mental Health Services in Nunavik*. Online. [https://www.inspq.qc.ca/pdf/publications/869_MentalHealthNunavik.pdf, viewed on November 4, 2020.]

INUULITSIVIK HEALTH CENTER. 2019. *Inukjuak*. Online. [https://www.inuulitsivik.ca/northern-life-and-inuit-culture/villages/inukjuak/?lang=en, viewed on May 12, 2020.]

JUTRAS, J., M. DELORME, J. MCDUFF and C. VASSEUR. 2012. "Le suivi des chauves-souris du Québec." *Le Naturaliste canadien*, Vol. 136, No. 1, pp. 48-52.

KATIVIK ILISARNILIRINIQ. 2020. Online. [https://www.kativik.qc.ca/, viewed on May 7, 2020.]

KATIVIK REGIONAL GOVERNMENT (KRG) Undated. *Nunavik Residual Materials Management Plan*. Renewable Resources, Environment, Lands and Parks Department. 174 p.

KATIVIK REGIONAL GOVERNMENT (KRG). 2019. *About Us*. Online. [https://www.krg.ca/en-CA/, viewed on May 12, 2020.]

Kativik Regional Government (KRG). 2019. *Inukjuak Master Plan Draft. 2016-2036.*

LABRÈCHE, Y. 2012. "Les Inuits et la modernisation de l'Arctique (1960-1990)." In R. Girard, R. Auger, V. Collette, D. David and Y. Labrèche (ed.). *Histoire du Nord-du-Québec*. Québec, Presses de l'Université Laval, pp. 322-352.

LANDRY, B. 2013. *Notions de géologie. 4e édition*. Montréal, Modulo Éditeur. 656 p.

LARIVÉE, J. 2018. *Étude des populations d'oiseaux du Québec.* Database. Rimouski, Regroupement QuébecOiseaux.

LI, T., J.-P. DUCRUC, M.-J. CÔTÉ, D. BELLAVANCE and F. POISSON. 2019. *Les provinces naturelles : première fenêtre sur l'écologie du Québec.* Québec, Ministère de l'Environnement et de la Lutte contre les changements climatiques, Direction de la connaissance écologique. 24 p.

LICHVAR, R.W., D.L. BANKS, W.N. KIRCHNER AND N.C. MELVIN. 2016. "The National Wetland Plant List: 2016 wetland ratings." *Phytoneuron*, 2016-30, pp. 1-17.

MAKIVIK CORPORATION, KATIVIK REGIONAL GOVERNMENT, KATIVIK SCHOOL BOARD, NUNAVIK LANHOLDING CORPORATIONS ASSOCIATION, SAPUTIIT YOUTH ASSOCIATION OF NUNAVIK, NUNAVIK REGIONAL BOARD OF HEALTH AND SOCIAL SERVICES AND AVATAQ CULTURAL INSTITUTE. 2014. *Parnasimautik Consultation Report on the Consultations Carried Out with Nunavik Inuit in 2013*. 262 p.

MAKIVIK CORPORATION. 2019*a*. *Corporate*. Online. [https://www.makivik.org/corporate/, viewed on May 14, 2020.]

MAKIVIK CORPORATION. 2019*b*. *Our Communities. Inukjuak*. Online. [https://www.makivik.org/inukjuak/, viewed on June 12, 2020.]

MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES NATURELLES (MERN). 2020. Province du Supérieur. Online. [http://gq.mines.gouv.qc.ca/lexique-stratigraphique/province-du-superieur/, viewed on May 13, 2020.]

MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES NATURELLES (MERN). 2020. *Cartographie topographique des villages autochtones du nord*. Digital data.

MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MELCC). 2019*a*. *Terrains contaminés*. Digital data.

MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MELCC). 2019*b*. *Milieux humides potentiels*. Digital data.

MINISTÈRE DE L'ENVIRONNEMENT. (MENV). 2002. *Guide d'analyse des risques d'accidents technologiques majeurs. Document de travail.* Ministère de l'Environnement, Direction des évaluations environnementales. 44 p.

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). 2010. Garrot d'Islande. https://www3.mffp.gouv.qc.ca/faune/especes/menacees/fiche.asp?noEsp=83, viewed in February 2021

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). 2010. *Requête concernant une étude environnementale dans le cadre de la réfection de la centrale hydroélectrique d'Inukjuak, Nord-du-Québec*. Viewed on June 2, 2020.

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). 2010. *Suivi démographique du troupeau de caribous migrateurs de la Rivière aux Feuilles. Press release dated December 13, 2018.* Online. [https://mffp.gouv.qc.ca/caribous-migrateurs-riviere-aux-feuilles-2018-12-13/, viewed in June 2020.]

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). 2010. *Zones de végétation et domaines bioclimatiques du Québec*. Online. [https://mffp.gouv.qc.ca/forets/inventaire/inventaire-zones-carte.jsp#toundraArctiqueArb, viewed in June 2020.]

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). 2015. *Habitats fauniques du Québec*. Digital version of geo-descriptive data describing wildlife habitats (version 2015).

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS (MFFP). Hibou des marais. 2021. https://www3.mffp.gouv.qc.ca/faune/especes/menacees/fiche.asp?noEsp=83, viewed in February 2021

MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MDDELCC). *Lignes directrices relativement aux niveaux sonores provenant d'un chantier de construction industriel.* Online. [https://www.environnement.gouv.qc.ca/publications/note-instructions/98-01/lignes-directrices-construction.pdf, viewed in February 2020.]

NATIONAL RESEARCH COUNCIL OF CANADA (NRCC). 2015. *National Building Code of Canada.* Canada 2015.

NATURAL RESOURCES CANADA. 2018. *Earthquakes Canada*. Online. [https://www.seismescanada.rncan.gc.ca/index-en.php, viewed in November 2020.]

NAUGHTON, D. 2012. *The natural history of Canadian mammals*. Toronto, Canadian Museum of Nature and University of Toronto Press. 784 p.

NORTHERN/NORTH MART. 2020. Online. [https://www.northmart.ca/, viewed on June 18, 2020.]

NUNAVIK LANDHOLDING CORPORATION ASSOCIATION (NLHCA). 2020. *Home*. Online. [http://www.nlhca.ca/index.shtml, viewed on May 14, 2020.]

NUNAVIK REGIONAL BOARD OF HEALTH AND SOCIAL SERVICES (NRBHSS). 2020. Online. [https://nrbhss.ca/en, viewed on May 15, 2020.]

PAYETTE, S. (under the direction of). 2013. *Flore nordique du Québec et du Labrador - Tome 1*. Québec, Presses de l'Université Laval.

PAYETTE, S. (under the direction of). 2015. *Flore nordique du Québec et du Labrador - Tome 2*. Québec, Presses de l'Université Laval.

PAYETTE, S. (under the direction of). 2018. *Flore nordique du Québec et du Labrador - Tome 3*. Québec, Presses de l'Université Laval.

PHILLIPS, D. 2013. "Arctic Haze". In *The Canadian Encyclopedia*. Online. [https://www.thecanadianencyclopedia.ca/en/article/arctic-haze, viewed in July 2020.]

PITUVIK LANDHOLDING CORPORATION INUKJUAK 2010. *Projet d'aménagement hydroélectrique Innavik, rivière Inukjuak.* Environmental and social impact report. 126 p.

POLY-GÉO, 2019. *Construction d'une nouvelle centrale thermique à Inukjuak, Nunavik. Caractérisation de sites potentiels pour l'aménagement de la nouvelle centrale thermique*. Rimouski. 27 p.

QUÉBEC BREEDING BIRD ATLAS (QBBA). 2020. *Atlas results*. Online. [https://www.atlas-oiseaux.qc.ca/donneesqc/cartes.jsp?lang=en, viewed in June 2020.]

INUIT ADVENTURES. 2018. *Discover our trips. Nuvvuagittuq Greenstone Belt (NGB)*. Online. [http://www.aventuresinuit.ca/en/pierre-verte, viewed on July 2, 2020.]

QUMAQ, T. 2010. *Je veux que les Inuit soient libres à nouveau. Autobiographie (1914-1993).* Montréal, Presses de l'Université du Québec and Imaginaire Nord.

ROBICHAUD, V. AND G. DUHAIME. 2015. *Portrait économique du Nunavik 2012. Rapport final sur la construction d'une matrice de comptabilité sociale pour le Nunavik*. Report submitted to the Kativik Regional Government. 18 p.

RODRIGUE, D. AND J.-F. DESROCHES. 2018. *Amphibiens et reptiles du Québec et des maritimes.* Montréal, Éditions Michel Quintin. 375 pages.

RSW INC. 2010. *Projet d'aménagement hydroélectrique Innavik, rivière Inukjuak.* Étude d'impact sur l'environnement et le milieu social. Montréal. 119 p.

SNC-LAVALIN. 2015. *The Raglan Mine Property Beyond 2020 (Phases II and III): Continuation of Mining Operations East of Katinniq. Environmental and social impact assessment. Volume 1.* Main report. Report submitted to Mine Raglan, a Glencore company.

STATISTICS CANADA. 2017*a*. *Inukjuak, VN [Census subdivision], Québec and Nunavik Region [Health Region, December 2017], Québec (table). Census Profile, 2016 Census, catalogue No. 98-316-X2016001.* Ottawa. Release date: November 29, 2017. Online. [https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E, viewed on June 11, 2020).

STATISTICS CANADA. 2017*b*. *Inukjuak, VN [Census subdivision], Québec and Québec [Province] (table). Census Profile, 2016 Census, catalogue No. 98-316-X2016001.* Ottawa. Release date: November 29, 2017. Online. [https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E, viewed on June 11, 2020).

TAILLON, J., V. BRODEUR and S. RIVARD. 2016. *Biological status of migratory caribou, Leaf River herd.* Québec, Ministère des Forêts, de la Faune et des Parcs. 67 p.

TARDIF, B., B. TREMBLAY, G. JOLICOEUR and J. LABRECQUE. 2016. *Les plantes vasculaires en situation précaire au Québec.* Centre de données sur le patrimoine naturel du Québec (CDPNQ) Québec, Gouvernement du Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), Direction de l'expertise en biodiversité. 420 p.

TRANSPORT CANADA. 2013. *Aviation – Land Use in the Vicinity of Aerodromes*. Document TP1247E. Ottawa, Civil Aviation Directorate. 37 p.

TREASURY BOARD OF CANADA SECRETARIAT (TBS). 2019. *Federal Contaminated Sites* Digital data.

Printed on paper made in Québec
from 100% postconsumer recycled fibre

Original text written in French.
Ce document est également publié en français.

2021E0545-A